Maryland Offshore Wind Draft Environmental Impact Statement

Volume 1

BOEM
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COVER SHEET

Maryland Offshore Wind Project Environmental Impact Statement

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Area of Potential Impact: List the areas

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ABSTRACT

This Draft Environmental Impact Statement (EIS) assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction and installation, operations and maintenance, and conceptual decommissioning of the Maryland Offshore Wind Project (Project) proposed by US Wind, Inc. (US Wind), in its Construction and Operations Plan (COP). The proposed Project described in the COP and this Draft EIS would have a capacity of up to 2,000 megawatts (MW) and would be sited offshore Maryland, within Commercial Lease OCS-A 0490 (Lease Area). The Project is designed to serve demand for renewable energy in the Delmarva Peninsula, including Maryland.

This Draft EIS was prepared in accordance with the requirements of the National Environmental Policy Act (42 United States Code 4321 et seq.) and implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500–1508). This Draft EIS will inform the Bureau of Ocean Energy Management in deciding whether to approve, approve with modifications, or disapprove the COP (30 CFR 585.628). The reorganization of the Renewable Energy rules (30 CFR Parts 285, 585, and 586) enacted on January 31, 2023) reassigned existing regulations governing safety and environmental oversight and enforcement of OCS renewable energy activities from BOEM to Bureau of Safety and Environmental Enforcement (BSEE). Publication of the Draft EIS initiates a 45-day public comment period open to all, after which all the comments received will be assessed and considered by BOEM in preparation of a Final EIS.

Additional copies of this Draft Environmental Impact Statement may be obtained by writing the Bureau of Ocean Energy Management (address above); by contacting Lorena Edenfield via telephone at (907) 231-7679; or by downloading from the BOEM website at https://www.boem.gov/renewable-energy/state-activities/us-wind.

Executive Summary

ES.1 Introduction

This Draft Environmental Impact Statement (EIS) assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction, operations and maintenance (O&M), and conceptual decommissioning of the Maryland Offshore Wind Project (Project) proposed by US Wind, Inc. (US Wind), in its Construction and Operations Plan (COP). The Bureau of Ocean Energy Management (BOEM) has prepared this Draft EIS under the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] 4321–4370f) and implementing regulations. This Draft EIS will inform BOEM's decision on whether to approve, approve with modifications, or disapprove the COP (30 Code of Federal Regulations [CFR] 585.628).

Cooperating agencies may rely on this Draft EIS to support their decision-making. In conjunction with submitting its COP, US Wind applied to the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) for an incidental take authorization in the form of a Letter of Authorization (LOA) for Incidental Take Regulations under the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. 1361 et seq.), for incidental take of marine mammals during Project construction. Under the MMPA, NMFS is required to review applications and, if appropriate, issue an incidental take authorization. NMFS intends to adopt the Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support its separate proposed action and decision to issue the authorization, if appropriate. The U.S. Army Corps of Engineers (USACE) similarly intends to adopt the Final EIS to meet its responsibilities under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 (RHA).

ES.2 Purpose and Need for the Proposed Action

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

Through a competitive leasing process under 30 CFR 585.211, BOEM awarded US Wind with Renewable Energy Lease Number OCS-A 0490 in 2014. During the same competitive lease sale, BOEM also awarded US Wind with Renewable Energy Lease Number OCS-A 0489. By a lease amendment, made effective March 1, 2018, OCS-A 0489 and OCS-A 0490 were merged into a single lease, Renewable Energy Lease Number OCS-A 0490. Renewable Energy Lease Number OCS-A 0489 automatically terminated. US Wind has the exclusive right to submit a COP for activities within the Lease Area. US Wind has submitted a COP to BOEM proposing the construction, installation, operation, and conceptual decommissioning of an offshore wind energy facility in the Lease Area (the Project).

US Wind's goal is to develop a commercial-scale, offshore wind energy project in the Lease Area. The Project (full build-out) comprises as many as 121 wind turbine generators (WTGs), up to 4 offshore substations (OSSs), up to 4 offshore export cables, and 1 meteorological tower (Met Tower), with a total of up to 123 structures in a gridded array pattern distributed across the Lease Area. The offshore export cables are planned to make landfall in Sussex County, Delaware. The Project will be interconnected to the onshore electric grid by up to four new 230 kilovolt (kV) export cables to new US Wind onshore substations, with an anticipated connection to the existing Indian River substation near Millsboro, Delaware (Figure ES-1).

Based on (1) BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA) to authorize renewable energy activities on the OCS, and EO 14008, (2) the shared goals of the federal agencies to deploy 30 gigawatts (GW) of offshore wind energy capacity in the U.S. by 2030, while protecting biodiversity and promoting ocean co-use,[1] and (3) in consideration of the goals of US Wind, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove US Wind's COP. BOEM will make this determination after weighing the factors in subsection 8(p)(4) of OCSLA that are applicable to plan decisions and in consideration of the above goals. BOEM's action is needed to fulfill its duties under the lease, which requires BOEM to make a decision on the lessee's plan to construct and operate a commercial-scale, offshore wind energy facility in the Lease Area.

In addition, the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) anticipates one or more requests for authorization under the Marine Mammal Protection Act (MMPA) to take marine mammals incidental to construction activities related to the Project. NMFS's issuance of an MMPA incidental take authorization would be a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)).[2] The purpose of the NMFS action—which is a direct outcome of US Wind's request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile-driving)—is to evaluate US Wind's request pursuant to specific requirements of the MMPA and its implementing regulations administered by NMFS, consider impacts of US Wind's activities on relevant resources, and, if appropriate, issue the permit or authorization. NMFS must render a decision regarding the request for authorization as part of the agency's responsibilities under the MMPA (16 U.S.C. 1371(a)(5)(A) & (D)) and its implementing regulations. If NMFS makes the findings necessary to issue the requested authorization, NMFS intends to adopt, after independent review, BOEM's EIS to support that decision and fulfill its NEPA requirements.

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

[2] Under the MMPA, a ''take'' means ''to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal'' (16 U.S.C. 1362).

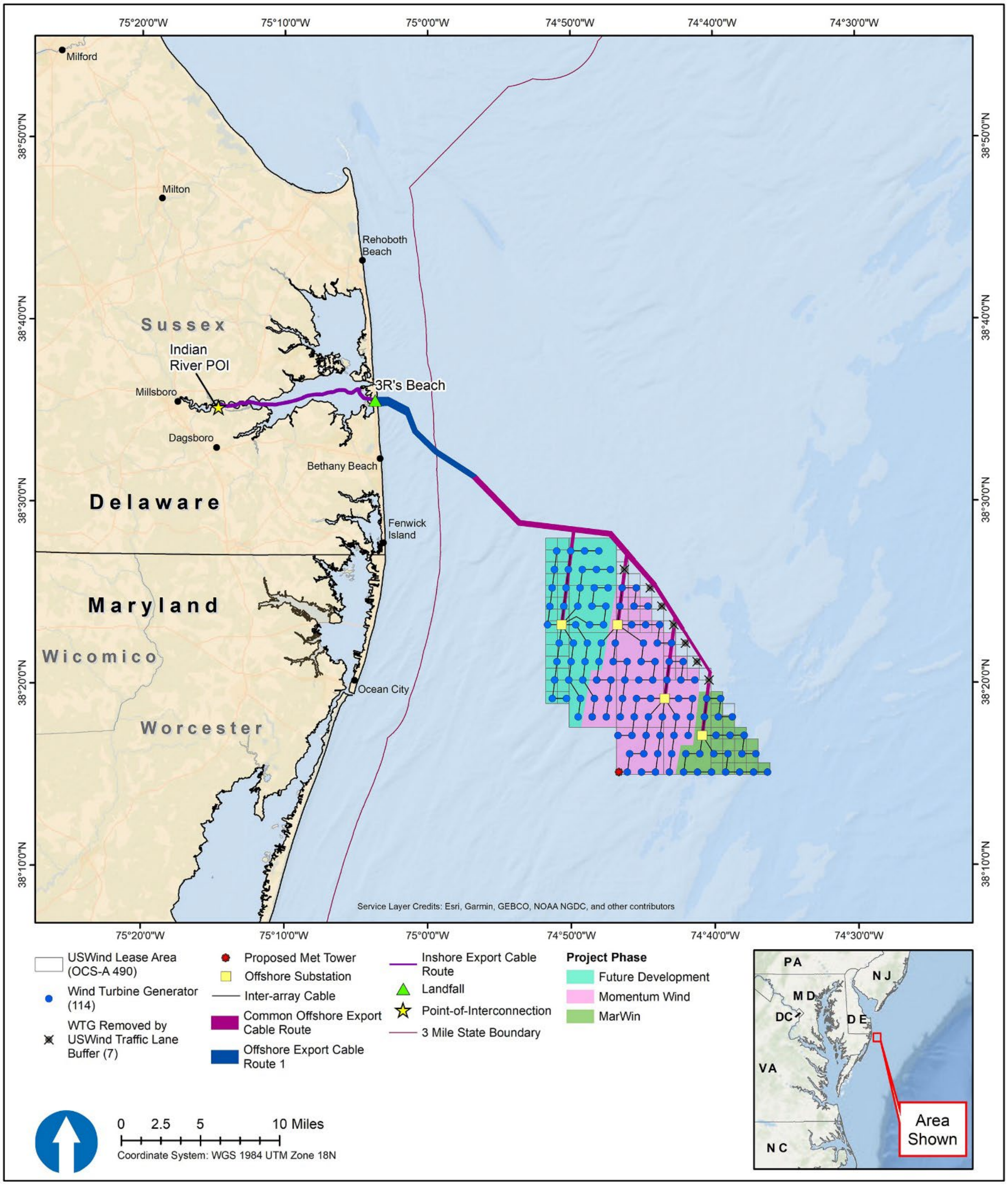

Figure ES-1. Maryland offshore wind project area

The U.S. Army Corps of Engineers (USACE) Baltimore District anticipates requests for authorization of a permit action to be undertaken through authority delegated to the district engineer by 33 CFR 325.8, under Section 10 of the Rivers and Harbors Act of 1899 (RHA) (33 U.S.C. 403) and Section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344). In addition, it is anticipated that a Section 408 permission will be required pursuant to Section 14 of the RHA (33 U.S.C. 408) for any proposed alterations that could alter, occupy, or use any federally authorized civil works projects. The USACE considers issuance of permits/ permissions under these three delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)). The need for the Project, as provided in the COP (Volume I, Section 1.1.2; US Wind 2023) and reviewed by the USACE for NEPA purposes, is to provide a commercially viable offshore wind energy project within the Lease Area to help the State of Maryland achieve its renewable energy goals. The basic Project purpose, as determined by the USACE for Section 404(b)(1) guidelines evaluation, is offshore wind energy generation. The overall Project purpose for Section 404(b)(1) guidelines evaluation, as determined by the USACE, is the construction and operation of a commercial-scale, offshore wind energy project for renewable energy generation in Lease Area OCS-A 0490 offshore Maryland and transmission/distribution to the PJM energy grid.

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

ES.3 Public Involvement

On June 8, 2022, BOEM issued a Notice of Intent (NOI) to prepare an EIS consistent with NEPA regulations (40 CFR Parts 1500-1508) to assess the potential impacts of the Proposed Action and alternatives (87 Federal Register 34901). The NOI commenced a public scoping process for identifying issues and potential alternatives for consideration in the EIS. The formal scoping period was from June 8 through July 8, 2022. BOEM held three virtual public scoping meetings on June 21, 23 and 27, 2022 to solicit feedback and to identify issues and potential alternatives for consideration in the EIS. Throughout this timeframe, federal agencies, state and local governments, and the general public had the opportunity to help BOEM identify potential significant resources and issues, impact producing factors (IPFs), reasonable alternatives (e.g., geographic, seasonal, or other restrictions on construction and siting of facilities and activities), and potential mitigation measures to analyze in the EIS, as well as provide additional information. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the NHPA (54 U.S.C. 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), which requires federal agencies to assess the effects of projects on historic properties. Additionally, BOEM informed its Section 106 consultation by seeking public comment and input through the NOI regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the

COP. The NOI requested comments from the public in written form, delivered by hand or by mail, or through the http://www.regulations.gov web portal.

BOEM reviewed and considered all scoping comments in the development of the Draft EIS and used the comments to identify alternatives for analysis. A Scoping Summary Report (BOEM 2022) summarizing the submissions received and the methods for analyzing them is available on BOEM's website at https://www.boem.gov/renewable-energy/state-activities/uswind-scoping-report. In addition, all public scoping submissions received can be viewed online at http://www.regulations.gov by typing "BOEM-2022-0025" in the search field. As detailed in the Scoping Summary Report, the resource areas or NEPA topics most referenced in the scoping comments include commercial fisheries and for-hire recreational fishing; mitigation and monitoring; alternatives; birds; NEPA/Public Involvement Process; cumulative effects; climate change; marine mammals; and others.

ES.4 Alternatives

Under NEPA, a reasonable range of alternatives framed by the purpose and need must be developed for analysis for any major federal action. The alternatives should be "reasonable", which the USDOI has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action."[3] BOEM considered alternatives to the Proposed Action that were developed using BOEM's *Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act* (BOEM 2022).

The Draft EIS evaluates the No Action alternative and four action alternatives (one of which has sub-alternatives). The action alternatives are not mutually exclusive; BOEM may select a combination of alternatives that meet the purpose and need of the proposed Projects. The alternatives are as follows:

- Alternative A – No Action Alternative
- Alternative B – Proposed Action
- Alternative C – Landfall and Onshore Export Cable Routes Alternative
    - Alternative C-1 includes the Towers Beach landfall and a terrestrial-based Onshore Export Cable Route
    - Alternative C-2 includes the 3R's Beach landfall and terrestrial-based Onshore Export Cable Routes
- Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative, and
- Alternative E – Habitat Impact Minimization Alternative

Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.2.

ES.4.1 Alternative A – No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP. Project construction and installation, O&M, and decommissioning would not occur, and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project (as described under the Proposed Action) would not occur. However, all other existing

[3] 43 CFR 46.420(b). The terms "practical" and "feasible" are not intended to be synonymous (73 *Federal Register* 61331, October 15, 2008).

ongoing or other reasonably foreseeable future activities described in Appendix D, *Planned Activities Scenario*, would continue. The ongoing effects of the No Action Alternative serve as the baseline against which all action alternatives are evaluated. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to US Wind.

ES.4.2 Alternative B—Proposed Action

The Proposed Action is to construct, operate, maintain, and decommission an up to 2.2-GW wind energy facility in the Lease Area, 10.1 miles (16.2 kilometer) off the coast of Maryland. The facility would consist of up to 114 WTGs—ranging from 14 to 18 MW each, up to four offshore substations (OSSs), inter-array cables in strings of four to six linking the WTGs to the OSSs, and substation interconnector cables linking the OSSs to each other. The Proposed Action includes a 1 nautical mile (1.9 kilometer) setback from the traffic separation scheme (TSS) from Delaware Bay which removes 7 of the 121 WTG positions, resulting in a total of 114 WTGs. Up to four offshore export cables (installed within one Offshore Export Cable Route) would transition to a landfall at 3R's Beach via horizontal directional drilling (HDD). From the landfall, the cables would continue along the Inshore Export Cable Route within Indian River Bay to connect to an onshore substation adjacent to the point of interconnection (POI) at the Indian River substation owned by Delmarva Power and Light in Dagsboro, Delaware. The POI will include an expansion of the existing substation and construction of new substations adjacent to the existing substation (US Wind 2023).

Development of the wind energy facility would occur within the range of design parameters described in the COP (Volume I; US Wind 2023) and summarized in Appendix C, *Project Design Envelope and Maximum-Case Scenario*. The Project includes MarWin, a wind farm of approximately 300 MW for which the State of Maryland awarded to US Wind ORECs in 2017; Momentum Wind, consisting of approximately 808 MW for which the State of Maryland awarded additional ORECs in 2021; and build-out of the remainder of the Lease Area to fulfill ongoing, government-sanctioned demands for offshore wind energy. A description of construction and installation, O&M, and decommissioning activities for the Proposed Action is included in Sections 2.1.2.1 to 2.1.2.3. The US Wind COP (US Wind 2023) and all other supporting volumes (https://www.boem.gov/renewable-energy/state-activities/us-wind-construction-and-operations-plan) contain additional details on Project design, and are incorporated by reference throughout this EIS.

ES.4.3 Alternative C – Landfall and Onshore Export Cable Route Alternative

Alternative C was developed through the scoping process for the Draft EIS in response to comments requesting an alternative to minimize impacts on Indian River Bay. Under Alternative C, the Landfall and Onshore Export Cable Route Alternative ("Landfall Alternative"), the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility on the OCS offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative includes an Onshore Export Cable Route that avoids crossing Indian River Bay and the Indian River (i.e., Inshore Export Cable Route). Offshore Project components within the Lease Area (WTGs, OSSs, inter-array cables, and Met Tower) would be the same as the Proposed Action (Alternative B). Each of the below sub-alternatives may be individually selected, subject to meeting the purpose and need.

- Alternative C-1 includes the Towers Beach landfall (i.e., exclusion of the 3R's Beach landfall), and a terrestrial Onshore Export Cable Route from the Towers Beach landfall to the Indian River substation (POI) (Onshore Export Cable Route 2). This would be contingent on selection of Offshore Cable Route 2 (northern route). Under Alternative C-1, the offshore export cables would make landfall at Towers Beach, approximately 5 miles (7.7 kilometers) north of the Indian River Inlet, in an existing parking lot within Delaware Seashore State Park. When the offshore cables reach the landfall, they will be pulled into a cable duct that positions the cables underground to subterranean transition vaults and then run via Onshore Export Cable Route 2 to the POI utilizing Delaware Department of Transportation (DelDOT) ROWs.
- Alternative C-2 includes the 3R's Beach landfall similar to the Proposed Action (i.e., exclusion of the Towers Beach landfall); however, only terrestrial Onshore Export Cable Routes from the 3R's Beach landfall to the Indian River substation would be considered (i.e., Onshore Export Cable Routes 1a, 1b, and 1c). This would be contingent on selection of Offshore Cable Route 1 (southern route). When the offshore cables reach the landfall, they will be pulled into a cable duct that positions the cables underground to subterranean transition vaults and then run via an Onshore Export Cable Route to the specific POI utilizing DelDOT ROWs, except for portions of Onshore Export Cable Routes 1b and 1c that will utilize a Sussex County ROW under development.

ES.4.4 Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative

Alternative D was identified during the scoping process for the Draft EIS in response to public comments concerning the visual impacts of the Project. Under Alternative D, the Viewshed Alternative, the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility on the OCS offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in the exclusion of 32 WTG positions and 1 OSS within 14 miles (22.5 kilometers) of shore associated with the future development phase. The 14-mile (22.5-kilometer) exclusion allows for full development of MarWin and Momentum and fulfillment of existing power purchase agreements, while still allowing site selection flexibility. The public comment process proposed a 15-mile (24.1 kilometer) exclusion zone for WTGs, but the difference of 1 mile in the exclusion zone is not likely to result in a significant reduction in impact. Thus, the benefit gained in an additional mile of exclusion (15-mile versus 14-mile [24.1 kilometer versus 22.5 kilometer]) would not warrant the added strain on the Project, given the currently identified WTG capacity, and the risk of failure to meet current power purchase agreements.

ES.4.5 Alternative E – Habitat Impact Minimization Alternative

Alternative E was identified through the scoping process for the Draft EIS in response to comments received requesting an alternative to minimize impacts on offshore benthic habitats. Under Alternative E, the Habitat Impact Minimization Alternative, the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility on the OCS offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and realignment of the offshore export cables. Micrositing the WTGs and cables may be necessary to avoid areas of concern (AOCs; i.e., sensitive benthic habitat).

ES.5 Environmental Impacts

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

BOEM analyzes the impacts of past and ongoing activities in the absence of the Projects as the No Action Alternative. The No Action Alternative serves as the existing baseline against which all action alternatives are evaluated. BOEM also separately analyzes cumulative impacts of the No Action Alternative, which considers all other ongoing and reasonably foreseeable future activities described in Appendix D, *Planned Activities Scenario*. In this analysis, the cumulative impacts of the No Action Alternative serve as the future baseline against which the cumulative impacts of all action alternatives are evaluated. Table ES-1 summarizes the impacts of each alternative and the cumulative impacts of each alternative. Under the No Action Alternative, the environmental and socioeconomic impacts of the action alternatives would not occur.

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

Table ES-1. Summary and comparison of impacts among Alternatives with no mitigation measures

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Landfall and Onshore Export Cable Route Alternative	Alternative D No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E Habitat Impact Minimization Alternative
Air Quality					
Alternative Impacts	Minor	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial
Cumulative Impacts	Minor; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial
Water Quality					
Alternative Impacts	Minor	Minor	Minor	Minor	Minor
Cumulative Impacts	Minor to Moderate	Minor	Minor	Minor	Minor
Bats					
Alternative Impacts	Negligible	Negligible	Negligible	Negligible	Negligible
Cumulative Impacts	Negligible	Negligible	Negligible	Negligible	Negligible
Benthic Resources					
Alternative Impacts	Moderate	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial
Cumulative Impacts	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial
Birds					
Alternative Impacts	Minor; Moderate beneficial	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial
Cumulative Impacts	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial	Moderate; Moderate beneficial
Coastal Habitats and Fauna					
Alternative Impacts	Negligible to Moderate	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Landfall and Onshore Export Cable Route Alternative	Alternative D No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E Habitat Impact Minimization Alternative
Finfish, Invertebrates and EFH					
Alternative Impacts	Moderate	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate
Marine Mammals					
Alternative Impacts	Minor	Negligible to Moderate for mysticetes and Negligible to Major for the NARW: Minor beneficial impacts for odontocetes and pinnipeds	Negligible to Moderate for mysticetes and Negligible to Major for the NARW: Minor beneficial impacts for odontocetes and pinnipeds	Negligible to Moderate for mysticetes and Negligible to Major for the NARW: Minor beneficial impacts for odontocetes and pinnipeds	Negligible to Moderate for mysticetes and Negligible to Major for the NARW: Minor beneficial impacts for odontocetes and pinnipeds
Cumulative Impacts	Moderate impacts, except for the NARW, impacts would be Major	Moderate impacts, except for the NARW, impacts would be Major	Moderate impacts, except for the NARW, impacts would be Major	Moderate impacts, except for the NARW, impacts would be Major	Moderate impacts, except for the NARW, impacts would be Major
Sea Turtles					
Alternative Impacts	Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate
Wetlands					
Alternative Impacts	Moderate	Minor	Moderate	Minor	Minor

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Landfall and Onshore Export Cable Route Alternative	Alternative D No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E Habitat Impact Minimization Alternative
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate
Commercial Fisheries and For-Hire Recreational Fishing					
Alternative Impacts	Moderate to Major long-term impacts on commercial fisheries and Moderate long-term impacts on for-hire recreational fisheries	Negligible to Major; Minor beneficial impacts for some for-hire recreational fishing operations	Negligible to Major; Minor beneficial impacts for some for-hire recreational fishing operations	Negligible to Major; Minor beneficial impacts for some for-hire recreational fishing operations	Negligible to Major; Minor beneficial impacts for some for-hire recreational fishing operations
Cumulative Impacts	Major long-term impacts on commercial fisheries and Moderate; Moderate beneficial long-term impact, particularly on the for-hire recreational fishing	Major	Major	Major	Major
Cultural Resources					
Alternative Impacts	Minor to Major; Negligible to Minor beneficial	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Landfall and Onshore Export Cable Route Alternative	Alternative D No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E Habitat Impact Minimization Alternative
Demographics, Employment, and Economics					
Alternative Impacts	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial
Cumulative Impacts	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial	Minor; Minor beneficial
Environmental Justice					
Alternative Impacts	Minor to Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial
Cumulative Impacts	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial
Land Use and Coastal Infrastructure					
Alternative Impacts	Negligible; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial	Minor to Moderate; Minor beneficial
Cumulative Impacts	Minor; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial
Navigation and Vessel Traffic					
Alternative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Landfall and Onshore Export Cable Route Alternative	Alternative D No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E Habitat Impact Minimization Alternative
Other Uses					
Alternative Impacts	Negligible to Moderate	Negligible to Major	Negligible to Major	Negligible to Major	Negligible to Major
Cumulative Impacts	Negligible impacts for aviation and air traffic and cables and pipelines; Minor impacts for marine mineral extraction; Moderate impacts for radar systems due to WTG interference; Minor impacts for military and national security uses; Moderate impacts for USCG SAR operations, Major impacts for scientific research and surveys.	Negligible to Minor impacts for aviation and air traffic, cables and pipelines, and radar systems; Moderate for most military and national security uses and marine mineral extraction; and Major for scientific research and surveys.	Negligible to Minor impacts for aviation and air traffic, cables and pipelines, and radar systems; Moderate for most military and national security uses and marine mineral extraction; and Major for scientific research and surveys.	Negligible to Minor impacts for aviation and air traffic, cables and pipelines, and radar systems; Moderate for most military and national security uses and marine mineral extraction; and Major for scientific research and surveys.	Negligible to Minor impacts for aviation and air traffic, cables and pipelines, and radar systems; Moderate for most military and national security uses and marine mineral extraction; and Major for scientific research and surveys.
Recreation and Tourism					
Alternative Impacts	Negligible	Negligible to Moderate; Minor beneficial	Negligible to Moderate; Minor beneficial	Negligible to Moderate; Minor beneficial	Negligible to Moderate; Minor beneficial
Cumulative Impacts	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial	Moderate; Minor beneficial

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Landfall and Onshore Export Cable Route Alternative	Alternative D No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E Habitat Impact Minimization Alternative
Visual Resources					
Alternative Impacts	Minor to Moderate	Minor to Major	Minor to Major	Minor to Major	Minor to Major
Cumulative Impacts	Major	Major	Major	Major	Major

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

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Abbreviations and Acronyms

°C	degree Celsius
°F	degree Fahrenheit
ac	acre
AC	alternating current
ADLS	aircraft detection lighting system
APE	area of potential effect
AOC	area of concern
AWEA	American Wind Energy Association
BA	Biological Assessment
BIA	Biologically Important Area
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CEJST	Climate and Economic Justice Screening Tool
CFR	Code of Federal Regulations
cm	centimeter
CMECS	Coastal and Marine Ecological Classification Standard
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COBRA	Co-benefits Risk Assessment
COP	Construction and Operations Plan
CPAPARS	Consolidated Port Approaches Port Access Route Studies
CWA	Clean Water Act
dB	decibel
DelDOT	Delaware Department of Transportation
DNREC	Delaware Department of Natural Resources and Environmental Control
EA	environmental assessment
EFH	essential fish habitat
EIS	environmental impact statement
EMF	electromagnetic field
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDR	Facility Design Report

FIR	Fabrication and Installation Report
ft	foot
ft^2	square foot
G&G	geological and geophysical
GDP	gross domestic product
GHG	greenhouse gas
GSOE	Garden State Offshore Energy
GW	gigawatt
ha	hectare
HAP	hazardous air pollutant
HDD	horizontal directional drilling
in.	inch
IPF	impact-producing factor
IWG	Interagency Working Group
km	kilometer
km^2	square kilometer
km/h	kilometers per hour
kn	knot
Lease Area	Renewable Energy Lease Number OCS-A 0490
LME	Large Marine Ecosystem
LSZ	Landscape Similarity Zone
m	meter
m^2	square meter
MAB	Mid-Atlantic Bight
MABS	Mid-Atlantic Baseline Studies
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
MDE	Maryland Department of the Environment
Met Tower	meteorological tower
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mi	mile
mi^2	square mile
mm	millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	mean sea level
MW	megawatt
NAAQS	National Ambient Air Quality Standards

NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
nmi	nautical mile
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
O_3	ozone
O&M	operations and maintenance
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OREC	offshore renewable energy credit
OSRP	Oil Spill Response Plan
OSS	offshore substation
PAHs	polycyclic aromatic hydrocarbons
PAPE	preliminary area of potential effects
Pb	lead
PDE	Project Design Envelope
$PM_{2.5}$	particulate matter with a diameter less than or equal to 2.5 microns
PM_{10}	particulate matter with a diameter less than or equal to 10 microns
POI	point of interconnection
Project	Maryland Offshore Wind Project
PSU	practical salinity unit
Q	quarter
RHA	Rivers and Harbors Act
ROD	Record of Decision
ROV	remotely operated vehicle
ROW	right-of-way
RSZ	rotor-swept zone
SAP	Site Assessment Plan
SAV	submerged aquatic vegetation
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure (Plan)
SR	State Route
SWPPP	Stormwater Pollution Prevention Plan
TPA	Tradepoint Atlantic

TSS	traffic separation scheme
U.S.	United States
U.S.C.	United States Code
US Wind	US Wind, Inc.
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WEA	Wind Energy Area
WTG	wind turbine generator

Chapter 1

Introduction

1 Introduction

This Draft Environmental Impact Statement (EIS) assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction, operations and maintenance (O&M), and conceptual decommissioning of the Maryland Offshore Wind Project (Project) proposed by US Wind, Inc. (US Wind), in its Construction and Operations Plan (COP).[4] The Project described in the COP and this Draft EIS would be up to 2,000 megawatts (MW) in scale and sited 10.1 statute miles (mi) (16.2 kilometers [km]) off the coast of Maryland, within the area of Renewable Energy Lease Number OCS-A 0490 (Lease Area). The Project is designed to serve demand for renewable energy in the Delmarva Peninsula, including Maryland. This Draft EIS was prepared following the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] 4321–4370f) and implementing regulations (40 CFR 1500-1508). This Draft EIS will inform the Bureau of Ocean Energy Management (BOEM) in deciding whether to approve, approve with modifications, or disapprove the COP (30 Code of Federal Regulations [CFR] 585.628). Publication of the Draft EIS initiates a 45-day comment period; BOEM will use the comments received during the public comment period to inform preparation of the Final EIS.

1.1 Background

In 2009, the U.S. Department of the Interior (USDOI) announced final regulations for the Outer Continental Shelf (OCS) Renewable Energy Program, which was authorized by the Energy Policy Act of 2005, Public Law 109-58. The Energy Policy Act provisions implemented by BOEM provide a framework for issuing renewable energy leases, easements, and rights-of-way (ROWs) for OCS activities (Section 1.3). BOEM's OCS Renewable Energy Program occurs in four distinct phases: (1) regional planning and analysis, (2) lease issuance, (3) site assessment, and (4) construction and operations. The history of BOEM's planning and leasing activities offshore Maryland is summarized in Table 1-1.

[4] The Maryland Offshore Wind Project COP and appendices are available on BOEM's website: https://www.boem.gov/renewable-energy/state-activities/us-wind-construction-and-operations-plan.

Table 1-1. History of BOEM planning and leasing offshore Maryland

Year	Milestone
2012	On February 3, 2012, BOEM published a Call for Information and Nominations for Commercial Leasing for Wind Power on the OCS Offshore Maryland in the *Federal Register*. The public comment period for the Call closed on March 19, 2012. In response, BOEM received six commercial indications of interest.
2012	On February 3, 2012, BOEM published in the *Federal Register* a Notice of Availability of a final Environmental Assessment and Finding of No Significant Impact for commercial wind lease issuance and site assessment activities on the Atlantic OCS offshore New Jersey, Delaware, Maryland, and Virginia.
2013	On December 18, 2013, BOEM published a Proposed Sale Notice requesting public comments on the proposal to auction two leases offshore Maryland for commercial wind energy development.
2014	On July 3, 2014, BOEM announced that it published a Final Sale Notice, which stated a commercial lease sale would be held August 19, 2014, for the Wind Energy Area offshore Maryland. The Maryland Wind Energy Area was auctioned as two leases (OCS-A 0489 and OCS-A 0490). US Wind won both leases.
2016–2018	On April 7, 2016, US Wind submitted a Site Assessment Plan for commercial wind lease. BOEM approved the plan on March 22, 2018, for Renewable Energy Lease Number OCS-A 0490.
2018	On January 26, 2018, BOEM received a request from US Wind to merge Renewable Energy Lease Numbers OCS-A 0489 and OCS-A 0490 into a single lease, with the single retaining lease number OCS-A 0490. BOEM approved the request on March 1, 2018.
2020–2021	On October 22, 2020, US Wind submitted a new Site Assessment Plan for Renewable Energy Lease Number OCS-A 0490. BOEM approved the plan on May 5, 2021.
2020–2022	On August 11, 2020, US Wind submitted its COP for the construction, operations, and conceptual decommissioning of the Project within the Lease Area. Updated versions of the COP were submitted on November 23, 2021, March 3, 2022, and May 27, 2022.
2022	On June 8, 2022, BOEM published a Notice of Intent to Prepare an EIS for US Wind's Proposed Wind Energy Facility Offshore Maryland (87 *Federal Register* 34901).
2023	On October 6, 2023, BOEM published a Notice of Availability of a Draft EIS initiating a 45-day public comment period for the Draft EIS.

Source: BOEM 2022a,b, https://www.boem.gov/renewable-energy/state-activities/maryland-activities, https://www.boem.gov/renewable-energy/state-activities/us-wind

BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; EIS = environmental impact statement; OCS = Outer Continental Shelf

1.2 Purpose of and Need for the Proposed Action

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

Through a competitive leasing process under 30 CFR 585.211, BOEM awarded US Wind with Renewable Energy Lease Number OCS-A 0490 in 2014. During the same competitive lease sale, BOEM also awarded US Wind with Renewable Energy Lease Number OCS-A 0489. By a lease amendment, made effective March 1, 2018, OCS-A 0489 and OCS-A 0490 were merged into a single lease, Renewable Energy Lease Number OCS-A 0490. Renewable Energy Lease Number OCS-A 0489 automatically terminated. US Wind has the exclusive right to submit a COP for activities within the Lease Area. US Wind has submitted a COP to BOEM proposing the construction, installation, operation, and conceptual decommissioning of an offshore wind energy facility in the Lease Area (the Project).

US Wind's goal is to develop a commercial-scale, offshore wind energy project in the Lease Area. The Project (full build-out) comprises as many as 121 wind turbine generators (WTGs), up to 4 offshore substations (OSSs), up to 4 offshore export cables, and 1 meteorological tower (Met Tower), with a total of up to 123 structures in a gridded array pattern distributed across the Lease Area. The offshore export cables are planned to make landfall in Sussex County, Delaware. The Project will be interconnected to the onshore electric grid by up to four new 230 kilovolt (kV) export cables to new US Wind onshore substations, with an anticipated connection to the existing Indian River substation near Millsboro, Delaware (Figure 1-1).

The Project would generate up to 2,000 MW of wind energy to the Delmarva Peninsula, including Maryland, in fulfillment of state and federal clean energy standards and targets (COP, Volume I, Section 1.1.2; US Wind 2023). The Project (full build-out) includes (1) MarWin, a wind farm of approximately 300 MW for which US Wind was awarded offshore renewable energy credits (ORECs) in 2017 by the State of Maryland; (2) Momentum Wind, consisting of approximately 808 MW for which the State of Maryland awarded additional ORECs in 2021; and (3) future development of approximately 600 to 800 MW of the remainder of the Lease Area to fulfill ongoing, government-sponsored demands for offshore wind energy.

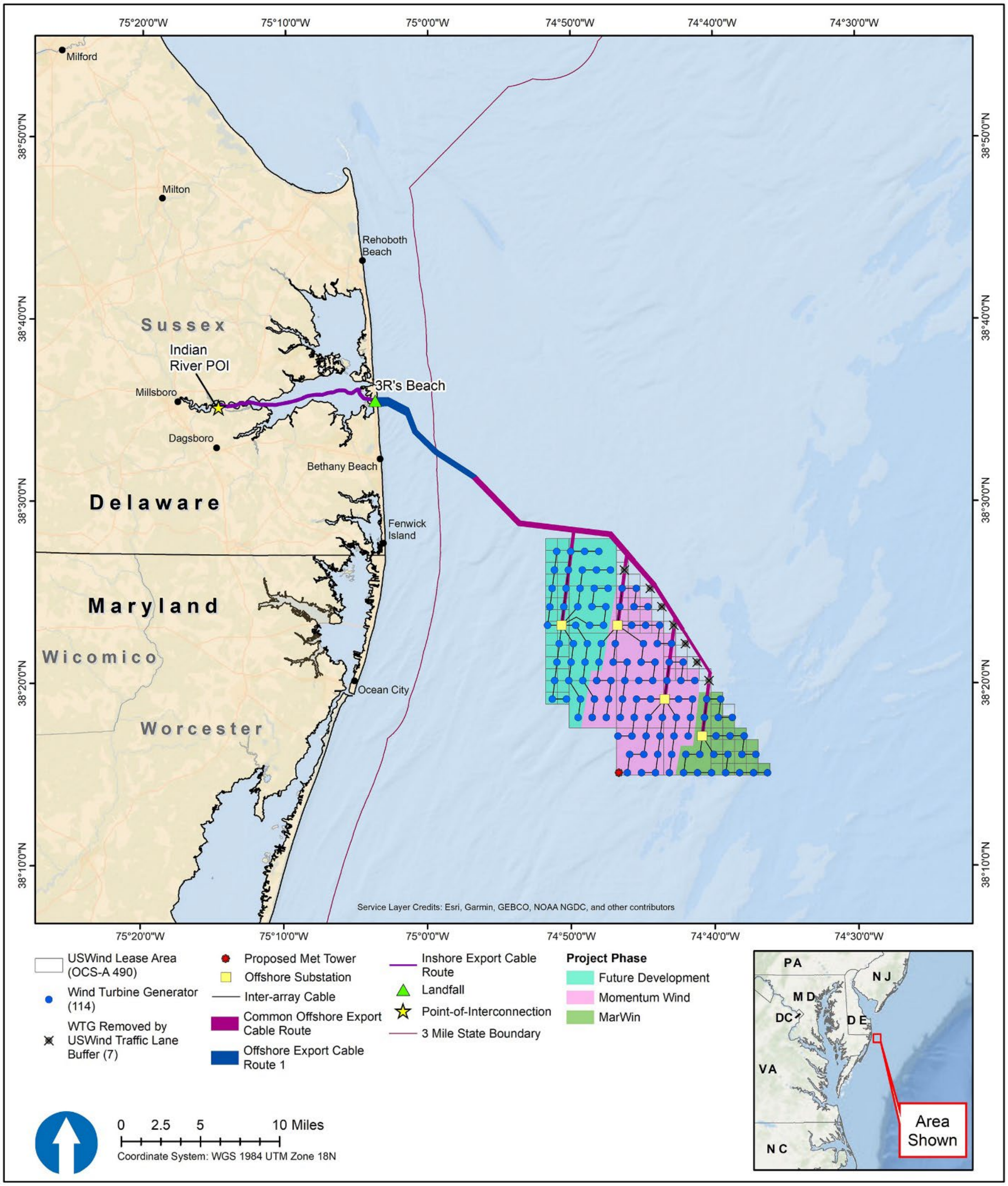

Figure 1-1. Maryland offshore wind Project area

Based on (1) BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA) to authorize renewable energy activities on the OCS, and EO 14008, (2) the shared goals of the federal agencies to deploy 30 gigawatts (GW) of offshore wind energy capacity in the U.S. by 2030, while protecting biodiversity and promoting ocean co-use,[5] and (3) in consideration of the goals of US Wind, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove US Wind's COP. BOEM will make this determination after weighing the factors in subsection 8(p)(4) of OCSLA that are applicable to plan decisions and in consideration of the above goals. BOEM's action is needed to fulfill its duties under the lease, which requires BOEM to make a decision on the lessee's plan to construct and operate a commercial-scale, offshore wind energy facility in the Lease Area.

In addition, the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) anticipates one or more requests for authorization under the Marine Mammal Protection Act (MMPA) to take marine mammals incidental to construction activities related to the Project. NMFS's issuance of an MMPA incidental take authorization would be a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)).[6] The purpose of the NMFS action—which is a direct outcome of US Wind's request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile-driving)—is to evaluate US Wind's request pursuant to specific requirements of the MMPA and its implementing regulations administered by NMFS, consider impacts of US Wind's activities on relevant resources, and, if appropriate, issue the permit or authorization. NMFS must render a decision regarding the request for authorization as part of the agency's responsibilities under the MMPA (16 U.S.C. 1371(a)(5)(A) & (D)) and its implementing regulations. If NMFS makes the findings necessary to issue the requested authorization, NMFS intends to adopt, after independent review, BOEM's EIS to support that decision and fulfill its NEPA requirements.

The U.S. Army Corps of Engineers (USACE) Baltimore District anticipates requests for authorization of a permit action to be undertaken through authority delegated to the district engineer by 33 CFR 325.8, under Section 10 of the Rivers and Harbors Act of 1899 (RHA) (33 U.S.C. 403) and Section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344). In addition, it is anticipated that a Section 408 permission will be required pursuant to Section 14 of the RHA (33 U.S.C. 408) for any proposed alterations that could alter, occupy, or use any federally authorized civil works projects. The USACE considers issuance of permits/permissions under these three delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)). The need for the Project, as provided in the COP (Volume I, Section 1.1.2; US Wind 2023) and reviewed by the USACE for NEPA purposes, is to provide a commercially viable offshore wind energy project within the Lease Area to help the State of Maryland achieve its renewable energy goals. The basic Project purpose, as determined by the USACE for Section 404(b)(1) guidelines evaluation, is offshore wind energy generation. The overall Project purpose for Section 404(b)(1) guidelines evaluation, as determined by the USACE, is the construction and

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

[6] Under the MMPA, a ''take'' means ''to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal'' (16 U.S.C. 1362).

operation of a commercial-scale, offshore wind energy project for renewable energy generation in Lease Area OCS-A 0490 offshore Maryland and transmission/distribution to the PJM energy grid.[7]

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

1.3 Regulatory Overview

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

The Secretary of the Interior delegated this authority to the former Minerals Management Service (MMS), and later to BOEM. Final regulations implementing the authority for renewable energy leasing under the OCSLA (30 CFR Part 585) were promulgated on April 22, 2009.[9] These regulations prescribe BOEM's responsibility for determining whether to approve, approve with modifications, or disapprove US Wind's COP (30 CFR 585.628). The reorganization of Renewable Energy rules (30 CFR Parts 285, 585, and 586) enacted on January 31, 2023, reassigned existing regulations governing safety and environmental oversight and enforcement of OCS renewable energy activities from BOEM to Bureau of Safety and Environmental Enforcement (BSEE).

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

- (A) safety;
- (B) protection of the environment;
- (C) prevention of waste;
- (D) conservation of the natural resources of the outer Continental Shelf;
- (E) coordination with relevant federal agencies;

[7] Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 *Federal Register* 19638–19871 (April 29, 2009)
[8] Public Law No. 109-58, § 119 Stat. 594 (2005)
[9] Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 *Federal Register* 19638–19871 (April 29, 2009)

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

As stated in M-Opinion 37067, "...subsection 8(p)(4) of OCSLA imposes a general duty on the Secretary to act in a manner providing for the subsection's enumerated goals. The subsection does not require the Secretary to ensure that the goals are achieved to a particular degree, and she retains wide discretion to determine the appropriate balance between two or more goals that conflict or are otherwise in tension."[10]

Section 2 of Renewable Energy Lease Number OCS-A 0490 provides the lessee with an exclusive right to submit a Site Assessment Plan (SAP) and COP for the Project to BOEM for approval. Section 3 provides that BOEM will decide whether to approve an SAP or COP in accordance with applicable regulations in 30 CFR Part 585, noting that BOEM retains the right to disapprove an SAP or COP based on its determination that the proposed activities would have unacceptable environmental consequences, would conflict with one or more of the requirements set forth in 43 U.S.C. 1337(p)(4), or for other reasons provided by BOEM under 30 CFR 585.613(e)(2) or 585.628(f); BOEM reserves the right to approve an SAP or COP with modifications; and BOEM reserves the right to authorize other uses within the leased area that will not unreasonably interfere with activities described in Addendum A, Description of Leased Area and Lease Activities.

BOEM's evaluation and decision on the COP are also governed by other applicable federal statutes and implementing regulations such as NEPA and the Endangered Species Act (ESA) (16 U.S.C. 1531–1544). The analyses in this Draft EIS will inform BOEM's decision under 30 CFR 585.628 for the COP that was initially submitted on August 11, 2020, and later updated with new information on November 23, 2021, March 3, 2022, May 27, 2022, November 30, 2022, May 27 and July 28, 2023. BOEM is required to coordinate with federal agencies and state and local governments to ensure renewable energy development occurs in a safe and environmentally responsible manner. In addition, BOEM's authority to approve activities under the OCSLA only extends to approval of activities on the OCS. Appendix A, *Required Environmental Permits and Consultations*, outlines the federal, state, regional, and local

10 M-Opinion 37067 at page 5, http://doi.gov/sites/doi.gov/files/m-37067.pdf

permits and authorizations that are required for the Project and their status. Appendix A also provides a description of BOEM's consultation efforts during development of the Draft EIS.

1.4 Relevant Existing NEPA and Consulting Documents

The following NEPA documents informed the preparation of this Draft EIS and are incorporated in their entirety by reference.

- Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, OCS EIS/EA MMS 2007-046 (MMS 2007).
- Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment, OCS EIS/EA BOEM 2012-003 (BOEM 2012).

BOEM has elected to incorporate by reference the Maryland Offshore Wind COP (US Wind 2023) prepared by TRC Companies as updated in July 2023. The COP and its supporting documentation provide a description of the proposed Project activity, Project siting and design development, resources required, site characterization and assessment of potential impacts, and references. The Maryland Offshore Wind COP is located on the BOEM project webpage at this link: https://www.boem.gov/renewable-energy/state-activities/us-wind-construction-and-operations-plan.

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

1.5 Methodology for Assessing the Project Design Envelope

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

This Draft EIS assesses the impacts of the PDE described in the COP (US Wind 2023) and presented in Appendix C, *Project Design Envelope and Maximum-Case Scenario*, by using the "maximum-case scenario" process. The maximum-case scenario is composed of each design parameter or combination of parameters that would result in the greatest impact for each physical, biological, and socioeconomic resource. This Draft EIS evaluates potential impacts of the Proposed Action and each action alternative using the maximum-case scenario to assess the design parameters or combination of parameters for each environmental resource.[11] This Draft EIS considers the interrelationship between aspects of the PDE rather than simply viewing each design parameter independently. Certain resources may have

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

multiple maximum-case scenarios, and the most impactful design parameters may not be the same for all resources. Appendix C explains the PDE approach in more detail and presents a detailed table outlining the design parameters with the highest potential for impacts by resource area. Through consultation with its own engineers and outside industry experts, BOEM verified that the maximum-case scenario analyzed in the Draft EIS could reasonably occur. If any additional information is presented in future updated COP submissions it will be reviewed and incorporated in the EIS documents as appropriate.

1.6 Methodology for Assessing Impacts

This Draft EIS includes a description of the affected environment and potential impacts on the physical, biological, socioeconomic conditions, and cultural resources. The impacts analysis is bound by resource-specific geographic analysis areas, which are based on the anticipated geographic extent of impacts on each resource and are shown in each resource section.

For each resource, the affected environment section first describes the current conditions and ongoing trends resulting from past and present activities. Then, future baseline conditions are described, including changes to the current conditions that may result from anthropogenic or naturally occurring stressors (e.g., climate change), the continuation of ongoing activities, and planned activities in the absence of the Proposed Action. For a more accurate comparison of impacts, the No Action analysis considers impacts over the same time frame as the life of the project.

1.6.1 Impacts Resulting from Alternatives

Under the No Action Alternative, BOEM describes potential impacts from ongoing and planned activities (e.g., offshore and non-offshore wind power generation). The impacts of ongoing activities (e.g., current conditions) are presented first. Next, the impacts of planned activities without the Proposed Action (e.g., future baseline conditions) are presented. Last, the overall impacts of ongoing and planned activities without the Proposed Action are presented.

BOEM also analyzes potential impacts to resources that could result from the Proposed Action and alternatives to the Proposed Action. Additionally, BOEM evaluates the combination of those impacts with impacts from ongoing and planned activities. The potential impacts resulting from the Proposed Action are compared to the No Action Alternative, and potential impacts resulting from the alternatives are compared to the Proposed Action, each other, and the No Action Alternative.

1.6.2 Impacts Resulting from Planned Actions

Reasonably foreseeable impacts can occur from individually minor but collectively significant actions that take place over time. Therefore, this Draft EIS assesses ongoing and planned actions that could occur during the life of the Project and potentially contribute to cumulative impacts when combined with impacts from the Proposed Action and other action alternatives. Ongoing and planned actions include the following:

- Other offshore wind energy development activities

- Undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications)
- Tidal energy projects
- Marine minerals use and ocean-dredged material disposal
- Military use
- Marine transportation (commercial, recreational, and research-related)
- Fisheries use, management, and monitoring surveys
- Global climate change
- Oil and gas activities
- Onshore development activities

Appendix D, *Planned Activities Scenario*, describes the methodology used for assessing impacts from ongoing and planned activities in this Draft EIS and presents a description of the resource-specific geographic analysis areas, as well as actions that BOEM has identified as potentially contributing to reasonably foreseeable impacts when combined with impacts from the Proposed Action and other action alternatives over the specified spatial and temporal scales. Using the methodology described in Appendix D, each resource-specific *Environmental Consequences* section in Chapter 3 of this Draft EIS discusses reasonably foreseeable impacts.

1.6.3 Impacts Resulting from Climate Change

Impacts from climate change have influenced the current conditions of some resources and will likely continue to influence future baseline conditions. An analysis of environmental trends and climate change impacts is introduced in the No Action Alternative and assessed as part of the combined impacts resulting from action alternatives for each resource. A more detailed discussion of climate change (e.g., sea level rise, ocean acidification) is provided in Appendix D. The atmosphere, ocean, and land have warmed as a result of human influence, and widespread, rapid changes in the atmosphere, ocean, cryosphere, and biosphere have occurred. Observed warming is driven by emissions from human activities, such as fossil-fueled power-generating facilities. Local emissions, such as those from the construction of wind energy projects, would contribute to global emissions, and those global emissions do have impacts whose local effects are increasingly realized. However, as renewable energy projects begin operating and replacing fossil-fueled power-generating facilities (current and future facilities needed to meet energy demands), power generation emissions overall could decrease.

Chapter 2

Alternatives

2 Alternatives

This chapter (1) describes the alternatives carried forward for detailed analysis in this Draft EIS, including the No Action, Proposed Action, and other action alternatives; (2) describes the non-routine activities and low-probability events that could occur during construction, O&M, and decommissioning of the Project; and (3) presents a summary and comparison of impacts among alternatives and affected resources. The alternatives (Table 2-1) were developed using BOEM's *Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act* (BOEM 2022) and through extensive coordination with cooperating and participating (federal, state, local, and tribal) agencies, with input from the public and potentially affected stakeholders throughout the scoping process.

2.1 Alternatives Analyzed in Detail

Under NEPA, a reasonable range of alternatives framed by the purpose and need must be developed for analysis for any major federal action. The alternatives should be "reasonable," which the USDOI has defined as those that are "technically and economically practical or feasible, and meet the purpose and need of the proposed action" (43 CFR 46.420(b)). There also should be evidence that each alternative would avoid or substantially lessen one or more potential, specific, and significant socioeconomic or environmental effects of the Project. Alternatives that could not be implemented if they were chosen (for legal, economic, or technical reasons), or do not resolve the need for action and fulfill the stated purpose in taking action to a large degree, are not considered reasonable.

BOEM evaluated the alternatives and removed from further consideration alternatives that did not meet the purpose and need, the screening criteria, or both (BOEM 2022). These excluded alternatives and BOEM's screening criteria are provided in Section 2.2, *Alternatives Considered but not Analyzed in Detail*. The alternatives listed in Table 2-1 are not mutually exclusive. BOEM may select elements from several alternatives, resulting in a preferred alternative that will be identified in the Final EIS, provided that the design parameters are compatible and the preferred alternative still meets the purpose and need.

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

Table 2-1. Alternatives considered for analysis

Alternative	Description
Alternative A – No Action Alternative	Under Alternative A, the No Action Alternative, BOEM would not approve the COP; the Project construction and installation, O&M, and conceptual decommissioning would not occur; and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action (Alternative B) would not occur. However, all other existing or reasonably foreseeable future impact-producing activities would continue. The ongoing effects of the No Action Alternative serve as the baseline against which all action alternatives are evaluated. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to US Wind.
Alternative B – Proposed Action	Under Alternative B, the Proposed Action, the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility consisting of up to 114 WTGs, ranging from 14 to 18 MW each, up to 4 OSSs, 1 Met Tower, inter-array cables linking the individual WTGs to the OSSs, and substation interconnector cables linking the substations to each other would be developed in the Lease Area located 10.1 miles (16.2 kilometers) off the coast of Maryland at the closest point to shore. Additionally, up to four offshore export cables (installed within one Offshore Export Cable Route) that connect to Inshore Export Cable Route and three onshore substations with connections to the existing electrical grid near Millsboro, Delaware, would be constructed. The export cable would make landfall at 3R's Beach, traverse Indian River Bay (e.g., Inshore Export Cable Route), and connect to onshore substations next to the POI at the Indian River substation. The POI will include expansion of the existing substation and construction of two new substations adjacent to or within 0.5 miles (0.8 kilometers) of the existing substation. Development of the wind energy facility would occur within the range of design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures.
Alternative C – Landfall and Onshore Export Cable Routes Alternative	Under Alternative C, the Landfall Alternative, the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in onshore export cable routing that avoids crossing Indian River Bay and the Indian River (i.e., Inshore Export Cable Route). Each of the below sub-alternatives may be individually selected, subject to meeting the purpose and need. • **Alternative C-1** includes the Towers Beach landfall (i.e., exclusion of the 3R's Beach landfall), and a terrestrial-based Onshore Export Cable Route from the Towers Beach landfall to the Indian River substation (POI) (i.e., Onshore Export Cable Route 2). This would be contingent on selection of Offshore Cable Route 2 (northern route). • **Alternative C-2** includes the 3R's Beach landfall (i.e., exclusion of the Towers Beach landfall), and terrestrial-based Onshore Export Cable Routes from the 3R's Beach landfall to the Indian River substation would be considered (i.e., Onshore Export Cable Routes 1a, 1b, and 1c). This would be contingent on selection of Offshore Cable Route 1 (southern route).

Alternative	Description
Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Under Alternative D, the Viewshed Alternative, the construction, O&M, and eventual decommissioning of a wind energy facility offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. However, no surface occupancy would occur within 14 miles (22.5 kilometers) of shore, removing 32 WTG positions and one OSS associated with the future development phase, to reduce the visual impacts of the Project. This alternative would still allow for full development of MarWin and Momentum and fulfillment of existing power purchase agreements.
Alternative E – Habitat Impact Minimization Alternative	Under Alternative E, the Habitat Impact Minimization Alternative, the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), realigning of the offshore export cables, or both, and relocation of the Met Tower. Micrositing of WTGs, Met Tower, and cables may be necessary to avoid areas of concern.

BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; GW = gigawatt; km = kilometer; Met Tower = meteorological tower; mi = mile; MMPA = Marine Mammal Protection Act; MW = megawatt; NMFS = National Marine Fisheries Service; O&M = operations and maintenance; OSS = offshore substation; POI = point of interconnection; WTG = wind turbine generator

NMFS and the USACE are serving as cooperating agencies. NMFS intends to adopt the Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support its separate proposed action and decision to issue the authorization, if appropriate. The USACE similarly intends to adopt the EIS if it is determined to be sufficient after independent review to meet responsibilities under Section 404 of the CWA and Sections 10 and 14 of the RHA. Under the Proposed Action and other action alternatives, NMFS' action is to issue the requested Letter of Authorization to US Wind to authorize incidental take for the activities specified in its application and that are being analyzed by BOEM in the reasonable range of alternatives described here. The USACE is required to analyze alternatives to the Project that are reasonable and practicable pursuant to NEPA and the CWA 404(b)(1) guidelines. The range of alternatives analyzed in this Draft EIS, including cable route options within the PDE and alternatives considered but dismissed, represents a reasonable range of alternatives for this analysis.

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

2.1.1 Alternative A – No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP. Project construction and installation, O&M, and decommissioning would not occur, and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project (as described under the Proposed Action) would not occur. However, all other existing ongoing or other reasonably foreseeable future activities described in Appendix D, *Planned Activities Scenario*, would continue. The ongoing effects of the No Action Alternative serve as the baseline against which all action alternatives are evaluated. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to US Wind.

2.1.2 Alternative B – Proposed Action

The Proposed Action (Figure 2-1) is to construct, operate, maintain, and decommission an up to 2.2-GW wind energy facility in the Lease Area, 10.1 miles (16.2 kilometers) off the coast of Maryland. The facility would consist of up to 114 WTGs—ranging from 14 to 18 MW each, up to four offshore substations (OSSs), inter-array cables in strings of four to six linking the WTGs to the OSSs, and substation interconnector cables linking the OSSs to each other. The Proposed Action includes a 1 nautical mile (1.9 kilometer) setback from the traffic separation scheme (TSS) from Delaware Bay which removes 7 of the 121 WTG positions, resulting in a total of 114 WTGs (Figure 2-1). Up to four offshore export cables (installed within one Offshore Export Cable Route) would transition to a landfall at 3R's Beach via horizontal directional drilling (HDD). From the landfall, the cables would continue along the Inshore Export Cable Route within Indian River Bay to connect to an onshore substation adjacent to the point of interconnection (POI) at the Indian River substation owned by Delmarva Power and Light in Dagsboro, Delaware. The POI will include an expansion of the existing substation and construction of new substations adjacent to the existing substation (US Wind 2023).

Development of the wind energy facility would occur within the range of design parameters described in the COP (Volume I; US Wind 2023) and summarized in Appendix C, *Project Design Envelope and Maximum-Case Scenario*. The Project includes MarWin, a wind farm of approximately 300 MW for which the State of Maryland awarded to US Wind ORECs in 2017; Momentum Wind, consisting of approximately 808 MW for which the State of Maryland awarded additional ORECs in 2021; and build-out of the remainder of the Lease Area to fulfill ongoing, government-sanctioned demands for offshore wind energy. A description of construction and installation, O&M, and decommissioning activities for the Proposed Action is included in Sections 2.1.2.1 to 2.1.2.3. The US Wind COP (US Wind 2023) and all other supporting volumes (https://www.boem.gov/renewable-energy/state-activities/us-wind-construction-and-operations-plan) contain additional details on Project design, and are incorporated by reference throughout this EIS. If any additional information is presented in future updated COP submissions it will be reviewed and incorporated in the EIS documents as appropriate.

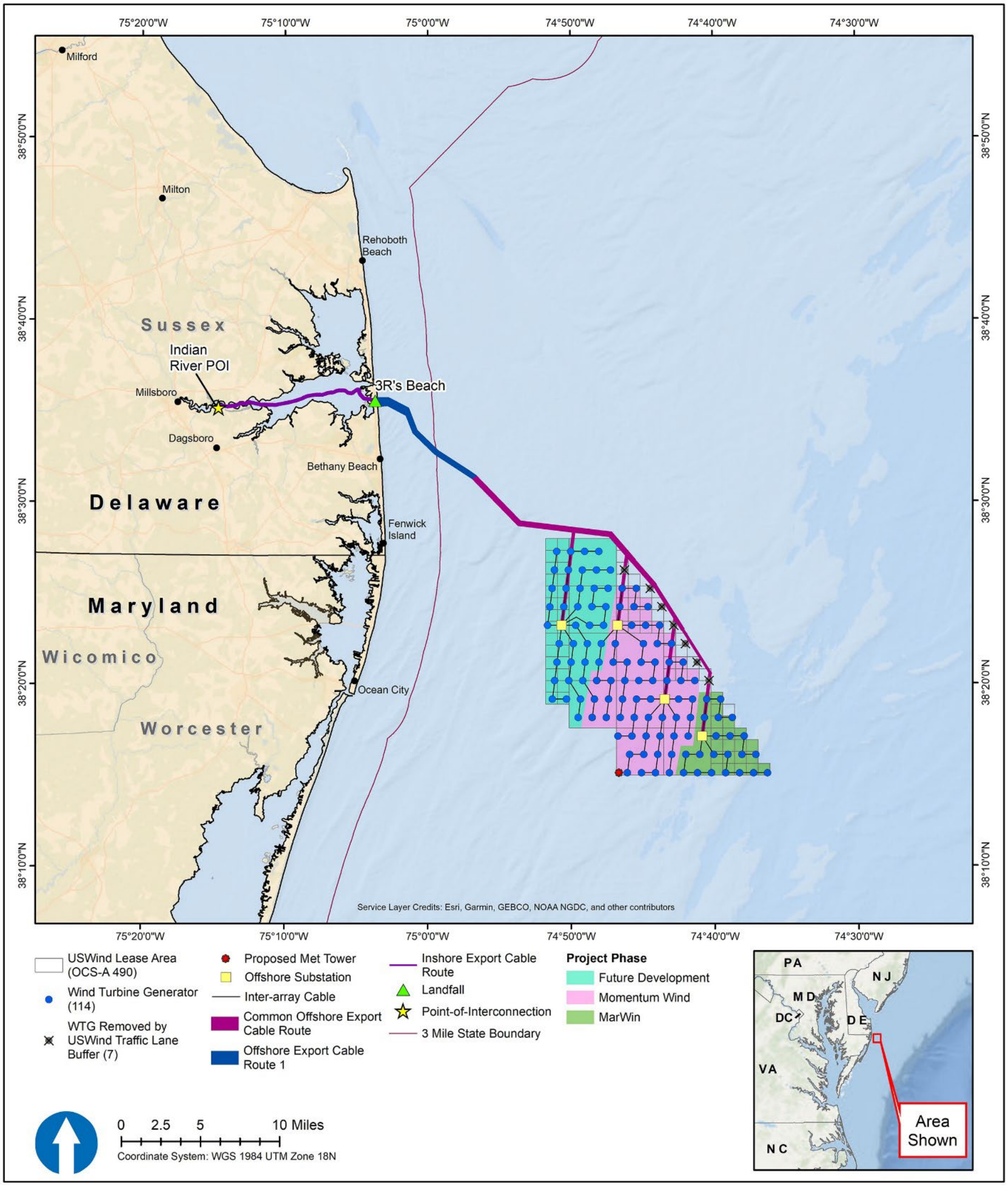

Figure 2-1. Maryland offshore wind Project area

2.1.2.1 Construction and Installation

The Proposed Action would include the construction and installation of onshore, inshore, and offshore facilities. US Wind anticipates development starting in MarWin and moving to the northwest in approximately 300 to 400 MW sections constructed over four campaigns, with the second and third occurring over the same time period. The subsequent campaigns would comprise Momentum Wind and any future build-out of the remaining Lease Area. Construction and installation of the phased development is targeted for completion in 2028, depending on whether the construction is staggered. An indicative Project schedule and alternative schedule for the phased development is included in the COP (Volume I, Section 1.1.4; US Wind 2023) and summarized below for the proposed schedule. Timeframes are identified by the 3-month quarter (Q) of that respective year.

Initial Construction Campaign

Foundations	Q2 2025 to Q4 2025
Onshore Substation	Q1 2024 to Q3 2025
Submarine Cable	Q2 2024 to Q1 2026
Onshore Cable	Q2 2024 to Q2 2026
Offshore Substations	Q2 2024 to Q3 2025
Wind Turbine Generators	Q2 2025 to Q1 2026

Second and Third Construction Campaigns

Foundations	Q2 2025 to Q4 2026
Onshore Substation	Q1 2024 to Q2 2026
Submarine Cable	Q3 2025 to Q3 2026
Onshore Cable	Q3 2025 to Q3 2026
Offshore Substations	Q2 2024 to Q3 2025
Wind Turbine Generators	Q2 2026 to Q1 2027

Fourth Construction Campaign

Foundations	Q2 2027 to Q4 2027
Onshore Substation	Q1 2024 to Q3 2025
Submarine Cable	Q3 2026 to Q2 2027
Onshore Cable	Q3 2026 to Q3 2027
Offshore Substations	Q3 2026 to Q3 2027
Wind Turbine Generators	Q2 2027 to Q1 2028

2.1.2.1.1 Onshore Activities and Facilities

Proposed onshore Project elements include the landfall site, the transition vaults that connect the offshore export cable to the inshore export cable (Indian River Bay route), the connections to the onshore substations, and the connection from the onshore substation to the existing grid. These elements collectively compose the Onshore Project area. Appendix C, *Project Design Envelope and Maximum-Case Scenario*, describes the PDE for onshore activities and facilities and the COP (Volume I;

US Wind 2023) provides additional details on construction and installation methods. The onshore elements of the Proposed Action are included in the EIS to support BOEM's analysis of a complete Project; however, BOEM's authority under the OCSLA only extends to the activities on the OCS.

The proposed offshore export cables would make landfall south of the Indian River Inlet at 3R's Beach, located within Delaware Seashore State Park. The proposed scenario is a landfall location in the vicinity of the 3R's Beach parking lot approximately 1 mile (1.6 kilometer) south of the Indian River Inlet (Figure 2-2).

Figure 2-2. Aerial view of 3R's Beach location within Delaware Seashore State Park

Source: US Wind 2023

When the offshore cables reach the landfall, they will be pulled into a cable duct that positions the cables under 3R's Beach to subterranean transition vaults. The transition vaults would be located in existing developed areas such as the adjacent parking area. Up to four HDD ducts and subterranean transition vaults may be installed at the landfall location. When fully installed, the shore end of the HDD ducts will terminate in a transition vault, and the water end will be sealed and buried to the installation depth of the offshore export cables. The proposed vaults are each approximately 40 feet (12 meters) long, 10 feet (3 meters) wide, and 10 feet (3 meters) deep. The HDD ducts will be connected to the transition vaults and backfilled with the excavated material or the appropriate clean fill. The transition vaults, when fully installed, will be accessed from ground-level access points.

There are no Onshore Export Cable Routes associated with the Proposed Action. The route connecting the landfall at 3R's Beach with the onshore substation at the Indian River substation is characterized as the Inshore Export Cable Route and discussed in the following section.

The existing 230 kV Indian River substation, owned by Delmarva Power and Light and located in Dagsboro, Delaware, is the proposed POI for the Project. The Indian River substation is adjacent to the NRG Energy Inc. Indian River Power Plant. Connection of the Project to the electrical grid is anticipated to involve expansion of the Indian River substation and construction of three new substations adjacent to or within 0.5 miles (0.8 kilometers). Expansion of the Indian River substation of up to 2 acres (0.8 hectares) is expected to accommodate the new capacity and required transformers, breakers, and switch and control gear.

US Wind also proposes to construct three new substations adjacent to the Indian River substation. Other location options for the new substations include several properties of sufficient size within 0.5 mile (0.8 kilometer) of the Indian River substation. Figure 2-3 shows a preliminary arrangement of the substations; however, the final design may vary within the shown footprint. The new substations would be constructed to the northwest and southwest of the Indian River substation. The proposed arrangement of the new substations allows for expansion of the Indian River substation and sequential construction of the new substations. The inshore export cables in Indian River Bay would exit the HDD duct into underground transition vaults approximately the same size as transition vaults at 3R's Beach landfall, and traverse underground to be terminated at the respective new substation block. The new substations would connect to the Indian River substation via a short overhead line approximately 500 feet (152 meters) long.

US Wind is evaluating gas- and air-insulated substations for the Project, which have different maximum footprints and tallest structures within the substation. Ground disturbance below the new substations is estimated to extend 12 feet (4 meters) below grade.

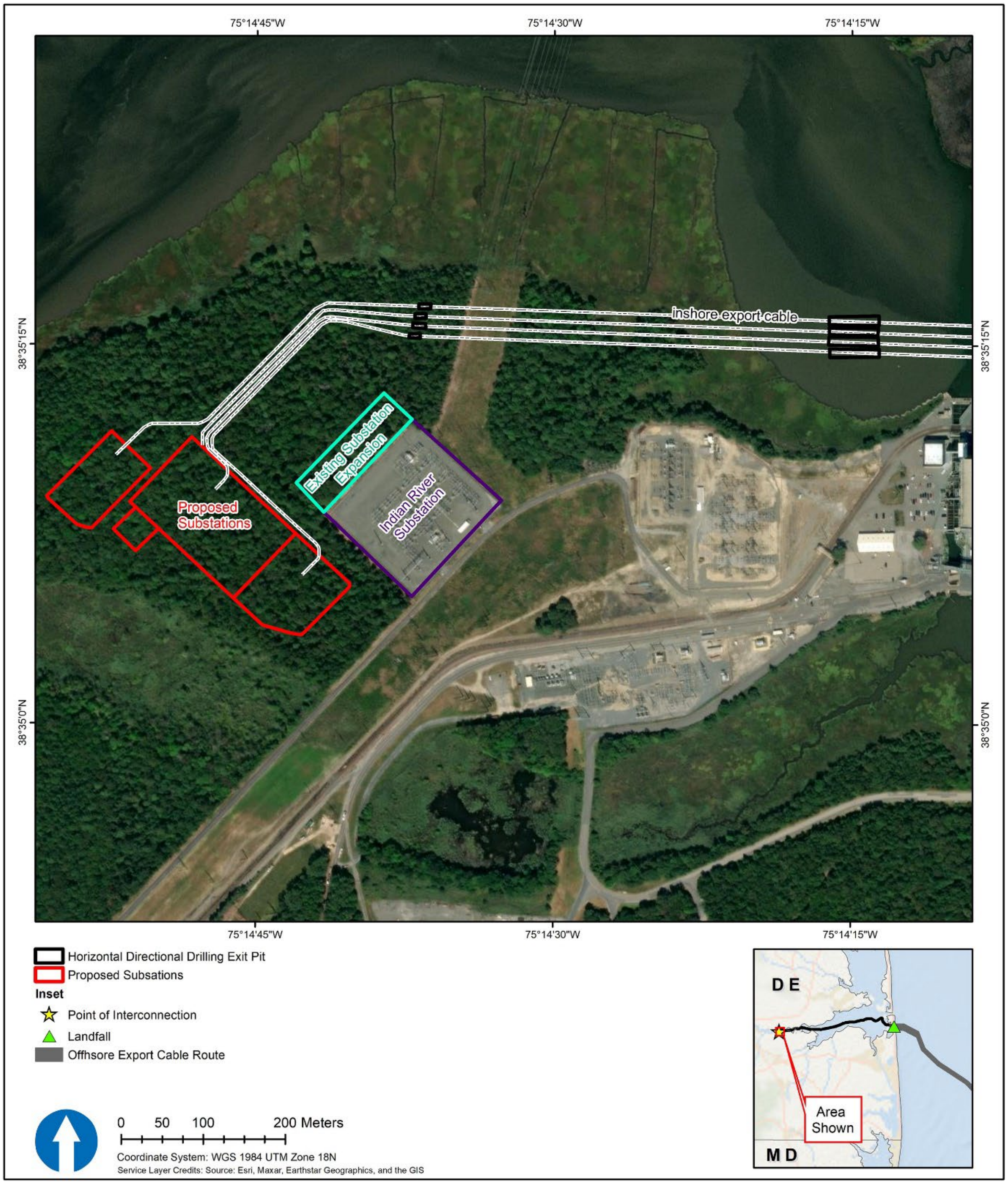

Figure 2-3. Onshore Indian River substation expansion and new (gas-insulated) US Wind substations

Source: US Wind 2023

2.1.2.1.2 Offshore and Inshore Activities and Facilities

Proposed offshore Project components include WTGs and their foundations, OSSs and their foundations, scour protection for foundations and cables, inter-array and substation interconnection cables, and offshore and inshore export cables. These elements collectively compose the Offshore/Inshore Project area. A Met Tower is also proposed to serve as a permanent metocean monitoring station outfitted with scientific instruments for recording empirical environmental and biological conditions. The proposed offshore/inshore Project elements are on the OCS, as defined in the OCSLA, except for a portion of the export cables that would be within state waters.

Appendix C, *Project Design Envelope and Maximum-Case Scenario*, provides the PDE for offshore activities and facilities and the COP (Volume I; US Wind 2023) provides additional details on construction and installation methods. The following descriptions provide an overview of the offshore Project elements.

The Proposed Action includes the installation of up to 114 WTGs, extending up to 938 feet (286 meters) (height of tip blade) above the sea surface with an east-west spacing of 0.77 nautical miles (1.43 kilometers) and a north-south spacing of 1.02 nautical miles (1.89 kilometers). Figure 2-4 presents a schematic drawing of the maximum WTG design parameters. US Wind would install the WTGs on monopile foundations, which are large-diameter, coated steel tubes driven into the seabed. The diameter, weight, length, and wall thickness of the monopile vary based on water depth, geotechnical conditions, metocean conditions, and WTG size.

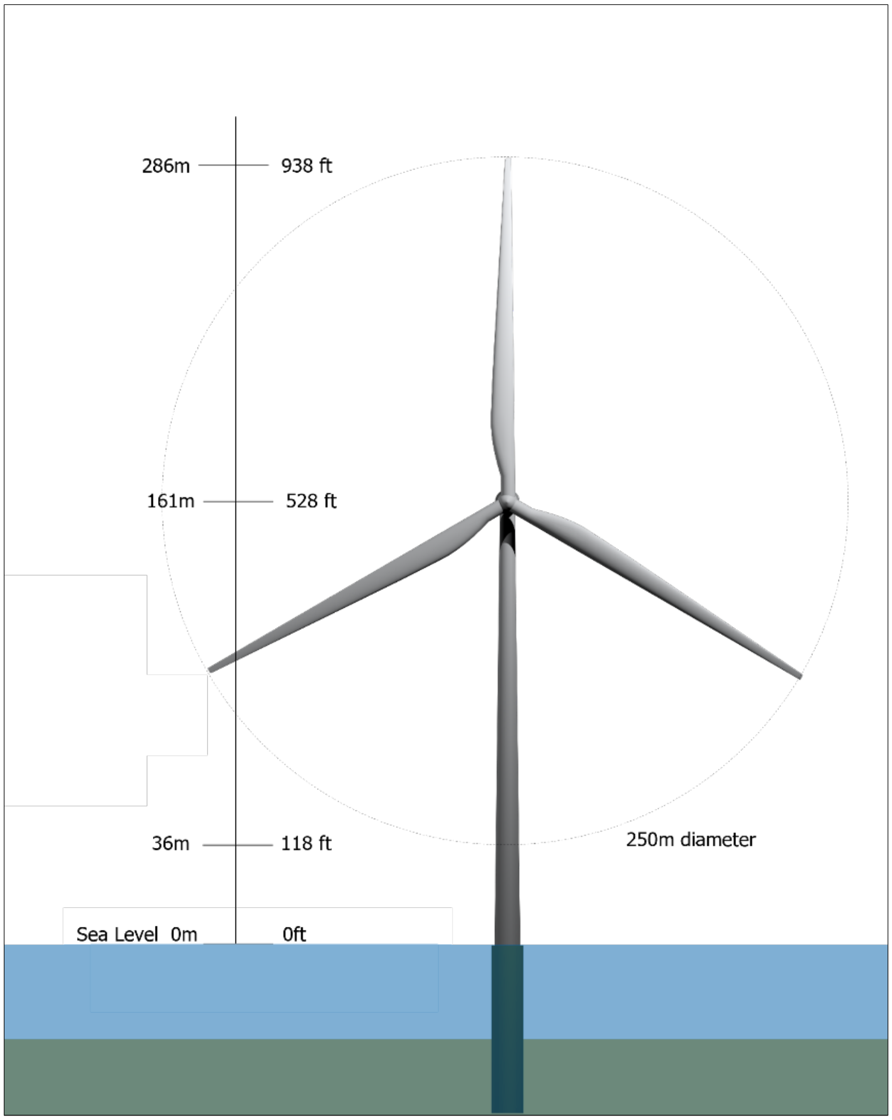

Figure 2-4. Wind turbine generator schematic (maximum design parameter)
Source: US Wind 2023

Monopile foundations will be transported to the installation site via self-floating or by using feeder vessels or direct installation vessels. The number of feeder vessels employed will be determined by foundation size and installation rate. US Wind anticipates up to four feeder vessels could be employed to support monopile installation. The feeder vessels may be jack-up vessels or tug and barge units. The feeder vessels may employ anchors for positioning, utilizing mid-line anchor buoys. The feeder vessels will sail from Baltimore, Maryland, to the Lease Area via the Chesapeake and Delaware Canal and Delaware Bay or via Chesapeake Bay. Installation of the monopile foundations offshore will be conducted using a dynamically positioned crane vessel or a jack-up style installation vessel equipped with a hydraulic impact hammer to drive the monopiles into the seabed.

US Wind intends to include scour protection in the form of rock around the base of the WTG monopile foundations, an area approximately three times the diameter of the foundation. The first layer of scour protection rocks will be deployed in a circle around the pile location, with a layer thickness of up to 2 feet (0.5 meters). This layer of small rocks—the filter layer—will stabilize the sandy seafloor, avoiding the development of scour holes. The rocks will be placed by a specialized rock-dumping vessel. Once the inter-array cables have been pulled into the monopile, a 2- to 7-feet (1- to 2-meters) thick layer of larger rocks—the armor layer—will be placed to stabilize the filter layer around the monopile.

Obstruction aviation lights are planned to be placed on the nacelle and tower of each WTG. US Wind expects to install two medium-intensity obstruction aviation lights on top of each nacelle and four low-intensity obstruction lights midway up each tower (approximately 229.7 to 262.5 feet [70 to 80 meters] above mean sea level), as well as a helicopter hoist status light. Navigation aids are likely to differ based on location within the wind energy facility. The COP (Volume II, Section 16.4 and Appendix K2; US Wind 2023) discusses US Wind's preliminary aviation and navigation lighting and marking plan for the maximum-case scenario and proposed layout.

The Proposed Action includes the installation of up to four OSSs for the Project, one for each grouping of 300 to 400 MW of WTG capacity, deployed atop monopile or jacket foundations. US Wind is evaluating a modular configuration of the OSS topsides, which is intended to be standardized to the extent possible to reduce cost, simplify installation, and facilitate review and approval. US Wind is also evaluating the combination of some or all OSS components onto one or two larger platforms. For this approach, equipment serving two or more arrangements of 300 to 400 MW (up to the full capacity of the Project) would be combined onto one or two large jacket foundations.

OSS topside dimensions are anticipated to range from 98 feet by 141 feet and 164 feet high (30 meters by 43 meters and 50 meters high) for a single module OSS in multiple locations and up to 131 feet by 262 feet and 197 feet high (40 meters by 80 meters and 60 meters high) for an OSS topside if the modules are placed at a single location. Monopile or jacket foundations are being considered for the OSSs.

A monopile foundation for an OSS would be similar to a monopile for a WTG. A jacket is a multi-leg lattice structure that is connected to the seabed via piling or suction buckets. The PDE includes a three-, four-, or six-leg jacket structure for the OSSs, depending on capacity. Piles driven into the seabed or suction buckets are used as the foundation of the jacket and to support the topsides. For piles, these may be pre-installed using a temporary template on the seabed or post-installed through jacket pile guides. For the jacket on suction bucket configuration, the buckets are integrated into the jacket legs and the structure is installed as one piece. Preliminary design parameters for the pile and jacket features are provided in Table 2-2. OSS commissioning activities are expected to be supported from a floating hotel (Flotel) or jack-up vessel. US Wind intends to include scour protection in the form of rock around the base of the OSS foundation, an area approximately three times the diameter of the piles or buckets. Suction buckets with scour protection mats incorporated into the buckets may be used if available and feasible.

Table 2-2. OSS foundation design parameters

OSS Parameter	Monopiles	Jacket on Suction Buckets	Jacket on Piles
Diameter (each)	26–36 ft (8–11 m)	33–49 ft (10–15 m)	7–13 ft (2–4 m)
Pile footprint (each)	165.0–312.0 ft^2 (50.3–95.1 m^2)	257.5–577.4 ft^2 (78.5–176.0 m^2)	10.2–23.3 ft^2 (3.1–7.1 m^2)
Pile penetration depth	98–131 ft (30–40 m)	33–49 ft (10–15 m)	98–262 ft (30–80 m)

Source: US Wind 2023

ft = feet; ft^2 = square foot; m = meter; m^2 = square meter

The Proposed Action includes inter-array cables connecting the WTGs to the OSSs that will run in a primarily north-south direction connecting four to six WTGs in a string. The cables will transition from their primary north-south direction to an east-west direction as required to connect the WTG strings to the OSSs. The inter-array cables will be 66 kV alternating current (AC), three-core cables with a maximum length of 125.6 miles (202.2 kilometers).

The Proposed Action includes up to four offshore export cables, one originating from each OSS within a single 1,968-foot (600-meter) wide Offshore Export Cable Route to the planned landfall at 3R's Beach. The offshore export cables will include 230 to 275 kV AC, three-core cables with a combined length of approximately 142.5 miles (229.3 kilometers).

For both the inter-array and offshore export cables, a pre-lay grapnel run will be conducted to remove debris prior to cable installation that may impact cable lay or burial. Seabed preparation such as leveling, pre-trenching, or boulder removal is not expected. Based on the sandy seafloor observed along the route, the cables likely will be installed using a towed or self-driving jet plow, which allows for direct installation and burial of the cable. A jet plow uses a combination of high-pressure water to temporarily fluidize the sediment, and the cable settles into the area opened by the jets through a combination of its own weight and a depressor arm. The displaced sediment settles back over the cable, effectively burying the cable. If soil conditions do not permit the use of a jet plow, a mechanical cutting/trenching tool or conventional cable plow may be employed. US Wind plans to bury cables 3.3 to 6.6 feet (1 to 2 meters) deep, but no more than 13.1 feet (4 meters) deep. If post-lay surveys determine insufficient burial depth, concrete mattresses will be installed. US Wind estimates a maximum of 10 percent of the offshore export cable would require additional protection, and it is likely to be significantly less.

The Proposed Action includes up to four inshore export cables connecting the planned landfall at 3R's Beach, traversing Indian River Bay, with the onshore Indian River substation. Similar to the offshore export cables, the inshore export cables will include 230 to 275 kV AC, three-core cables with a combined length across Indian River Bay of approximately 42.3 miles (68.1 kilometers).

Prior to installation of the inshore export cable in Indian River Bay, route clearance activities would include a pre-installation survey and grapnel run. Grapnel runs would be conducted to remove marine debris such as lost fishing nets, pots, or other objects from the construction path that could impact cable lay and burial. The cable installation spread will be arranged to maintain a limited draft and may be arranged on multiple barges. A cable storage barge will be equipped with a turntable, loading arm, and cable roller highway towards a cable installation barge. The barges would be suitable for positioning close to the HDD exit points (Old Basin Cove – Indian River Bay and Deep Hole – Indian River) due to the flat bottom and shallow draft. It is expected that the barge will be moved along the cable route using a six-point anchor system, assisted by an anchor-handling tug, in combination with spud piles.

Using small boats and flotation, the inshore cable will be fed to the HDD ducts, where it will be pulled through into the jointing/transition bays. If necessary, a temporary cable roller highway will be pre-installed in shallow water. The cable barge will lay and bury the cable between the two end points, maneuvering along the cable route using its anchoring system and positioned using spuds, as required. Based on the sediments observed along Inshore Export Cable Route in Indian River Bay, a barge-mounted vertical injector that fluidizes the soil likely will be the primary burial tool for the cable. The use of a cable plough or barge-mounted excavator may be required in some areas. In shallow water, a self-driving or towed post-lay cable burial tool may be used.

No cable or pipeline crossings have been identified within the Inshore Export Cable Route based on currently available information. The cable is anticipated to be installed in a continuous length; however, if operational needs warrant, the cable can be installed in smaller sections and spliced. US Wind will optimize the cable installation and construction methodologies and include the details in the Facility Design Report (FDR) and Fabrication and Installation Report (FIR) process.

In the shallow areas of Indian River Bay, shallow-water barge installation methods will be used. The barges would be suitable for positioning close to the HDD exit points due to the flat bottom and shallow draft. It is expected that the barge will be moved along the cable route using a six-point anchor system, assisted by an anchor handling tug, in combination with spud piles. The cable barge will lay and bury the cable between the two end points maneuvering along the cable route using its anchoring system and positioned using spuds as required. To achieve the target burial depth US Wind and its contractors have determined dredging would necessarily precede cable installation in locations along the cable routes for barge access.

With any of the cable burial methods in the Inshore Export Cable Route, the trench in the bay bottom would be narrow, about 3.3 feet (1 meters), and would collapse immediately after the cable has been depressed into the trench. The required burial depth will be based on the anticipated long-term bay bottom morphology and is expected to be 3 to 7 feet (1 to 2 meters). Up to four export cables may be laid in Indian River Bay, with spacing of 32 to 98 feet (10 to 30 meters) between the parallel alignments to allow for construction and any future maintenance. Construction would be confined to an approximately 1,640-foot (500-meter) wide Inshore Export Cable Route within Indian River Bay.

For the 3R's Beach landfall (Figure 2-5), HDD operations will be employed to install cable ducts at up to three transition points between water and land: (1) between the Atlantic Ocean and landfall at 3R's Beach; (2) from 3R's Beach into Indian River Bay (Old Basin Cove); and (3) from the Indian River (Deep Hole) to the onshore substations. The HDD work may be conducted simultaneously or in stages, depending on the final design of the Project.

Figure 2-5. 3R's Beach landfall: **HDD with offshore/onshore transition vault connection**

For the 3R's Beach landfall, the primary landside HDD equipment will be located in the parking lot, or other already developed areas such as access roads, and will consist of a drilling rig, mud pumps, drilling fluid cleaning systems, pipe-handling equipment, excavators, and support equipment such as generators and trucks. The approximate footprint required for HDD landside operations is 200 feet by 125 feet (60 meters by 38 meters). Prior to the commencement of drilling, a pit, potentially lined with sheet pile if needed for support, will be excavated at the landside drilling site for each bore. Alternatively, a casing pipe may be installed to help support the overlying soils. If sheet pile is required at the landside drilling site, it will be constructed of industry standard, interlocking sheet piling driven to design depth using a vibratory hammer. The pit will be excavated to the depth required to allow for HDD boring, avoiding bentonite flowing into the water. It is expected that the excavation will be to a depth of approximately 9.8 feet (3 meters). Any material from the excavation will be stockpiled in accordance with a stormwater management plan and used for backfill or repurposed as required.

Waterside HDD equipment will vary based on the installation location but will generally consist of a work platform (e.g., barge, small jack-up) and associated support vessels (e.g., tugs, small work boats). The work platform will be equipped with a crane, excavator, winches, and auxiliary equipment, including generators and lights. The limited water depth in Indian River Bay is expected to require in-water operations be based on a barge equipped with spuds for positioning. An anchor spread may be employed if required. The offshore (ocean-based) HDD works may be supported by a jack-up or barge. Approximate dimensions of the proposed HDD works are provided in Table 2-3. Final HDD lengths will depend on factors such as soil conductivity, cable design, and available installation methods to minimize disturbance in the shallow areas of the bay close to the landfall locations. The water side of the HDD duct would employ gravity cells or a casing pipe to facilitate cable installation, retain cuttings and drilling fluids, and ensure the HDD duct remains free of debris prior to installation of the export cable. The gravity cells for in-water operations are expected to be up to 197 feet (60 meters) long and 33 feet (10 meters) wide. The gravity cells will be designed to minimize the release of drilling cuttings and fluids and would be open on the seaward (outbound) side to facilitate installation of the export cables.

HDD operations commence with a pilot hole that is enlarged using progressively larger reaming tools. During HDD operations, drilling mud is injected to cool the drill bit, provide lubrication, and stabilize the borehole. The drilling mud is an inert bentonite slurry that carries cuttings back to the shoreside excavation pit for collection/removal and reuse. The HDD operation will include monitoring of the downhole water/bentonite slurry to minimize the potential of drilling fluid breakout. A series of reamers will be added to the drill string, as soil conditions allow, to progressively increase the size of the borehole until it is large enough to accept the final export cable duct. When the required borehole diameter is achieved, a pulling head is attached to the drill string at the in-water end of the bore. Prefabricated sections of duct are attached to the drilling head and pulled into the borehole. The duct sections are expected to be fabricated onshore and floated to the barge or jack-up for installation. A duct approximately 24 inches (60 centimeters) in diameter is planned, and final sizing of the duct will be confirmed based on cable sizing and thermal properties of the soils.

Table 2-3. Approximate HDD dimensions for the 3R's Beach landfall and Inshore Export Cable Route

Location	Length of HDD	Depth of Duct Below Grade	Water Depth Exit	Distance from Transition Vault to Shoreline
Atlantic Ocean (offshore export cable and 3R's Beach landfall)	1,600–5,300 ft (488–1,600 m)	8–60 ft (2–18 m)	30 ft (9 m)	550 ft (167 m)
Old Basin Cove (3R's Beach landfall and inshore export cable in Indian River Bay)	1,700–6,500 ft (518–2,000 m)	8–50 ft (2–15 m)	>2–5 ft (>1–1.5 m)	1,700 ft (518 m)
Deep Hole (inshore export cable and Indian River substation in Indian River)	1,600–3,200 ft (487–975 m)	8–40 ft (2–12 m)	>2–5 ft (>1–1.5 m)	1,350 ft (411 m)

Source: US Wind 2023

ft = feet; HDD = horizontal directional drilling; m = meter

The Proposed Action also includes installation of a Met Tower at three potential locations on the western edge of the southernmost row of the array. All locations under consideration would be the only structures considered outside of the Project's regular east-west spacing of 0.77 nautical miles (1.43 kilometers) and north-south spacing of 1.02 nautical miles (1.89 kilometers) array layout. The locations were selected to be in line with the east-west turbine row to limit any additional obstruction to fishing and other vessel traffic transiting across the Lease Area. The Met Tower will serve as a permanent metocean monitoring station to support project operations and long-term monitoring and is planned to include a robust suite of monitoring, data logging, and remote communications equipment as well as associated power supply, lighting, and marking equipment. The Met Tower would be a bottom-fixed structure consisting of a steel lattice mast fixed to a steel deck supported by a steel braced caisson-style foundation. The main caisson is a 6-feet (1.8-meters) diameter pile that tapers to 5 feet (1.5 meters) in diameter above the mudline. The pile will be driven to an anticipated maximum depth of 175 feet (53 meters). The two bracing piles are each 5 feet (1.5 meters) in diameter. These piles will be driven to an anticipated maximum depth of 166 feet (51 meters). The height of the Met Tower, including the mast and foundation, will be approximately 328 feet (100 meters) above mean sea level and no higher than maximum hub height. The platform deck supporting the mast will be approximately 3,000 square feet (279 square meters).

Due to the global nature of the offshore wind supply chain, some Project elements likely will be manufactured and transported to a staging facility at Sparrows Point, Maryland, for final assembly and transport to the Project site. The construction and staging facilities for the Project will allow for the receipt and fabrication of Project components as well as the pre-assembly of components prior to installation offshore. A facility at Sparrows Point, in addition to other locations, as needed, is anticipated to support multiple Project activities, including the following:

- Fabrication or assembly of foundations;
- Storage and pre-assembly of turbines;
- Storage and trans-shipment of export and inter-array cables;
- Fabrication or assembly of OSSs and support components;
- Fabrication or assembly of feeder barges;
- Loadout of project components for installation offshore; and
- Support for other offshore wind projects' fabrication needs.

The Proposed Action anticipates utilizing facilities in the Greater Baltimore area, including Sparrows Point. Other port facilities on the East Coast could be utilized to support the Project and will be considered by US Wind on an as-needed basis (Table 2-4). Development of some infrastructure at the potential port sites likely will be required.

Component fabrication and facility preparation is expected to commence 2 to 3 years prior to offshore construction, and Project construction activities likely will occur over a period of 2 to 5 years.

Table 2-4. Proposed construction activities and related port facilities

Port Facility	Project Elements	Activity
Baltimore, Maryland (Sparrows Point)	WTG – Primary Foundation – Primary OSS – Primary Cable – Primary Onshore Cable – Primary	Delivery, storage, pre-assembly and load out to installation or feeder vessel; Fabrication, assembly of components, load out to feeder or installation vessel; Fabrication, assembly of components, load out to feeder or installation vessel; Storage, load out to installation vessel; and Storage, load out to installation vessel (Indian River Bay crossing).
Portsmouth, Virginia (Hampton Roads area)	WTG – Alternate Foundation – Alternate Support Alternate	Delivery, storage, pre-assembly and load out to installation or feeder vessel; Fabrication, assembly of components, load out to feeder or installation vessel; and Large support vessels, assembly of components, load out to feeder vessel.
Port Norris, New Jersey	Support – Alternate	Support services, crew transfer
Ocean City, Maryland	Support – Primary	Support services, crew transfer
Lewes, Delaware	Support – Alternate	Support services, crew transfer
Cape Charles, Virginia	Support – Alternate	Assembly of components, load out to feeder vessel

Source: US Wind 2023
OSS = offshore substation; WTG = wind turbine generator

2.1.2.2 Operations and Maintenance

As the owner and operator of the Project, US Wind will be responsible for daily operations, including planned and unplanned maintenance. US Wind's maintenance strategy assumes an integrated maintenance approach that incorporates the maintenance activities of all Project components in order to minimize the time technicians spend offshore and downtime. The planned O&M Facility is intended to serve as the primary access point for Project maintenance activities. The 24/7 monitoring of the Project will be conducted at both the O&M Facility and the original equipment manufacturer's remote operations center, which will monitor the WTGs and electrical systems and coordinate with the grid operator, PJM.

The O&M Facility will have access to a nearby quayside area that allows for the loading of maintenance crews, replacement components, and consumables onto crew transfer vessels. The crew transfer vessels will transport the maintenance crews to the offshore site on an as-needed basis dependent on weather conditions. Potential O&M ports are listed in Table 2-5.

Table 2-5. Potential O&M ports

Ports	Potential O&M Activities
Ocean City, Maryland	Maintenance activities for WTGs, OSSs, and routine inspections
Lewes, Delaware	Maintenance activities for WTGs, OSSs, and routine inspections
Portsmouth (Hampton Roads area), Virginia	Major maintenance activities requiring deep draft or jack-up vessels
Baltimore, Maryland	Major maintenance activities requiring deep draft vessels

Source: US Wind 2023
O&M = operations and maintenance; OSS = offshore substation; WTG = wind turbine generator

2.1.2.2.1 Onshore Activities and Facilities

Maintenance of the onshore substation primarily consists of non-intrusive inspections of switchgear, transformers, control systems, conductors, and support structures. Similar to the OSSs, the scheduled maintenance of the onshore substation components will occur at predefined intervals in accordance with the manufacturer's recommendations and in coordination with PJM.

2.1.2.2.2 Offshore and Inshore Activities and Facilities

WTGs are designed to be operated remotely and only accessed by technicians for routine maintenance and inspections, or in the event of a fault that requires local reset or intervention. Operations will be monitored remotely from the O&M Facility and the original equipment manufacturer's remote operations center. Scheduled maintenance of the OSS components will occur at predefined intervals in accordance with the manufacturer's recommendations. Planned maintenance outages will be scheduled with PJM to avoid peak load periods. Scheduled maintenance will include high-voltage protection functional tests, switchgear tests, and detailed transformer inspections. Planned maintenance operations for foundations include visual inspections of the topside portions of the foundations and remotely operated vehicle (ROV) inspection of the underwater portions of the foundation, including cable protection and cable entry, cathodic protection, and scour systems. During the initial operational period of approximately 2 years, foundations will be inspected visually above and below the waterline at least once. The findings of the initial inspections will inform the frequency of inspections to be completed later in the project life cycle and is expected to be every 4 or 5 years.

Cable surveys are anticipated in year 1, year 3, and then every 5 years after. The frequency of the surveys may be adjusted based on the results of the first survey. The determination of cable burial depths may be derived indirectly from observed bathymetric changes with respect to the as-built situation.

2.1.2.3 Conceptual Decommissioning

Under 30 CFR Part 285 and Renewable Energy Lease Number OCS-A 0498, US Wind would be required to remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seabed of all obstructions created by the Project. All facilities would need to be removed 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)). Absent permission from BSSE, US Wind would have to achieve complete decommissioning within 2 years of termination of the lease and either reuse, recycle, or responsibly dispose of all removed materials. US Wind has submitted a conceptual decommissioning plan as part of the COP (Volume I, Chapter 7.0; US Wind 2023), and the final decommissioning application would outline US Wind's process for managing waste and recycling Project components.

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

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

2.1.2.3.1 Onshore Activities and Facilities

The decommissioning process for the onshore substations will include powering down a section of the substation and removing the equipment in the opposite order that it was installed. The onshore substations are anticipated to include perimeter fencing/access controls, security lighting, and up to four circuit breakers and associated disconnect switches, metering, relay, and control panels. Aboveground transmission structures will be dismantled and foundations removed as required by regulatory standards or landowner requirements. If underground cables are employed, the cables and associated conduits/duct banks and vaults will be removed. Typical onshore construction equipment, including cranes and earth-moving equipment, will be employed to decommission the onshore substations.

2.1.2.3.2 Offshore and Inshore Activities and Facilities

The inter-array, offshore, and inshore export cables will be disconnected from the WTGs and OSSs and, subject to discussions with the appropriate regulatory agencies on the preferred approach to minimize environmental impacts, either retired in place or removed from the seabed and recovered onto a barge or suitably equipped vessel. The cable routes will be exposed as needed to dislodge the cables and allow for the cable to be recovered. When the cable has been recovered, it will be transported to shore for disposal or recycling.

The OSSs will be decommissioned in a sequential manner similar to the manner in which they were installed. The equipment on the platforms will be de-energized and made safe for removal. Any cabling connections to the OSSs will be removed. Hazardous materials will be removed from the platform(s) and transported to shore in accordance with the Oil Spill Response Plan (OSRP) to prevent contamination of the environment. OSS removal is expected to be conducted using a combination of floating crane vessels, jack-up vessels, and associated support vessels. The OSS topside can be removed in its entirety or on a component-by-component basis. Foundation piling will be removed to a level below the mudline of the seafloor in accordance with the conditions of the lease.

The WTGs, including the nacelles, towers, and turbine blades, will be decommissioned using equipment similar to that employed for installation. The WTGs will be shut down, and any oils associated with the turbines will be drained in accordance with the OSRP. A jack-up or floating crane vessel will be utilized to remove the blades, nacelle, and tower, and the components will be transported to shore for recycling or disposal. The Project may use different types of foundations for the WTGs from those used for the OSSs. Removal of each foundation type will include removal of the transition piece (if applicable) and the foundation structure as required, potentially to 15 feet (5 meters) below the seafloor. Foundation removal likely will be conducted using a combination of floating crane vessels, jack-up vessels, and associated support vessels. Monopile and piled jacket foundations would be removed to a level below the mudline of the seafloor in accordance with the conditions of the lease. In the case of an OSS foundation consisting of a jacket with suction buckets, the buckets would be removed by reversing the installation process, pushing the buckets out of the seabed. Once the foundations are free from the seabed, they will be lifted onto transport vessels for recycling or disposal onshore.

Based on agency approval, scour protection systems used to protect foundations and cables may be left in place to provide seafloor habitat. If removed, a crane will pick up the material and place it on a barge. The rock in these systems can be reused for other projects and will not require disposal in a landfill. If required, the scour systems will be removed in such a manner that the seafloor will be returned to pre-project conditions, with no obstructions remaining to future activities.

The Met Tower decommissioning will include removal of small ancillary equipment, then a heavy lift derrick barge will be mobilized to the site to lift the mast and the heavier ancillary equipment from the Met Tower deck and place it on either the lift barge or a materials barge. In accordance with 30 CFR 585.910, the Met Tower foundation piles will be cut to a depth of 15 feet (5 meters) below the surveyed datum, removed to the deck of the lift barge or materials barge, and transported to shore for processing at a licensed recycling facility.

2.1.3 Alternative C – Landfall and Onshore Export Cable Route Alternative

Alternative C was developed through the scoping process for the Draft EIS in response to comments requesting an alternative to minimize impacts on Indian River Bay. Under Alternative C, the Landfall and Onshore Export Cable Route Alternative ("Landfall Alternative"), the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility on the OCS offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in terrestrial onshore export cable routing that avoids crossing Indian River Bay and the Indian River (i.e., Inshore Export Cable Route). Offshore Project components within the Lease Area (WTGs, OSSs, inter-array cables, and Met Tower) would be the same as the Proposed Action (Alternative B). Each of the below sub-alternatives may be individually selected, subject to meeting the purpose and need.

Alternative C-1 (Figure 2-6) includes the Towers Beach landfall (i.e., exclusion of the 3R's Beach landfall), and a terrestrial Onshore Export Cable Route from the Towers Beach landfall to the Indian River substations (POI) (i.e., Onshore Export Cable Route 2). This would be contingent on selection of Offshore Cable Route 2 (northern route). Under Alternative C-1, the offshore export cables would make landfall at Towers Beach, approximately 5 miles (7.7 kilometer) north of the Indian River Inlet, in an existing parking lot within Delaware Seashore State Park. When the offshore cables reach the landfall, they will be pulled into a cable duct that positions the cables underground to subterranean transition vaults and then run via Onshore Export Cable Route 2 to the POI utilizing Delaware Department of Transportation (DelDOT) ROWs. The Onshore Export Cable Route associated with Alternative C-1 is as follows:

- Onshore Export Cable Route 2: Approximately 17 miles (28 kilometers) along existing DelDOT ROWs from landfall at Towers Beach to the Indian River POI via a northern route around Indian River Bay. Cables would exit transition vaults at the Towers Beach landfall, traverse north along Coastal Highway/Route 1 through Dewey Beach and Rehoboth, turn west along Airport Road, continue south along Road 274 then west along Route 1D, connect to Route 24 South/John J Williams Highway to an Exelon overhead power line ROW, and then cross the Indian River via HDD and continue underground to the US Wind substations.

Alternative C-2 (Figure 2-7) includes the 3R's Beach landfall similar to the Proposed Action (i.e., exclusion of the Towers Beach landfall); however, only terrestrial Onshore Export Cable Routes from the 3R's Beach landfall to the Indian River substation would be considered (i.e., Onshore Export Cable Routes 1a, 1b, and 1c). This would be contingent on selection of Offshore Cable Route 1 (southern route). When the offshore cables reach the landfall, they will be pulled into a cable duct that positions the cables underground to subterranean transition vaults and then run via an Onshore Export Cable Route to the specific POI utilizing DelDOT ROWs, except for portions of Onshore Export Cable Routes 1b and 1c that will utilize a Sussex County ROW under development. The three Onshore Export Cable Routes associated with Alternative C-2 are as follows:

- Onshore Export Cable Route 1a: Approximately 16 miles (26 kilometers) from the landfall at 3R's Beach along existing DelDOT ROWs to the Indian River POI via a southern route around Indian River Bay. The cables would exit the transition vaults at 3R's Beach, traverse south along Coastal Highway/Route 1, turning west on Fred Hudson Road, south on Central Avenue, then along Route 26/Atlantic Avenue to Dagsboro, continuing north on Route 26/Main Street through Dagsboro, and then generally north along Iron Branch Road/Road 332 to the US Wind substations.
- Onshore Export Cable Route 1b: Approximately 16 miles (26 kilometers) along existing DelDOT ROWs and Sussex County ROWs under development from landfall at 3R's Beach to the Indian River POI. Cables would exit the transition vaults at 3R's Beach along the same route as Onshore Export Cable Route 1a until west of Millville, then head south on Route 17 until turning west/northwest along a Sussex County water line ROW, currently under development, crossing Route 26, then turning north in parallel with Iron Branch Road/Road 332 to the US Wind substations.
- Onshore Export Cable Route 1c: Approximately 17 miles (27 kilometers) along existing DelDOT ROWs and Sussex County ROWs under development from landfall at 3R's Beach to the Indian River POI. The cables would exit transition vaults at 3R's Beach, traverse south along Coastal Highway/Route 1 through Bethany Beach, turning west on Wellington Avenue, south on Kent Avenue to an Exelon substation, then generally west along an Exelon ROW, picking up the Sussex County ROW after crossing Route 17, and finally traversing the same remaining route to the US Wind substations as Onshore Export Cable Route 1b.

Construction of any of the terrestrial Onshore Export Cable Routes would require the cables be buried underground in previously disturbed ROWs that may include existing infrastructure such as utility lines. A trench would be excavated in the ROW to install a duct bank approximately 80 to 105 inches (203 to 267 centimeters) wide and approximately 30 to 90 inches (76 to 228 centimeters) high, depending on the configuration, with up to 18 inches (45 centimeters) of additional excavation on either side of the duct bank during construction. A maximum of four cables would be installed in duct banks of cement-bound sand in either a horizontal or vertical configuration. The duct banks would be buried such that the top of the bank is a minimum of 36 inches (91 centimeters) below grade.

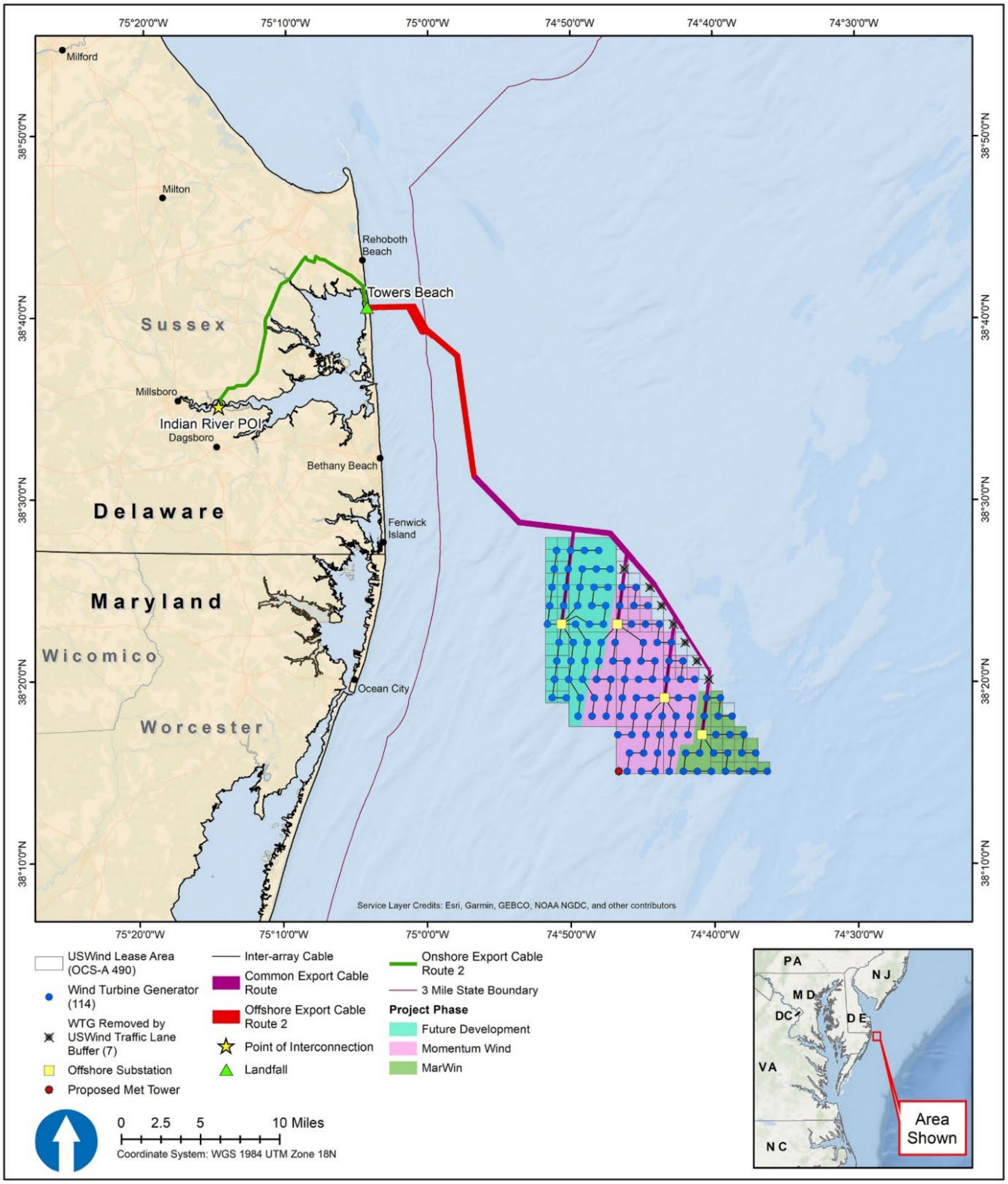

Figure 2-6. Alternative C-1 – Towers Beach Landfall Alternative

Source: US Wind 2023

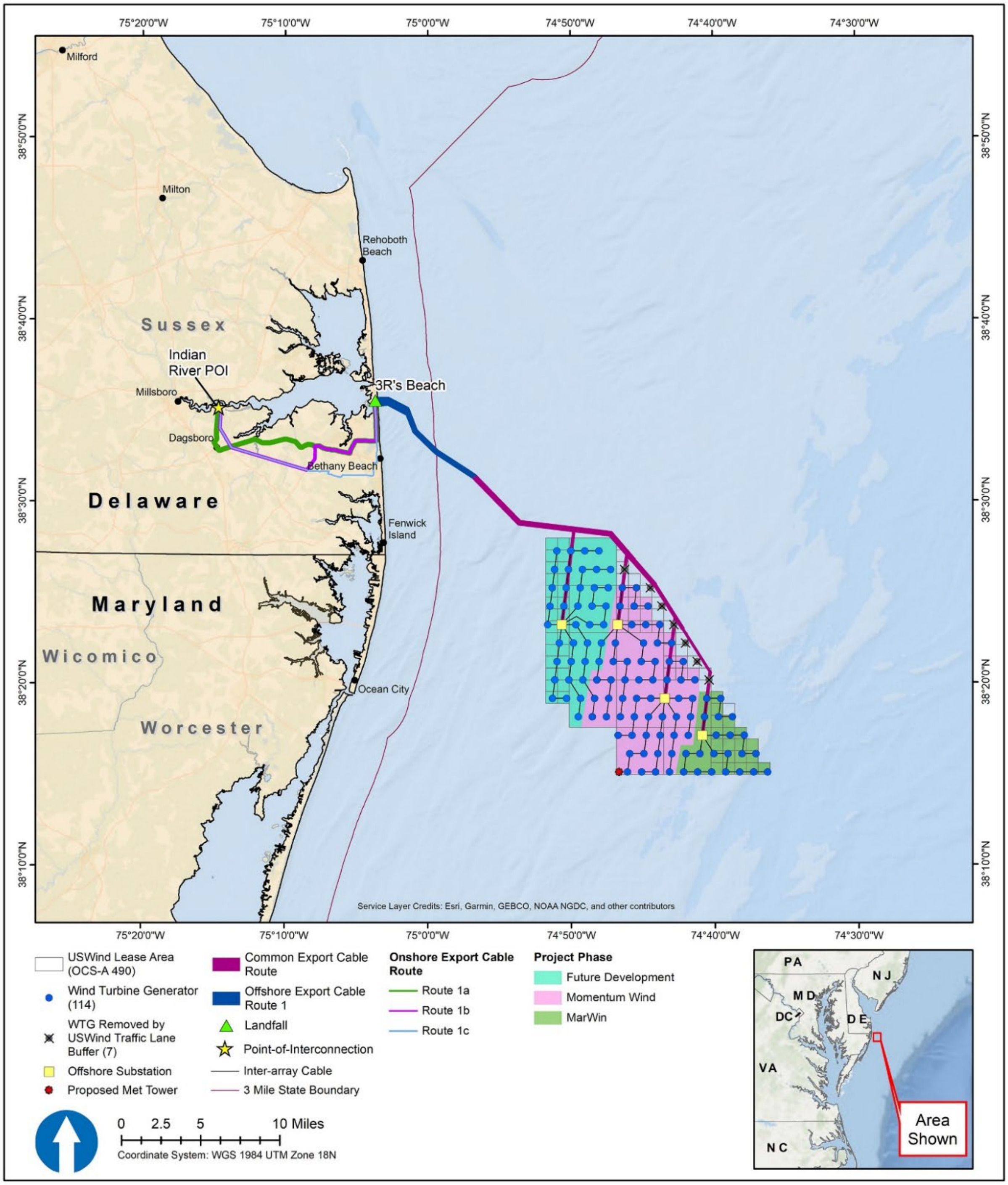

Figure 2-7. Alternative C-2 – 3R's Beach Landfall Alternative

Source: US Wind 2023

2.1.4 Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative

Alternative D was identified during the scoping process for the Draft EIS in response to public comments concerning the visual impacts of the Project. Under Alternative D, the Viewshed Alternative (Figure 2-8), the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility on the OCS offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in the exclusion of 32 WTG positions and one OSS within 14 miles (22.5 kilometers) of shore associated with the future development phase. The 14-miles (22.5-kilometers) exclusion allows for full development of MarWin and Momentum and fulfillment of existing power purchase agreements, while still allowing site selection flexibility. The public comment process proposed a 15-mile (24.1 kilometer) exclusion zone for WTGs, but the difference of 1 mile in the exclusion zone is not likely to result in a significant reduction in impact. Thus, the benefit gained in an additional mile of exclusion (15 miles versus 14 miles [24.1 kilometers versus 22.5 kilometers]) would not warrant the added strain on the Project, given currently identified WTG capacity, and the risk of failure to meet current power purchase agreements.

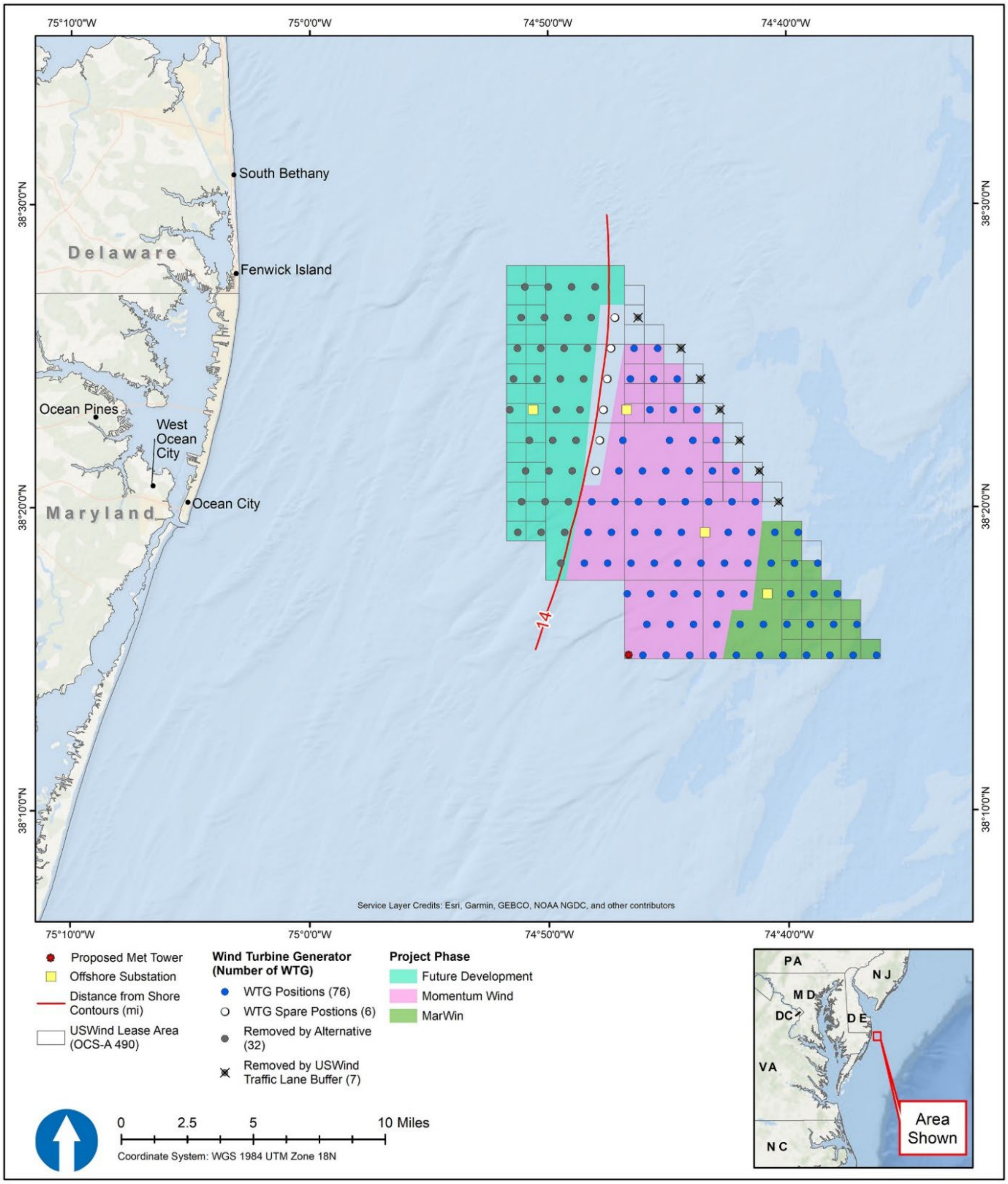

Figure 2-8. Alternative D – Viewshed Alternative that excludes 32 WTG positions and 1 OSS within 14 miles (22.5 kilometers) of shore associated with the future development phase

2.1.5 Alternative E – Habitat Impact Minimization Alternative

Alternative E was identified through the scoping process for the Draft EIS in response to comments received requesting an alternative to minimize impacts on offshore benthic habitats. NMFS identified six habitat areas using data provided by US Wind and previously collected data and reports (e.g., Guida et al. 2017). These areas are characterized by large, landscape scale features such as high-relief sand ridge and trough complexes and deep holes/drop-offs, where development and conversion of the bottom may result in significant impacts. These areas produce habitat value for fish and shellfish through vertical relief, high rugosity, stratification of sediments, presence of other benthic features, and other characteristics that result in high habitat heterogeneity and complexity on various spatial scales (from sub-meter to many kilometers).

Under Alternative E, the Habitat Impact Minimization Alternative (Figure 2-9), the construction, O&M, and eventual decommissioning of an up to 2.2 GW wind energy facility on the OCS offshore Maryland would occur within the range of the design parameters outlined in the COP (US Wind 2023), subject to applicable mitigation measures. This alternative would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), realignment of the offshore export cables, and relocation of the Met Tower. Micrositing the WTGs, Met Tower, and cables may be necessary to avoid areas of concern (AOCs; i.e., sensitive benthic habitat).

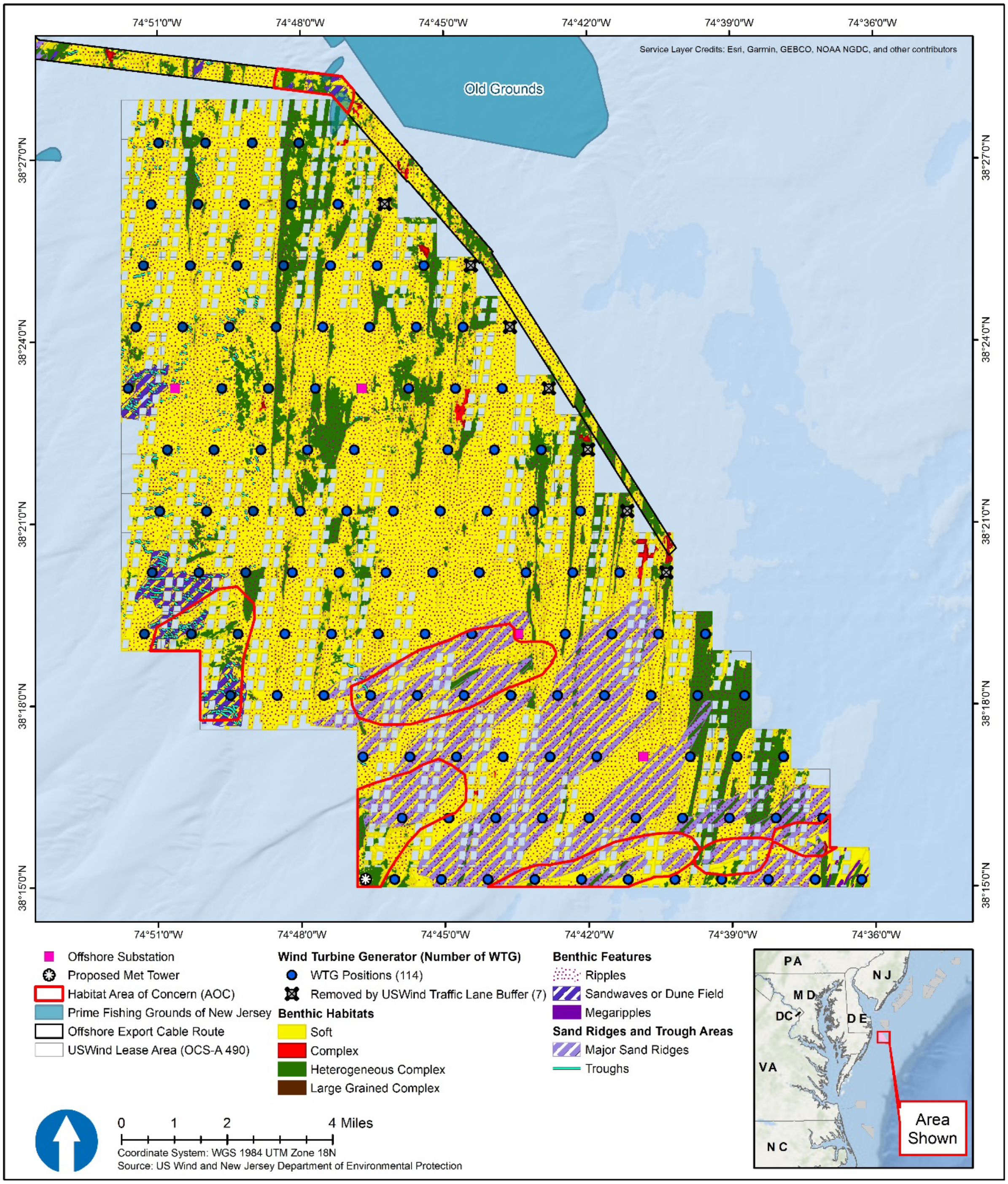

Figure 2-9. Alternative E – Habitat Impact Minimization Alternative

2.2 Alternatives Considered but Not Analyzed in Detail

Under NEPA, a reasonable range of alternatives framed by the purpose and need must be developed for analysis for any major federal action. The alternatives should be "reasonable" which the USDOI has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action."[12] There also should be evidence that each alternative would avoid or substantially lessen one or more potential, specific, and significant socioeconomic or environmental effects of the project.[13] Alternatives that could not be implemented if they were chosen (for legal, economic, or technical reasons), or do not resolve the need for action and fulfill the stated purpose in taking action to a large degree, are not considered reasonable.

BOEM considered alternatives to the Proposed Action that were developed using BOEM's *Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act* (BOEM 2022), through coordination with cooperating and participating agencies, and through public comments received during the public scoping period for the EIS. BOEM then evaluated the alternatives and dismissed from further consideration alternatives that did not meet the purpose and need, the screening criteria, or both, as outlined in BOEM's process (BOEM 2022). An alternative would be considered but not analyzed in detail if it meets any of the following criteria:

- It results in activities that are prohibited under the lease (e.g., requires locating part, or all, of the wind energy facility outside of the lease area, or constructing and operating a facility for another form of energy);
- It would not respond to the purpose and need of BOEM's action, including not furthering the nation's policy to make OCS energy resources available for expeditious and orderly development, subject to environmental safeguards;[14]
- It would not be responsive to US Wind's primary goal, such as alternatives that would:
    - Relocating a majority of the project outside the defined geographic area where it was proposed; or
    - Result in the development of a project that would not allow the developer to satisfy contractual offtake obligations (e.g., resulting in a project with a nameplate capacity that is less than what is required under a power purchase agreement; result in delays in the construction of the project, preventing the project from initiating commercial operations by the required date in the power purchase agreement);
- It is environmentally infeasible, meaning implementation of the alternative would result in an obvious and substantial impact on the human environment or result in an obvious and substantial increase in impacts to the human environment that outweighs potential benefits;

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[12] 43 CFR 46.420(b). The terms "practical" and "feasible" are not intended to be synonymous (73 *Federal Register* 61331, October 15, 2008).
[13] 43 CFR 46.415(b)
[14] 43 U.S.C. 1332(3)

- There is no scientific evidence that the alternative would avoid or substantially lessen one or more significant socioeconomic or environmental effects of the project;
- It is technically infeasible or impractical, meaning implementation of the alternative is unlikely given past and current practice, technology, or site conditions (e.g., presence of boulders), as determined by BOEM's technical experts;
- It is economically infeasible or impractical, meaning implementation of the alternative is unlikely due to unreasonable costs, as determined by BOEM's technical experts, while this does not require cost-benefit analysis or speculation about an applicant's costs and profits, there must be a reasonable basis;
- Its implementation is remote or speculative;
- It lacks sufficient detail to meaningfully analyze impacts;
- It is substantially similar in design to an alternative that is analyzed in detail;
- It would have substantially similar effects as an alternative that is analyzed in detail.

Table 2-6 lists the alternatives and the rationale for their dismissal. These alternatives are presented with a brief discussion of the reasons for their elimination as prescribed in Council on Environmental Quality regulations at 40 CFR 1502.14(a) and USDOI regulations at 43 CFR 46.420(b–c).

Table 2-6. Alternatives considered but not analyzed in detail

Alternative Considered	Justification for Eliminating the Alternative
Wind Farm Location and Generating Capacity	
Alternate locations for the wind energy facility outside the Lease Area (i.e., farther north/south, farther offshore, or in a different wind energy area)	Evaluating an alternate location for the wind energy facility outside the Lease Area would constitute a new Proposed Action and would not meet BOEM's purpose and need to respond to US Wind's proposal and to determine whether to approve, approve with modifications, or disapprove the COP to construct, operate and maintain, and decommission a commercial-scale offshore wind energy facility within the Lease Area. BOEM's regulations require the agency to analyze US Wind's proposal to build a commercial-scale wind energy facility in the Lease Area. BOEM would consider proposals in other existing leases through a separate regulatory process. This alternative would effectively be the same as selecting the No Action Alternative.
Removal of WTGs sited within 15 miles (24.1 kilometers) of shore	This alternative is substantially similar to Alternative D, the Viewshed Alternative. A public comment received during scoping proposed a 15-mile (24.1-kilometer) exclusion zone for WTGs, but a difference of 1 mile in the exclusion zone is not likely to result in a significant reduction in impact. Thus, the benefit gained in an additional mile of exclusion (15 miles versus 14 miles [24.1 kilometers versus 22.5 kilometers) would not warrant the added strain on the Project, given currently identified WTG capacity, and the risk of failure to meet current power purchase agreements.

Alternative Considered	Justification for Eliminating the Alternative
Wind Turbine Technology	
Alternate WTG foundations	US Wind proposed foundation types that meet technical and economic feasibility thresholds and have proven manufacturing and deployment histories in the offshore wind industry or comparable oil and gas deployments. US Wind evaluated the technical and economic viability of a range of foundation types for the primary project components, namely the WTGs and OSSs. The review was based on several inputs, including the Project's technical characteristics (e.g., WTG and OSS sizes), site conditions (including preliminary geotechnical and geophysical conditions), the state of the U.S. and global supply chains, and Project economics. US Wind also considered the ability to fabricate monopiles in the U.S., specifically Maryland, to develop a domestic supply chain using a local workforce. BOEM requested and validated information from US Wind that foundations other than monopiles for WTGs and jackets and monopiles for OSSs (e.g., gravity-based foundations, suction bucket, suction caisson, screw piling) are not technically and economically feasible because of the site-specific sediment characteristics and proven technology available.
Offshore Export Cables	
Shared cable corridor or shared transmission system	30 CFR 585.200(b) states, "A lease issued under this part confers on the lessee the rights to one or more project easements without further competition for the purpose of installing gathering, transmission, and distribution cables; pipelines; and appurtenances on the outer continental shelf (OCS) as necessary for the full enjoyment of the lease." While BOEM could require a lessee to use a previously existing shared cable corridor established by a right-of-way grant (30 CFR 585.113) when the use of the shared cable corridor is technically and economically practical and feasible alternative for the project, BOEM cannot limit a lessee's right to a project easement when such a cable corridor does not exist and there is no way of determining if the use of a future shared cable corridor would be a technically and economically practical and feasible alternative for the project. Therefore, BOEM cannot require the lessee to use a nonexistent shared cable corridor for this Project.
Minimize impacts on sand resource areas	There is no technically feasible alternative export cable route that would avoid all potential sand resources, and the Offshore Export Cable Routes are analyzed in detail under Alternative C (Landfall and Onshore Export Cable Route Alternative). Because of the lack of additional routes, an Alternative that minimizes impacts on sand resource areas became substantially similar in design and effects to Alternative C and was therefore consolidated into a single Alternative C. BOEM will analyze potential impacts to sand resources in its Alternative C analysis and may identify potential mitigations to reduce impacts to sand resources, such as micrositing.

Alternative Considered	Justification for Eliminating the Alternative
Alternate transmission technologies (i.e., high-voltage direct current [HVDC] versus alternating current [HVAC] cable technology)	It is neither technically nor economically feasible to use HVDC for the Project. The Project would require additional infrastructure offshore as well as onshore to accommodate HVDC transmission. Offshore, at least one additional HVDC platform – nominally twice the size of the largest alternating current (AC) OSSs currently included in the COP – would be needed to convert the power collected at the AC OSSs and convert it for transmission via one or two HVDC cables to shore. Onshore, at least one additional structure with a footprint exceeding the size of several football fields would be needed to convert the DC power to AC to be fed into the new US Wind onshore substations and then connected to the regional electrical grid. There is also an operational concern as well. Using HVDC would introduce a single point of failure for over 1,000 MW of generation, as compared to the up to the four HVAC cables currently planned. HVDC introduces additional grid stability and operational risk, as well as additional commercial complexity and risk for the Project to deliver under the multiple contracts US Wind has or will have to deliver power. The technical challenges with adding HVDC infrastructure to the Project would require a complete electrical redesign of the Project. Additionally, using HVDC would necessitate an entirely new process for interconnection into PJM versus US Wind's nearly completed interconnection process. Impacts to the Delaware community from the addition of the large DC to AC conversion facility could be significant. Acreage for such a large facility is not available at the Indian River Substation POI or the other POIs identified in US Wind's COP.
Onshore Export Cables	
Alternatives to Onshore Export Cable Routes (i.e., landfall in Maryland)	US Wind extensively evaluated various landfall, POI, and transmission routing options available on the Delmarva Peninsula, including in Delaware, Maryland, and Virginia. Specifically, all POIs greater than 115 kV and within 100 miles (160.9 kilometers) of the Lease Area were assessed. Engineering analyses commissioned by US Wind show that POIs south of the Maryland/Delaware border have significant power flow congestion issues and a high number of likely grid violations under scenarios where new injections of power are made to this relatively weak part of the local electric grid, resulting in more adverse impacts from the necessary transmission to those POIs. The Indian River POI is the southernmost location rated at 230 kV and, therefore, is robust enough to interconnect power from the Project without significant, disruptive, and costly upgrades to the transmission system. Currently, all the substations in Maryland near the coast are below 230 kV, making them infeasible POIs.

Alternative Considered	Justification for Eliminating the Alternative
Alternative to utilize lower export cable voltage level (less than 230 KV) to interconnect to closer electrical substations in Maryland	Exporting power from the Lease Area at voltages less than 230 kV endangers the Project's technical and commercial feasibility because 138 kV cables cannot transmit an equal amount of electricity as the proposed 230 to 275 kV cables. Utilization of 138 kV cables would (1) result in a material reduction in the amount of power that the Lease Area could deliver to the grid if restricted to four cables in the current PDE, or (2) require significantly more cables, potentially doubling the number of cables needed to deliver the Project's design capacity to the POI. Redesign of the offshore substations would be required, and the number of OSSs would likely increase, along with changes in the siting of new OSSs, re-surveying offshore to account for such structures in different locations, re-surveying offshore for expanded cable corridors, and identifying one or more new POIs. Interconnecting to a POI other than the Indian River substation would delay the Project by at least 5 years. Reducing the voltage of export cables would increase disturbance associated with siting more cables and identifying new landing locations and routes to new POIs and would further delay delivery of power to Maryland and other power offtakers.
Alternate Energy Source	
Alternative energy source to meet the demand	Commenters suggested BOEM analyze alternative energy options such as onshore wind, tidal movements, solar energy, small modular nuclear reactors, or natural gas. Renewable Energy Lease Number OCS-A 0490 only authorizes the submission of a COP for offshore wind energy. Generation of any other form of energy would not be permitted under this lease. For BOEM to analyze other renewable energy options on the OCS (e.g., marine hydrokinetics, including tidal energy), a new leasing process would need to occur specifically for that energy source. In addition, analyzing onshore conventional and alternative energy development is outside BOEM's jurisdiction. Finally, this alternative is not responsive to the purpose and need and would not address BOEM's regulatory need to determine whether to approve, approve with modifications, or disapprove the COP to construct, operate, and conceptually decommission a commercial-scale wind energy facility within the Lease Area.

BOEM = Bureau of Ocean Energy Management; CFR = Code of Federal Regulations; COP = Construction and Operations Plan; HVAC = high voltage alternating current; HVDC = high voltage direct current; km = kilometer; kV = kilovolt; mi = mile; OCS = Outer Continental Shelf; OSS = offshore substations; POI = point of interconnection; WTG = wind turbine generator

2.3 Non-Routine Activities and Low-Probability Events

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

- **Corrective maintenance activities:** These activities could be required as a result of other low-probability events or unanticipated equipment wear or malfunctions. US Wind anticipates housing spare parts for key Project components at the O&M Facility to initiate repairs expeditiously.
- **Collisions and allisions:** These could result in spills (described below) or injuries or fatalities to wildlife (Chapter 3). Collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the Project:
    - United States Coast Guard (USCG) requirement for lighting on vessels;
    - NOAA vessel speed restrictions;
    - The proposed spacing of WTGs and OSSs;
    - The lighting and marking plan that would be implemented; and
    - The inclusion of Project components on navigation charts.
- **Cable displacement or damage by vessel anchors or fishing gear:** This could result in safety concerns and economic damage to vessel operators and may require corrective action by US Wind such as the need for one or more cable splices to an export or inter-array cable(s). However, such incidents are unlikely to occur because the Project area would be indicated on navigational charts and the cable would be buried approximately 3.3 to 9.8 feet (1 to 3 meters)—not more than 13.1 feet (4 meters) deep—or protected with hard armor.
- **Chemical spills or releases:** For offshore activities, these include inadvertent releases from refueling vessels, spills from routine maintenance activities, and any significant spills resulting from a catastrophic event (which could include spills or releases from the WTG or OSS structures). All vessels would be certified by the Project to conform to vessel O&M protocols designed to minimize risk of fuel spills and leaks. US Wind would be expected to comply with USCG and BSEE regulations relating to prevention and control of oil spills. Onshore, releases could occur from construction equipment or HDD activities. All waste generated onshore shall comply with applicable state and federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Materials regulations.
- **Severe weather and natural events:** Extratropical storms, including northeasters, are common in the Lease Area from October to April. These storms bring high winds and heavy precipitation, which can lead to severe flooding and storm surges. Hurricanes that travel along the coastline of the eastern U.S. could affect the Lease Area with high winds and severe flooding. The Lease Area experiences a return period of 15 to 20 years for hurricanes with wind speeds equal to or in excess of 64 knots (118.5 kilometers per hour [km/h]). The estimated return period for hurricanes with wind speeds equal to or in excess of 96 knots (177.8 km/h) is 44 to 68 years (US Wind 2023). The return rate of hurricanes may become more frequent than the historical record, and the future probability of a major hurricane likely will be higher than the historical record of these events due to climate change. The engineering specifications of the WTGs and their ability to sufficiently withstand weather events are independently evaluated by a certified verification agent when reviewing the FDR and FIR according to international standards, which include withstanding hurricane-level events. One of these standards calls for the structure to be able to withstand a 50-year return

interval event. An additional standard also includes withstanding 3-second gusts of a 500-year return interval event, which would correspond to Category 5 hurricane wind speeds. If severe weather caused a spill or release, the actions outlined above would help reduce potential impacts. Severe flooding or coastal erosion could require repairs, with impacts associated with repairs being similar to those outlined in Chapter 3 for construction activities. While highly unlikely, structural failure of a WTG (e.g., loss of a blade, tower collapse) would result in temporary hazards to navigation for all vessels, similar to the construction and installation impacts described in Chapter 3.

- **Seismic activity:** While there are numerous seismic faults within Maryland, none is known or suspected to be active. Since 1758, most of the recorded 70 earthquakes occurring within Maryland have been minor (less than or equal to magnitude 4: non-damaging but felt) (Maryland Geological Survey 2022). Fault rupture is considered unlikely because no active or potentially active faults have been identified within or near the Project (US Wind 2023). The impacts from seismic activity would be similar to those assessed for other non-routine events or activities.
- **Terrorist attacks:** BOEM considers these unlikely, but impacts could vary depending on the magnitude and extent of any attacks. The actual impacts of this type of activity would be the same as the outcomes listed above. Therefore, terrorist attacks are not analyzed further.

2.4 Summary and Comparison of Impacts by Alternative

Table 2-7 provides a summary and comparison of the impacts under the No Action Alternative and each action alternative assessed in Chapter 3. Under the No Action Alternative, any potential environmental and socioeconomic impacts, including benefits, associated with the Project would not occur; however, impacts could occur from other ongoing and planned activities. Section 3.1 provides definitions for negligible, minor, moderate, and major impacts.

Table 2-7. Comparison of impacts by alternative and resources affected

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Air Quality	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **minor** adverse impacts due to emissions of criteria pollutants, volatile organic compounds, hazardous air pollutants, and greenhouse gases, mostly released during construction and decommissioning, and **minor beneficial** impacts on regional air quality after offshore wind projects are operational.	*Proposed Action*: The Proposed Action would result in **minor** to **moderate** adverse air quality impacts and **minor beneficial** impacts, to the extent that energy produced by the Project would displace energy produced by fossil fuel power plants. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **minor** to **moderate** adverse impacts because while emissions would incrementally increase ambient pollutant concentrations, they are not expected to exceed the National Ambient Air Quality Standards (NAAQS), and **minor beneficial** impacts because the magnitude of the potential reduction in emissions from displacing fossil fuel power generation would be small relative to total energy generation emissions in the area.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally larger construction impacts from air emissions; however, the overall impact would not change from the Proposed Action and would remain **minor** to **moderate** adverse and **minor beneficial**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor** to **moderate** adverse and **minor beneficial**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** to **moderate** adverse and **minor beneficial**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor** to **moderate** adverse and **minor beneficial**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of the offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** to **moderate** adverse and **minor beneficial**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor** to **moderate** adverse and **minor beneficial**.
Water Quality	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in temporary and **minor** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative, combined with all other planned activities, including other offshore wind activities, would result in **minor** to **moderate** impacts. When considering the possibility of impacts resulting from accidental releases, a **moderate** impact could occur if there was a large-volume, catastrophic release; however, the probability of such a release is very low.	*Proposed Action*: The Proposed Action would result in **minor** impacts because the impact would be detectable but not exceed water quality standards, and the resource would be expected to recover completely without remedial or mitigating action after decommissioning. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action, when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **minor** impacts and would not alter the overall character of water quality.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes, resulting in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **minor**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor**.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Bats	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative, combined with all other planned activities, including other offshore wind activities, would result in **negligible** impacts because bat presence on the OCS is anticipated to be limited and onshore bat habitat impacts are expected to be minimal.	*Proposed Action*: The Proposed Action would result in **negligible** impacts because no measurable impacts are expected due to the anticipated absence of bats within the offshore portions of the Project area and the minimal impacts due to onshore habitat loss or disturbance. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action, when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **negligible** impacts.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes, resulting in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **negligible**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **negligible**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **negligible**.
Benthic Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative, combined with all other planned activities, including other offshore wind activities, would result in **moderate** adverse impacts and could include **moderate beneficial** impacts due to habitat creation from other offshore wind projects.	*Proposed Action*: The Proposed Action would result in **moderate** impacts because the effect would be localized, and the benthic environment would recover completely over time without remedial and mitigation actions. In addition, **moderate beneficial** impacts could result from habitat alteration from soft-bottom to hard-bottom "reefing" habitats. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action, when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts, because a measurable impact is anticipated and could include **moderate beneficial** impacts.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes, resulting in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **moderate** with potentially **moderate beneficial** impacts. *Cumulative Impacts of Alternative C*: Impacts of Alternative C, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** and could include **moderate beneficial** impacts.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore, resulting in decreased potential impacts on benthic resources; however, impacts would be similar to the Proposed Action, to a lesser degree, but remain **moderate** with potentially **moderate beneficial** impacts. *Cumulative Impacts of Alternative D*: Impacts of Alternative D, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** and could include **moderate beneficial** impacts.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in decreased potential impacts on benthic resources; however, impacts would be similar to the Proposed Action, to a lesser degree, but remain **moderate** with potentially **moderate beneficial** impacts. *Cumulative Impacts of Alternative E*: Impacts of Alternative E, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** and could include **moderate beneficial** impacts.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Birds	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate** adverse impacts but could include **moderate beneficial** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative, combined with all other planned activities, including other offshore wind activities, would result in **moderate** adverse impact on birds but could include **moderate beneficial** impacts due to fish aggregation and associated increase in foraging opportunities provided by the WTG and OSS foundations.	*Proposed Action*: The Proposed Action would result in **minor** impacts on birds, depending on the location, timing, and species affected by an activity and could also result in potential **minor beneficial** impacts associated with foraging opportunities for marine birds. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action, when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** adverse and **moderate beneficial** impacts. Climate change and the presence of operating WTGs may result in habitat loss and mortality. The Proposed Action would contribute to the overall impacts primarily through the presence of structures.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **minor**, with **minor beneficial** impacts**.** *Cumulative Impacts of Alternative C*: Impacts of Alternative C, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse and **moderate beneficial**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor**, with **minor beneficial** impacts. *Cumulative Impacts of Alternative D*: Impacts of Alternative D, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**, with **moderate beneficial** impacts.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor**, with **moderate beneficial** impacts. *Cumulative Impacts of Alternative E*: Impacts of Alternative E, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**, with **moderate beneficial** impacts.
Coastal Habitat and Fauna	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** to **moderate** impacts, depending on the IPF. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative, combined with all other planned activities, including other offshore wind activities, would result in **moderate** impacts.	*Proposed Action*: The Proposed Action would result in **negligible** to **minor** impacts because the effect would be localized and, for the most part, temporary and includes mitigation measures. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action, when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **minor**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **minor**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **minor**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Finfish, Invertebrates, and EFH	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities would result in **moderate** impacts.	*Proposed Action*: The Proposed Action would result in **moderate** impacts, including the presence of structure, which may result in **minor beneficial** that would be localized; however, because the structures would remain for the full life of the Project, impacts would be long term. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts. The main drivers for this impact rating are fish mortality, climate change, recurring seafloor disturbance from bottom-tending fishing gear, and mortality resulting from offshore construction.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **moderate** with potentially **minor beneficial** impacts. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** with potentially **minor beneficial** impacts.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate** with potentially **minor beneficial** impacts. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** with potentially **minor beneficial** impacts.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate** with potentially **minor beneficial** impacts. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** with potentially **minor beneficial** impacts.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Marine Mammals	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **moderate** impacts, except for the NARW, impacts would be **major**, largely due to pile-driving noise, the presence of structures, and vessel traffic, as population-level impacts cannot be ruled out.	*Proposed Action*: The Proposed Action would result in **negligible** to **moderate** for mysticetes because impacts would be noticeable and measurable, but would not result in population-level effects, except for the NARW. BOEM expects individual impacts ranging from **negligible** to **major** for the NARW because population-level effects may occur, primarily due to vessel traffic and entanglement risk associated with the presence of structures. **Minor beneficial** impacts for odontocetes and pinnipeds are possible from the presence of structures. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts, except for the NARW, impacts would be **major**, because the anticipated impact would be noticeable and measurable, but marine mammals are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken, except for the NARW.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate** and **negligible** to **major** for the NARW, with possible **minor beneficial** impacts for odontocetes and pinnipeds. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**, except for the NARW, impacts would be **major**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate** and **negligible** to **major** for the NARW, with possible **minor beneficial** impacts for odontocetes and pinnipeds. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**, except for the NARW, impacts would be **major**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate** and **negligible** to **major** for the NARW, with possible **minor beneficial** impacts for odontocetes and pinnipeds. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**, except for the NARW, impacts would be **major**.
Sea Turtles	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities would result in **moderate** impacts.	*Proposed Action*: The Proposed Action would result in **negligible** to **moderate** impacts because impacts would be noticeable and measurable, but would not result in population-level effects. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts because impacts would be noticeable and measurable, but sea turtles are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities of offshore export cables, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Wetlands and Other Waters of the US	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **moderate** impacts.	*Proposed Action*: The Proposed Action would result in **minor** impacts on wetlands. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would be **moderate**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.
Commercial Fisheries and For-Hire Recreational Fishing	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate** to **major** long-term impacts on commercial fisheries and **moderate** long-term impacts on for-hire recreational fisheries. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **major** long-term impacts on commercial fisheries and **moderate** long-term impacts on for-hire recreational fishing due primarily to the presence of structures, new cable emplacement, and noise from pile-driving. The presence of structures may also induce a **moderate beneficial** long-term impact, particularly on the for-hire recreational fishing.	*Proposed Action*: The Proposed Action would result in long-term impacts ranging from **negligible** to **major**, depending on the fishery and fishing operation and could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **major** and long-term impacts because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely, even with mitigation.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **major** and could include **minor beneficial** impacts for some for-hire recreational fishing operations. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **major**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **major** and could include **minor beneficial** impacts for some for-hire recreational fishing operations. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **major**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **major** and could include **minor beneficial** impacts for some for-hire recreational fishing operations.. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **major**.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Cultural Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** to **major** impacts as well as **negligible** to **minor** beneficial impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **moderate** impacts.	*Proposed Action*: The Proposed Action would result in **moderate** impacts because a notable and measurable impact requiring mitigation is anticipated. In most cases, the resource would likely recover completely when the affecting agent was gone or remedial or mitigating action were taken. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **moderate**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.
Demographics, Employment, and Economics	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** adverse and **minor beneficial** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **minor** adverse and **minor beneficial** impacts.	*Proposed Action*: The Proposed Action would result in **minor** adverse impacts to certain recreation and tourism businesses and **minor beneficial** impacts through job creation, expenditures on local businesses, tax revenues, grant funds, and support for additional regional offshore wind development. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including, other offshore wind activities, would result in **minor** adverse and **minor beneficial** impacts.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **minor** adverse and **minor beneficial**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor** adverse and **minor beneficial**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** adverse and **minor beneficial**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor** adverse and **minor beneficial**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** adverse and **minor beneficial**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **minor** adverse and **minor beneficial**.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Environmental Justice	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** to **moderate** adverse and **minor beneficial** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **moderate** adverse and **minor beneficial** impacts.	*Proposed Action*: The Proposed Action would result in **moderate** impacts because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. Potentially small and measurable **minor beneficial** impacts could result from port utilization and the resulting employment and economic activity at ports as well as from enhanced opportunities for for-hire recreational fishing. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** adverse with **minor beneficial**.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**.
Land Use and Coastal Infrastructure	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** adverse and **minor beneficial** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **minor** adverse impacts and **minor beneficial** impacts.	*Proposed Action*: The Proposed Action would result in **minor** to **moderate** adverse with **minor beneficial** impacts. Minor beneficial impacts would result from port utilization. The moderate adverse impacts would be due to the potential for land use change due to the visibility of Proposed Action WTGs and OSSs from coastal and elevated locations. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** adverse and **minor beneficial** impacts. The main drivers for this impact rating are the **minor beneficial** impacts of port utilization, as well as **moderate** impacts from the presence of structures.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **minor** to **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse and **minor beneficial**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** to **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse and **minor beneficial**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** to **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse and **minor beneficial**.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Navigation and Vessel Traffic	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **moderate** impacts primarily due to the presence of structures.	*Proposed Action*: The Proposed Action would result in **moderate** impacts from changes in navigation routes, delays in ports, degraded communication and radar signals, and increased difficulty of offshore SAR or surveillance missions, all of which would increase navigational safety risks. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** impacts, due primarily to the increased possibility for marine accidents.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **moderate**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **moderate**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate**.
Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts for marine mineral extraction, marine and national security uses, aviation and air traffic, cables and pipelines, and radar systems; and **moderate** impacts on scientific research and surveys. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **negligible** impacts for aviation and air traffic and cables and pipelines; **minor** impacts for marine mineral extraction; **moderate** impacts for radar systems due to WTG interference; **minor** impacts for military and national security uses except for USCG SAR operations, which would have **moderate** impacts; and **major** impacts for scientific research and surveys.	*Proposed Action*: The Proposed Action would result in impacts ranging from **negligible** to **major**, depending on the IPF. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **negligible** to **minor** impacts for aviation and air traffic, cables and pipelines, and radar systems; **moderate** for most military and national security uses and marine mineral extraction; and **major** for scientific research and surveys.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **major**, depending on the IPF. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; **moderate** for most military and national security uses and marine mineral extraction; and **major** for scientific research and surveys.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **major**, depending on the IPF. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; **moderate** for most military and national security uses and marine mineral extraction; and **major** for scientific research and surveys.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **major**, depending on the IPF. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; **moderate** for most military and national security uses and marine mineral extraction; and **major** for scientific research and surveys.

Resource	Alternative A – No Action Alternative	Alternative B – Proposed Action	Alternative C – Landfall and Onshore Export Cable Route Alternative	Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative	Alternative E – Habitat Impact Minimization Alternative
Recreation and Tourism	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **moderate** adverse and **minor beneficial** impacts.	*Proposed Action*: The Proposed Action would result in **negligible** to **moderate** adverse with **minor beneficial** impacts. Short-term impacts during construction include noise, anchored vessels, and hindrances to navigation from the installation of the export cable and WTGs; Long-term impacts result from the presence of cable and foundation hard protection and structures in the Lease Area during O&M. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **moderate** adverse with **minor beneficial** impacts. The main drivers for this impact rating are the visual impacts associated with the presence of structures and lighting; impacts on fishing and other recreational activity from noise, vessel traffic, and cable emplacement during construction; and beneficial impacts on fishing from the reef effect.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not be less than the Proposed Action and would be **negligible** to **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **negligible** to **moderate** adverse with **minor beneficial**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **moderate** adverse with **minor beneficial**.
Visual Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** to **moderate** impacts. *Cumulative Impacts of the No Action Alternative*: The No Action Alternative combined with all other planned activities, including other offshore wind activities, would result in **major** impacts.	*Proposed Action*: The Proposed Action would result in **minor** to **major** impacts based on location and IPF. *Cumulative Impacts of the Proposed Action*: Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including other offshore wind activities, would result in **major** impacts associated with the presence of structures, lighting, and vessel traffic.	*Alternative C*: Alternative C would avoid crossing Indian River Bay and the Indian River by using Onshore Export Cable Routes and would result in marginally lower construction impacts; however, the overall impact would not change from the Proposed Action and would remain **minor** to **major**. *Cumulative Impacts of Alternative C*: Impacts of Alternative C when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **major**.	*Alternative D*: Alternative D would remove 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) from shore, resulting in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** to **major**. *Cumulative Impacts of Alternative D*: Impacts of Alternative D when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **major**.	*Alternative E*: Alternative E would remove up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or realignment of offshore export cables and/or micrositing to avoid areas of concern and would result in marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables; however, the overall impact would not change from the Proposed Action and would remain **minor** to **major**. *Cumulative Impacts of Alternative E*: Impacts of Alternative E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain **major**.

IPF = impact-producing factor; km = kilometer; mi = mile; OCS = Outer Continental Shelf; OSS = offshore substation; SAR = search and rescue; USCG = U.S. Coast Guard; WTG = wind turbine generator

Chapter 3

Affected Environment and Environmental Consequences

3 Affected Environment and Environmental Consequences

3.1 Impact-Producing Factors

In 2019, BOEM completed a study of impact-producing factors (IPFs) on the North Atlantic OCS to consider in an offshore wind development planned activities scenario (BOEM 2019). That study, incorporated in this document by reference, provides the following insights regarding IPFs related to wind development:

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

The BOEM (2019) study identifies the relationships between IPFs associated with specific past, present, and reasonably foreseeable future actions in the North Atlantic OCS. BOEM determined the relevance of each IPF to each resource analyzed in this Draft EIS.

For the current analysis, IPFs for the Project were identified. Table 3.1-1 provides a brief description of the primary IPFs involved in this analysis, including examples of sources and activities that result in each IPF. The IPFs cover all phases of the Project, including construction, O&M, and conceptual decommissioning. Each IPF is assessed in relation to ongoing activities, planned activities, and the Proposed Action. Planned activities include non-offshore wind activities and future offshore wind activities. If an IPF was not associated with the Project, it was not included in the analysis. Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts*, includes the IPF tables for each resource considered in this Draft EIS.

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

Table 3.1-1. Primary impact-producing factors (IPFs) addressed in this analysis

IPF	Sources and Activities	Description
Accidental releases	• Mobile sources (e.g., vessels) • Installation, operation, and maintenance of onshore or offshore stationary sources (e.g., wind turbine generators, offshore substations, transmission lines, inter-array cables)	Refers to unanticipated releases or spills into receiving waters of a fluid or other substance, such as fuel, hazardous materials, suspended sediment, invasive species, trash, or debris. Accidental releases or spills are distinct from routine discharges, consisting of authorized operational effluents and which are restricted via treatment and monitoring systems and permit limitations.
Air emissions	• Combustion-related stationary or mobile emission sources (e.g., generators [onshore and offshore], support vessels, vehicles, aircraft) • Non-combustion-related sources (e.g., leaks from tanks and switchgears)	Refers to emission sources that emit regulated air pollutants (gaseous or particulate matter) into the atmosphere. Releases can occur onshore and offshore.
Anchoring	• Anchoring of vessels • Attachment of a structure to the seafloor by use of an anchor, mooring, or gravity-based weighted structure (i.e., bottom-founded structure)	Refers to seafloor disturbances (anything below mean higher high water) related to any offshore construction or maintenance activities. Refers to an action or activity that disturbs or attaches objects to the seafloor.
Cable emplacement and maintenance	• Dredging or trenching • Cable placement • Seafloor profile alterations • Sediment deposition and burial • Cable protection of concrete mattress and rock placement	Refers to seafloor disturbances (anything below mean higher high water) related to the installation and maintenance of new offshore submarine cables. Cable placement methods include trenchless installation (e.g., horizontal directional drilling [HDD], direct pipe, auger bore), jetting, vertical injection, control flow excavation, trenching, and plowing.

IPF	Sources and Activities	Description
Discharges/intakes	• Vessels • Structures • Onshore point and non-point sources • Dredged material ocean disposal • Installation, operation, and maintenance of submarine transmission lines, cables, and infrastructure • HVDC converter cooling system	Refers to routine, permitted, operational effluent discharges of pollutants to receiving waters. Types of discharges may include bilge water, ballast water, deck drainage, gray water, fire suppression system test water, chain locker water, exhaust gas scrubber effluent, condensate, seawater cooling system intake and effluent, and horizontal directional drilling (HDD) fluid. Water pollutants include produced water, manufactured or processed hydrocarbons, chemicals, sanitary waste, and deck drainage. Rainwater, freshwater, or seawater mixed with any of these constituents is also considered a pollutant. These discharges are restricted to uncontaminated or properly treated effluents that require best management practice or numeric pollutant concentration limitations as required through U.S. Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) permits or U.S. Coast Guard (USCG) regulations. Refers to the discharge of solid materials, such as the deposition of sediment at approved offshore disposal or nourishment sites and cable protection. Discharge of dredged or fill material may be regulated through the Clean Water Act. Refers to entrainment/impingement as a result of intakes used by cable-laying equipment and in HVDC converter cooling systems.

IPF	Sources and Activities	Description
Electric and magnetic fields (EMFs) and cable heat	• Substations • Power transmission cables • Inter-array cables • Electricity generation	Power generation facilities and cables produce electric fields (proportional to the voltage) and magnetic fields (proportional to flow of electric current) around power cables and generators. Three major factors determine levels of the magnetic and induced electric fields from offshore wind energy projects: (1) the amount of electrical current being generated or carried by the cable, (2) the design of the generator or cable, and (3) the distance of organisms from the generator or cable. Refers to thermal effects of the transmission of electrical power, depending on cable design and burial depth.
Gear utilization	• Monitoring surveys	Refers to entanglement and bycatch during monitoring surveys.
Land disturbance	• Vegetation clearance • Excavation • Grading • Placement of fill material	Refers to land disturbances (anything above mean higher high water) during onshore construction activities.
Lighting	• Vessels or offshore structures above or underwater • Onshore infrastructure	Refers to lighting associated with offshore wind development and activities that utilize offshore vessels, and which may produce light above the water onshore and offshore, as well as underwater.

IPF	Sources and Activities	Description
Noise	• Aircraft • Vessels • Turbines • Geophysical and geotechnical surveys • O&M • Onshore and offshore construction and installation • Impact pile-driving • Dredging and trenching • Unexploded ordinance (UXO) detonations	Refers to noise from various sources. Commonly associated with construction activities, geophysical and geotechnical surveys, and vessel traffic. May be impulsive (e.g., impact pile-driving) or non-impulsive (e.g., drilling), intermittent (e.g., high-resolution geophysical signals) or continuous (e.g., vessel noise), and broadband (e.g., explosives) or tonal (e.g., SONAR). May also be noise generated by turbines or interactions of the turbines with wind and waves.
Port utilization	• Expansion and construction • Maintenance • Use • Revitalization	Refers to an action or activity associated with port activity, upgrades, or maintenance that occur from increased economic activity only as a result of the Project. Includes activities related to port expansion and construction such as placement of dredged materials, dredging to deepen channels for larger vessels, and maintenance dredging.
Presence of structures	• Onshore structures, including towers and transmission cable infrastructure • Offshore structures, including wind turbine generators, offshore substations, and scour/cable protection	Refers to the post-construction, long-term presence of onshore or offshore structures.
Traffic	• Aircraft • Vessels (construction, O&M, surveys) • Vehicles • Towed arrays/equipment	Refers to marine and onshore vessel and vehicle use, including use in support of surveys such as geophysical and geotechnical, fisheries monitoring, and biological monitoring surveys.
Gear utilization	• Monitoring surveys	Refers to entanglement and bycatch from gear utilization during fisheries and benthic monitoring surveys.

IPF	Sources and Activities	Description
Energy generation/security	• Wind energy production	Refers to the generation of electricity and its provision of reliable energy sources compared with other energy sources (i.e., energy security). Associated with renewable energy development operations.
Climate change	• Emissions of greenhouse gases	Refers to the effects of climate change, such as warming and sea level rise, and increased storm severity or frequency. Ocean acidification refers to the effects associated with the decreasing pH of seawater from rising levels of atmospheric carbon dioxide.

HVDC = high voltage direct current; O&M = operations and maintenance

3.2 Mitigation Identified for Analysis in the Environmental Impact Statement

During development of the Draft EIS, and in coordination with cooperating agencies, BOEM considered potential additional mitigation measures that could further avoid, minimize, or mitigate impacts on the physical, biological, socioeconomic, and cultural resources assessed in this document. The potential additional mitigation measures are described in Appendix G, Table G-2, and analyzed in the relevant resource sections of this chapter. BOEM may choose to incorporate one or more of the additional mitigation measures in the preferred alternative. In addition, other mitigation measures may be required through consultations, authorizations, and permits with respect to several environmental statutes such as the MMPA, Section 7 of the ESA, or the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Mitigation imposed through consultations will be included in the Final EIS. The additional mitigation measures presented in Appendix G, Table G-2 may not all be within BOEM's statutory and regulatory authority to require; however, other jurisdictional governmental agencies may potentially require them. Mitigation measures for completed consultations, authorizations, and permits will be included in the Final EIS. BOEM may choose to incorporate one or more additional measures in the ROD and adopt those measures as conditions of COP approval. All US Wind-committed measures (Lessee proposed measures [LPM]) are part of the Proposed Action.

3.3 Definition of Impact Levels

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

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

- Short-term effects are effects that may extend up to 3 years. Construction and conceptual decommissioning activities are anticipated to occur for a duration of 2 to 3 years. An example would be clearing of onshore shrubland vegetation during construction; the area would be revegetated when construction is complete, and, after revegetation is successful, this effect would end. Short-term effects may be further defined as temporary if the effects end as soon as the activity ceases. An example would be road closures or traffic delays during onshore export cable installation. Once construction is complete, the effect would end.
- Long-term effects are effects that may extend for more than 3 years and may extend for the life of the Project (35 years). An example would be habitat loss where a foundation has been installed.
- Permanent effects are effects that extend beyond the life of the Project. An example would be the conversion of land to support new onshore facilities or the placement of scour protection that is not removed as part of decommissioning.

Beyond the impact definitions provided in the following resource-specific sections, consideration has been given to impact definitions for ongoing and planned actions. The following terms are used to describe the incremental impact of the action alternative in relation to the combined impacts from all ongoing and planned activities, including both non-offshore and offshore wind activities.

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

3.4 Physical Resources

3.4.1 Air Quality

This section discusses potential impacts on air quality from the Proposed Action, action alternatives, and ongoing and planned activities in the air quality geographic analysis area (Figure 3.4.1-1). The air quality geographic analysis area includes the airshed within 25 mile (40 kilometer) of the Lease Area (corresponding to the OCS permit area) and the airshed within 15.5 mile (25 kilometer) of onshore construction areas and ports that may be used for the Project. The geographic analysis area encompasses the region subject to United States Environmental Protection Agency (USEPA) review as part of an OCS permit for the Project under the Clean Air Act (CAA). The Maryland Department of the Environment (MDE) is delegated OCS permitting authority based on the Project's location on the inner OCS. The geographic analysis area also considers potential air quality impacts associated with the onshore construction areas and the port(s) outside the OCS permit area. The dispersion characteristics of emissions from marine vessels, equipment, and similar emission sources that would be used during proposed construction and O&M activities would likely have maximum potential air quality impacts occurring within a few miles of the source, as would decommissioning activities if emissions are similar to those during construction. BOEM selected the 15.5-mile (25-kilometer) distance to provide a reasonable buffer to ensure that the locations of maximum potential air quality impact would be considered.

Air quality is characterized by comparing the ambient air concentrations of criteria pollutants to the National Ambient Air Quality Standards (NAAQS), which were established by the USEPA to be protective of public health and the environment. The CAA established two types of NAAQS: (1) primary standards, which set limits to protect public health, including the health of "sensitive" populations (e.g., asthmatics, children, the elderly); and (2) secondary standards, which set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. NAAQS were established in 40 CFR 50 for six criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter ($PM_{2.5}$ and PM_{10}, particulate matter with a diameter less than or equal to 2.5 and 10 microns [µm], respectively), and sulfur dioxide (SO_2). Current NAAQS levels are provided in Table 3.4.1-1 (USEPA 2019).

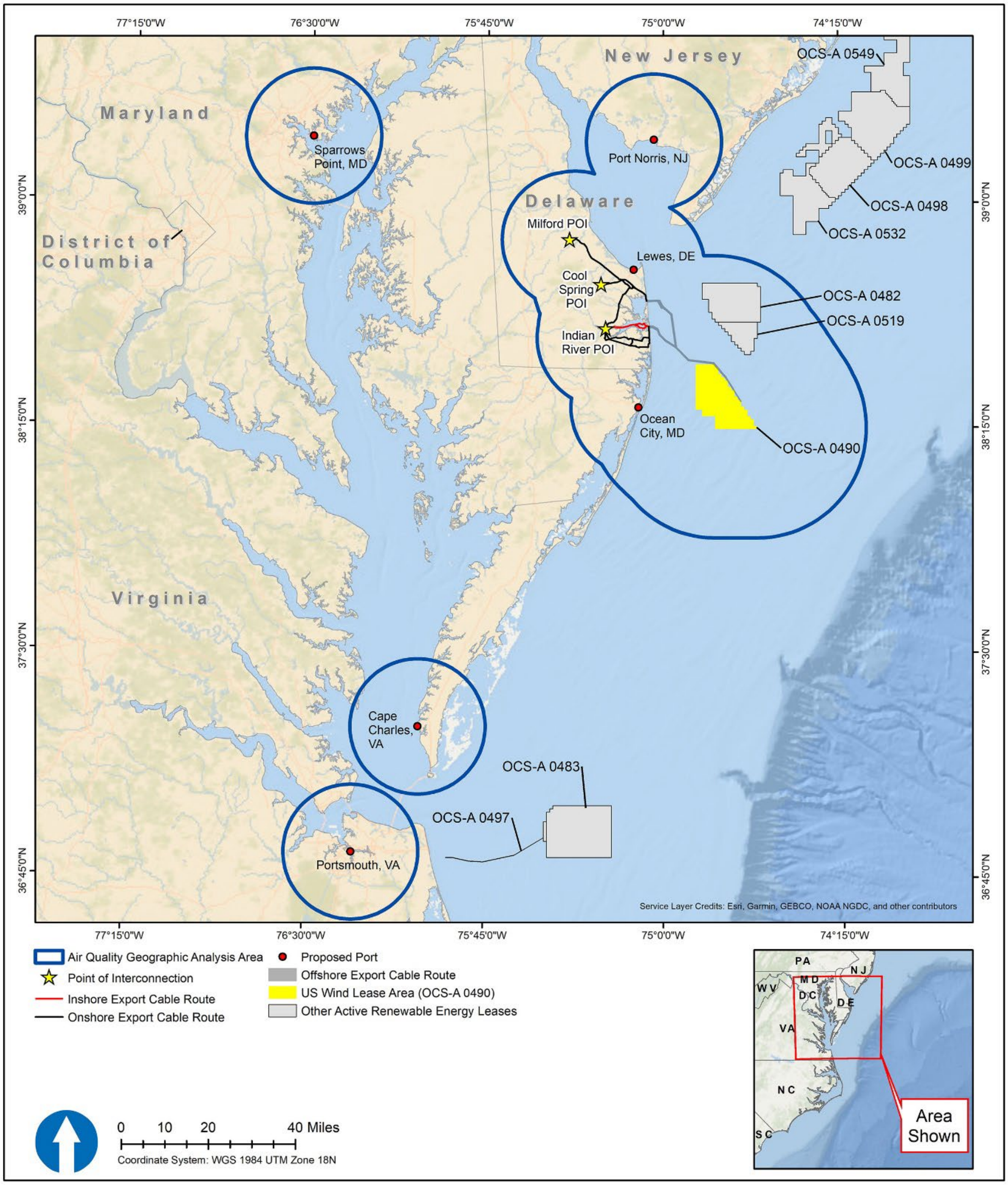

Figure 3.4.1-1. Air quality geographic analysis area

Table 3.4.1-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
CO	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
	Primary and Secondary	1 hour	35 ppm	Not to be exceeded more than once per year
Pb	Primary and Secondary	Rolling 3-month average	0.15 $\mu g/m^3$	Not to be exceeded
NO_2	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary and Secondary	1 year	53 ppb	Annual mean
O_3	Primary and Secondary	8 hours	0.07 ppm	Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years
$PM_{2.5}$	Primary	1 year	12.0 $\mu g/m^3$	Annual mean, averaged over 3 years
	Secondary	1 year	15.0 $\mu g/m^3$	Annual mean, averaged over 3 years
PM_{10}	Primary and Secondary	24 hours	35 $\mu g/m^3$	98th percentile, averaged over 3 years
	Primary and Secondary	24 hours	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
SO_2	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

$\mu g/m^3$ = micrograms per cubic meter; CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter smaller than 2.5 microns; PM_{10} = particulate matter smaller than 10 microns; ppb = parts per billion; ppm = parts per million; SO_2 = sulfur dioxide

When the monitored concentrations in an area exceed the NAAQS for any pollutant, the area is classified as "nonattainment" for that pollutant. The surrounding areas impacted by the Project as shown in Figure 3.4.1-1 are assessed for attainment status. Maryland is presently "in attainment" with the NAAQS, except for 12 counties in the Baltimore and Washington, D.C. metropolitan areas (Anne Arundel, Baltimore, Baltimore City, Calvert, Carroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery, and Prince George's counties). These counties are in densely populated, urban core areas and are in nonattainment with the O_3 NAAQS (all 12 counties) and the SO_2 NAAQS (Anne Arundel and Baltimore counties). Virginia is presently in attainment with the NAAQS, except for Giles County, which is in nonattainment with the SO_2 NAAQS, and nine counties in the Washington, D.C., metropolitan area

(Alexandria City, Arlington, Fairfax, Fairfax City, Falls Church, Loudoun, Manassas Park City, Manassas City, and Prince William counties), which are in nonattainment with the O_3 NAAQS. Delaware is presently in attainment with the NAAQS, except for two counties in the Wilmington metropolitan area (Newcastle and Sussex counties), which are in nonattainment with the O_3 NAAQS (USEPA 2022). New Castle, Sussex, and Kent counties were all nonattainment for the 1979 1-Hour O_3 standard and 1997 8-Hour O_3 standard, but those standards have since been revoked. Although revoked, the control measures in place for the 1979 and 1997 O_3 standards remain in effect.

O_3 is a regional air pollutant issue. Prevailing southwest to west winds carry air pollution from the Ohio River Valley, where major nitrogen oxide (NO_x) emission sources (e.g., power plants) are located, and from mid-Atlantic metropolitan areas to the northeast, contributing to high O_3 concentrations in these areas. Major SO_2 sources include power plants and other industrial facilities burning coal and other fossil fuels.

The USEPA Regional Haze Rule requires state and federal agencies to develop and implement air quality plans to reduce the air pollution that causes decreased visibility in national wilderness areas and parks designated as Class I areas. The Class I areas closest to the Project are the Brigantine Wilderness Area in New Jersey and Shenandoah National Park in Virginia. Federal land managers must be notified of facilities that will be located within 62 miles (100 kilometers) of a Class I area. The Project is not within that distance of any Class I area and is not anticipated to impact visibility in any Class I area.

The Project will require air permitting and air dispersion modeling in accordance with the USEPA and Maryland Department of the Environment (MDE). The Air Quality Permit to Construct will address the implementation of best available control technology for Project emissions sources and will require air dispersion modeling to comply with Code of Maryland Regulation (COMAR) 26.11.15.06, Ambient Impact Requirement. If required, US Wind will follow MDE Guidance Document “Demonstrating Compliance with the Ambient Impact Requirement under the Toxic Air Pollutant (TAP) Regulations (COMAR 26.11.15.06)” (MDE 2016a) or other acceptable air dispersion modeling procedures for the analysis.

US Wind submitted the Notice of Intent required for 40 CFR 55.4 on August 5, 2022, to commence the air permitting process with the USEPA and MDE. Additionally, a standard offshore and coastal dispersion modeling protocol was sent by US Wind to the MDE on September 16, 2022. The MDE responded on December 27, 2022, that an alternative modeling protocol should be used. All alternative modeling protocols require approval by USEPA Region 3. On January 26, 2023, US Wind, the USEPA, and the MDE met to discuss the alternative protocol review and approval process. The approval process, including receipt of data from the USEPA, is expected to take approximately 2 months from submission. Additional mitigation measures may be identified during the best available control technology and modeling processes. On March 10, 2023, US Wind submitted the alternative modeling protocol to MDE.

3.4.1.1 Description of the Affected Environment and Future Baseline Conditions

3.4.1.2 Impact-Level Definitions for Air Quality

Definitions of impact levels for air quality are provided in Table 3.4.1-2. Impact levels are intended to serve NEPA purposes only and are not intended to establish thresholds or other requirements with respect to permitting under the CAA. Appendix F, Table F-1, identifies potential IPFs, issues, and indicators to assess impacts on air quality.

Table 3.4.1-2. Impact level definitions for air quality

Impact Level	Type of Impact	Definition
Negligible	Adverse	Increases in ambient pollutant concentrations due to Project emissions would not be detectable.
Negligible	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would not be detectable.
Minor to Moderate	Adverse	Increases in ambient pollutant concentrations due to Project emissions would be detectable but would not lead to exceedance of the NAAQS.
Minor to Moderate	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be detectable.
Major	Adverse	Changes in ambient pollutant concentrations due to Project emissions would lead to exceedance of the NAAQS.
Major	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be larger than for minor to moderate impacts.

NAAQS = National Ambient Air Quality Standards

3.4.1.3 Impacts of Alternative A – No Action on Air Quality

When analyzing the impacts of the No Action Alternative on air quality, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

The Maryland Energy Administration (2022) projected that under current regulations and policies, emissions from electricity generation would decline through 2050 due to improvements in efficiency and switching to cleaner fuels. Maryland’s Renewable Portfolio Standard includes carve-outs for offshore wind and requires the State to generate 50 percent of its electricity from renewable energy sources by 2030 and 100 percent by 2040. Under the No Action Alternative, without implementation of other offshore wind projects, the electricity that would have been generated by offshore wind would likely be provided by nuclear or natural gas as the dominant fuels for electricity generation in the interim. As a result, a continuation of ongoing activities under the No Action Alternative could lead to a smaller decline in emissions than would occur with offshore wind development. An overall mix of natural gas, solar, wind, and energy storage would likely occur in the future due to market forces and state energy policies. In addition to electricity generation, emissions from other ongoing activities, including vessel and vehicle emissions as well as accidental releases of fuel or other hazardous material, would continue to contribute to ongoing regional air quality impacts.

Impacts from fossil fuel facilities are expected to be mitigated partially by implementation of other planned offshore wind projects near the proposed geographic analysis area, including in regions off New England, New York, New Jersey, Delaware, and Maryland, to the extent that these wind projects would result in reduced emissions from fossil fuel power-generating facilities. Other planned activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military use; marine transportation; oil and gas activities; and onshore development activities (Appendix D, Section D.2 contains a complete description of planned activities). These activities could contribute to air quality impacts associated with the IPFs of air emissions, climate change, and accidental releases. Appendix D, Table D1-1, presents a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for air quality.

3.4.1.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind activities to affect air quality through the following primary IPFs.

Accidental releases: Offshore wind activities could release air toxins or hazardous air pollutants (HAPs) because of accidental chemical spills within the air quality geographic analysis area. Section 3.4.2, *Water Quality*, includes a discussion of the nature of anticipated releases. Based on Appendix D, Table D2-3, up to 338,082 gallons (1,279,778 liters) of coolants, 673,545 gallons (2,549,646 liters) of oils and lubricants, and 196,437 gallons (743,595 liters) of diesel fuel would be contained in the 113 WTG and 3 OSS structures for wind energy projects (other than the Proposed Action) within the air quality geographic analysis area. If accidental releases occur, they would most likely be during construction but could occur during operations and decommissioning of offshore wind facilities. These may lead to short-term periods (hours to days)[15] of HAP emissions through surface evaporation. HAP emissions would consist of volatile organic compounds (VOCs), which may lead to O_3 formation. By comparison, the smallest tanker vessel operating in these waters (a general-purpose tanker) has a capacity of between 3.2 and 8 million gallons (12.1 and 30.3 million liters). Tankers are relatively common in the area, and the total WTG chemical storage capacity within the air quality geographic analysis area is much less than the volume of hazardous liquids transported by ongoing activities (U.S. Energy Information Administration 2014). BOEM expects air quality impacts from accidental releases would be negligible because impacts would be short term and limited to the area near the accidental release location. Accidental releases would occur infrequently over a 25-year period, with a higher probability of releases during future project construction, but they would not be expected to contribute appreciably to overall impacts on air quality.

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[15] For example, small diesel fuel spills (500 to 5,000 gallons [1,893 to 18,927 liters]) usually will evaporate and disperse within a day or less (NOAA 2006).

Air emissions: Most air pollutant emissions and air quality impacts from offshore wind projects would occur during construction, potentially from multiple projects occurring simultaneously. All projects would be required to comply with the CAA. Primary emission sources would include increased public and commercial vehicular traffic, air traffic, combustion emissions from construction equipment, and fugitive emissions from construction-generated dust for onshore portions of the projects. As wind energy projects come online, power generation emissions overall could decrease, and the region as a whole could realize a net benefit to air quality.

Offshore wind projects other than the Proposed Action that may result in air pollutant emissions and air quality impacts within the air quality geographic analysis area include projects within all or portions of lease areas OCS-A 0482 (Garden State Offshore Energy [GSOE] 1) and OCS-A 0519 (Skipjack Wind 1 and 2) (Appendix D, Table D2-4). These projects would produce 2,448 MW of renewable power from the installation of 110 WTGs. Based on the assumed offshore construction schedule, the projects within the air quality geographic analysis area would have overlapping construction periods beginning in 2024 and continuing through 2030.

Table 3.4.1-3 summarizes the total emissions of criteria pollutants and O_3 precursors from construction of offshore wind projects other than the Proposed Action within the air quality geographic analysis area as well as the annual emissions of criteria pollutants and O_3 precursors during operation of the projects. These emission estimates were developed by BOEM based on offshore wind demand, as discussed in their 2019 study, *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (Appendix D, Table D2-4).

Table 3.4.1-3. Emissions (tons) from Project construction and operations, No Action Alternative

Phase	VOCs	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2e
Construction (Total, All Years)	141.4	1,271	5,740	189.8	187.6	42.65	370,372
Operations (Average Annual)	6.06	78.48	332.9	10.91	10.44	0.92	22,330

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NO_x = nitrogen oxide; $PM_{2.5}$ = particulate matter smaller than 2.5 microns; PM_{10} = particulate matter smaller than 10 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound

Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would be **minor**, shifting spatially and temporally across the air quality geographic analysis area.

During operations, emissions from offshore wind projects within the air quality geographic analysis area would overlap temporally. However, operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would come largely from commercial vessel traffic and emergency diesel generators. The combined operational emissions for all projects within the air quality geographic analysis area would vary by year as successive projects begin operation. Operational emissions would result in negligible air quality impacts because emissions would be intermittent, localized, and dispersed throughout the combined approximate 193,000 acres (78,104.3 hectares) of lease areas and vessel routes from the onshore O&M facility.

Offshore wind energy development could help offset emissions from fossil fuels, potentially improving regional air quality and reducing greenhouse gases (GHGs). An analysis of five variable renewable power plant data sets, representing approximately 183 GWh, by Katzenstein and Apt (2009) estimated that carbon dioxide (CO_2) emissions can be reduced up to 80 percent and NO_x emissions can be reduced up to 50 percent by implementing wind energy projects[16]. Additionally, an analysis by Barthelmie and Pryor (2021) calculated that, depending on global trends in GHG emissions and the amount of wind energy expansion, development of wind energy could reduce predicted increases in global surface temperature by 0.5 to 1.4 degrees Fahrenheit (°F) (0.3 to 0.8 degrees Celsius [°C]) by 2100.

Estimations and evaluations of potential health and climate benefits from offshore wind activities for specific regions and project sizes rely on information about the air pollutant emission contributions of the existing and projected mixes of power generation sources, and generally estimate the annual health benefits of an individual, commercial-scale offshore wind project to be valued in the hundreds of millions of dollars (Kempton et al. 2005; Buonocore et al. 2016).

The potential health benefits of avoided emissions can be evaluated using the USEPA's Co-benefits Risk Assessment (COBRA) health impacts screening and mapping tool, which estimates the health and economic benefits of clean energy policies (USEPA 2020a). COBRA was used to analyze the avoided emissions that were calculated for development of 2,448 GW of planned wind power. Table 3.4.1-4 presents the estimated monetized health benefits and avoided mortality for this example scenario.

Table 3.4.1-4. Co-benefits Risk Assessment (COBRA) estimate of annual avoided health effects with 2,448 GW of reasonably foreseeable offshore wind power

Discount Rate[1] (2023)	Monetized Total Health Benefits (million U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate[2]	High Estimate[2]	Low Estimate[2]	High Estimate[2]
3 Percent	239.1	539.3	21	49
7 Percent	213.4	480.8	21	49

[1] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the "time value of money" preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[2] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

[16] Emissions reductions estimated by Katzenstein and Apt (2009) through use of multiple renewable energy sources, including solar and wind.

BOEM anticipates the air quality impacts associated with offshore wind activities other than the Proposed Action in the geographic analysis area would result in minor to moderate adverse impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning. Impacts would be minor to moderate because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a NAAQS violation. Offshore wind projects likely would lead to reduced emissions from fossil fuel power-generating facilities and consequently minor to moderate beneficial impacts on air quality.

Climate change: Construction and operation of offshore wind projects would produce GHG emissions (mostly CO_2) that contribute to climate change; however, these contributions would be minuscule compared to aggregate global emissions. CO_2 is relatively stable in the atmosphere and, for the most part, mixed uniformly throughout the troposphere and stratosphere. As such, the impact of GHG emissions does not depend on the source location. Increasing energy production from offshore wind projects could reduce regional GHG emissions by replacing energy derived from fossil fuels. This reduction could more than offset the GHG emissions from offshore wind projects. Additionally, this reduction in GHG emissions would be noticeable in the regional context, would contribute incrementally to reducing climate change, and would represent a moderate beneficial impact in the regional context. U.S. offshore wind projects would likely have a limited impact on global emissions and climate change, but they may be significant and beneficial as a component of many actions addressing climate change and integral for fulfilling state plans regarding climate change.

3.4.1.3.2 Conclusions

Under the No Action Alternative, air quality would continue to reflect current regional trends and respond to IPFs introduced by other ongoing and planned activities. Additionally, higher-emitting, fossil fuel energy facilities could be built or kept in service to meet future power demand. These larger impacts would be mitigated partially by other offshore wind projects surrounding the geographic analysis area, including offshore Delaware, New Jersey, and Virginia. Although the Project would not be built under the No Action Alternative, BOEM expects ongoing and planned non-offshore and offshore wind activities to have continuing regional air quality impacts, primarily through air pollutant emissions and accidental releases.

BOEM anticipates ongoing non-offshore wind activities would result in **minor to moderate** impacts on air quality due to air pollutant and GHG emissions during construction and operation. Planned non-offshore wind activities may also contribute to air quality impacts because air pollutant and GHG emissions would increase through construction and operation of new energy generation facilities to meet future power demands. Although there are no such power-generating facilities planned within the air quality geographic analysis area, continuation of current regional trends in energy development could include new power plants that could contribute to air quality and GHG impacts in Maryland and the Mid-Atlantic states. BOEM anticipates the impacts of planned non-offshore wind activities would be **minor to moderate**. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in **minor to moderate** impacts on air quality, primarily driven by recent market and permitting trends indicating future electric-generating units would most likely include natural-gas-fired facilities.

Offshore wind activities in the geographic analysis area would contribute to the emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning. Impacts would be **minor to moderate** because these emissions would not increase ambient pollutant concentrations enough to violate the NAAQS. Pollutant emissions during operations generally would be lower and more transient. Most air pollutant emissions and air quality impacts would occur during multiple overlapping project construction phases from 2024 through 2030. Overall, adverse air quality impacts from offshore wind projects are expected to be transient. Offshore wind projects likely would lead to reduced emissions from fossil fuel power-generating facilities and consequently **minor** to **moderate beneficial** impacts on regional air quality after offshore wind projects are operational.

Under the No Action Alternative, existing environmental trends and activities would continue, and air quality would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **minor to moderate** impacts on air quality. BOEM anticipates the No Action Alternative combined with all other planned activities (including other offshore wind activities) would result in **minor to moderate** adverse impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning, and **minor beneficial** impacts on regional air quality after offshore wind projects are operational.

3.4.1.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum case scenario; any potential variances in the Project build-out, as defined in the PDE, would result in impacts similar to or less than those described in the following sections. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) would influence the magnitude of impacts on air quality:

- Emission ratings of construction equipment and vehicle engines;
- Location of construction laydown areas;
- Choice of cable-laying locations and pathways;
- Choice of marine traffic routes to and from the Lease Area and Offshore Export Cable Route;
- Soil characteristics at excavation areas, which may affect fugitive emissions; and
- Emission control strategy for fugitive emissions due to excavation and hauling operations.

Changes to the design capacity of the WTGs would not alter the maximum potential air quality impacts for the Proposed Action and other action alternatives because the maximum case scenario involved the maximum number of WTGs allowed in the PDE.

US Wind has committed to measures to minimize impacts on air quality. US Wind will obtain any necessary CAA permits under the State of Maryland's delegated program and comply with applicable permit conditions. Low-sulfur fuels would be used to the extent practicable, and specific engines designed to reduce air pollution would be used when practicable, in addition to limiting engine idling times, complying with international air emission standards for marine vessels, and using engines with add-on emission controls where practicable (COP, Volume II, Section 5.3; US Wind 2023).

3.4.1.5 Impacts of Alternative B – Proposed Action on Air Quality

3.4.1.5.1 Construction and Installation

During the construction stage, the activities of additional workers, increased traffic congestion, additional commuting miles for construction personnel, and increased air polluting activities of supporting businesses could result in impacts on air quality. Fuel combustion and some incidental solvent use would cause construction related air emissions. Air pollutants would include CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, VOCs, carbon dioxide equivalent (CO_2e) or GHG emissions, O_3, and total HAPs. The COP (Volume II, Appendix C1; US Wind 2023) provides a description of emission sources associated with the construction and operations stages of the Proposed Action. The total construction emissions of each pollutant for the Proposed Action are summarized Table 3.4.1-5 and in Appendix A of the Notice of Intent (NOI) to Submit an Application for an Outer Continental Shelf Air Permit (US Wind 2022). Construction equipment would use appropriate fuel-efficient engines and comply with all applicable air emission standards to keep combustion emissions and associated air quality impacts to a minimum. The combustion of fuels (diesel oil and gasoline) in the propulsion engines of vessels and stationary equipment on vessels installing the WTGs and OSSs (e.g., cranes, generators) will produce emissions of criteria pollutants. These emissions will primarily be NO_x and CO, with lesser amounts of VOCs, an O_3 precursor, and PM_{10} (mostly in the form of $PM_{2.5}$), and negligible amounts of sulfur oxides (SO_x) and lead (leaded gasoline has been phased out in favor of unleaded gasoline).

Table 3.4.1-5. Proposed Action total construction emissions (tons)

Period	NO_x	VOCs	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	HAPs
Year 1	817.7	10.9	192.2	16.3	15.8	31.9	52,661	0.2	0.04	52,679	1.5
Year 2	2,081.3	27.8	48.3	41.4	40.2	81.3	134,046	0.5	0.1	134,091	3.9
Year 3	1,115.0	14.9	262.1	22.2	21.5	43.6	71,811	0.3	0.1	71,835	2.1
Year 4	408.8	5.5	96.1	8.1	7.9	16.0	26,331	0.1	0.02	26,39	0.8
Total	4,422.8	59.2	1,039.7	88.0	85.4	172.8	284,848	1.1	0.2	284,944	8.3

Source: Notice of Intent (NOI) to Submit an Application for an Outer Continental Shelf Air Permit
CH_4 = methane; CO = carbon monoxide; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; HAP = hazardous air pollutant; N_2O = nitrous oxide; NO_x = nitrogen oxide; $PM_{2.5}$ = particulate matter smaller than 2.5 microns; PM_{10} = particulate matter smaller than 10 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound
Sum of individual values may not equal total due to rounding.
Note 1: Emissions for NOx, $PM_{2.5}$, and SO_2 based on BOEM Tool as provided in May 2022 US Wind Construction and Operations Plan (COP) and Project specific design criteria.
Note 2: The BOEM Tool uses the latest EPA emission factors from the Ports Emissions Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Report (EPA 420-B-20-046, September 2020).
Note 3. Emission factors for VOC, CO, PM_{10}, CH_4, and HAPs were based on the latest EPA emission factors from the Ports Emissions Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Report (EPA 420-B-20-046, September 2020).

The Proposed Action would affect air quality through the following primary IPFs during construction, operations, and decommissioning.

3.4.1.5.1.1 Onshore Activities and Facilities

Air emissions: Onshore air emissions would occur at the landfall site and at points of interconnection in Sussex County. The COP (Volume II, Section 17.2 and Appendix C1; US Wind 2023) provides additional information on land use and proposed ports. Onshore activities of the Proposed Action would consist primarily of HDD, duct bank construction, cable-pulling operations, and substation construction. Additional emissions related to the Project could occur at nearby ports used to transport material and personnel to and from the Project site. Emissions would primarily be from operation of diesel-powered equipment; vehicle activity such as bulldozers, excavators, and diesel trucks; and fugitive particulate emissions from excavation and hauling of soil. Low-sulfur fuels would be used to the extent practicable, and engines designed to reduce air pollution would be used when practicable, in addition to limiting engine idling times and using engines with add-on emission controls where practicable (COP, Volume II, Section 5.3; US Wind 2023).

Air emissions would be highly variable and limited in spatial extent at any given period and would result in minor impacts because they would be temporary in nature. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to air quality impacts from ongoing and planned activities, including offshore wind associated with onshore construction, which would be minor to moderate. Emissions from ongoing and planned activities, including the Proposed Action, would be highly variable and limited in spatial extent at any given period. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

3.4.1.5.1.2 Offshore and Inshore Activities and Facilities

Accidental releases: Proposed Action construction could release air toxins or HAPs due to accidental chemical spills. The Proposed Action would have up to about 158,460 gallons (636,521 liters) of coolants, oils, lubricants, and diesel fuel in its 121 WTG foundations (PDE) and about 339,888 gallons (1,286,596 liters) of coolants, oils, lubricants, and diesel fuel in its 4 OSS foundations (COP, Volume I, Appendix A, Tables 7 and 8; US Wind 2023). Accidental spills of these fluids could lead to short-term periods of hazardous air pollutant emissions, such as VOCs through evaporation. VOC emissions would be an important precursor to O_3 formation. Air quality impacts would be short term and limited to the local area around the accidental release location. These activities would have a negligible air quality impact from the Proposed Action.

Accidental releases would occur infrequently over the 30-year period of operations with a higher probability of spills during construction of projects, but spills would not be expected to contribute appreciably to overall impacts on air quality. The total storage capacity within the air quality geographic analysis area is considerably less than the volumes of hazardous liquids being transported by ongoing activities such as tanker vessels traveling to and from Delaware Bay (Section 3.4.2, *Water Quality*). As a result, in the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal increment of the air quality impacts from ongoing and planned activities, including offshore wind associated with onshore construction, which would be negligible.

Air emissions: Offshore air emissions would occur within the OCS, including state offshore waters. Offshore emissions would occur in the Lease Area and the Offshore Export Cable Route. The COP (Volume II, Section 17.2; US Wind 2023) provides additional information on land use and proposed ports. Air quality in the geographic analysis area may be affected by emissions of criteria pollutants from sources involved in the construction or maintenance of the Project and, potentially, during operations. These impacts, while generally localized to the areas near the emission sources, may occur at any location associated with the Project, be it offshore in the Lease Area or at any onshore construction or support site. O_3 levels in the region could also be affected.

The Project's WTGs, OSSs, and offshore export cables would produce minimal air pollutant emissions during normal operations from accidental releases, vessel emissions, and maintenance and testing. Air pollutant emissions from equipment used in the construction could affect air quality in the geographic analysis area and nearby coastal waters and shore areas. Most offshore emissions would occur temporarily during construction in the Lease Area and along the Offshore Export Cable Routes.

Most air pollutant and GHG emissions from the Proposed Action alone would come from the main engines, auxiliary engines, and auxiliary equipment on marine vessels used during offshore construction activities. Fugitive dust emissions would occur as a result of excavation and hauling of soil during onshore construction activities. Emissions from the OCS source, as defined in the CAA, would be permitted as part of the OCS air quality permit. The US Wind submitted its OCS air quality permit Notice of Intent to the USEPA on August 5, 2022 (Appendix A, *Required Environmental Permits and Consultations*). As part of the OCS air permitting process, the Project must demonstrate compliance with the NAAQS. The OCS air permitting process will Include air dispersion modeling of emissions to demonstrate compliance with the NAAQS. Preliminary results of air dispersion modeling of emissions conducted in support of the OCS air permitting will be provided at a later date. As part of the air quality values analysis, the Project must demonstrate that significant visibility degradation would not occur as a result of increased haze or plumes. Long-range transport modeling conducted in conjunction with the OCS air permitting process will be presented in the Final EIS.

Fuel combustion and solvent use would cause construction-related emissions. The air pollutants would include criteria pollutants, VOCs, HAPs, and GHGs. During the construction phase, the activities of additional workers, increased traffic congestion, additional commuting miles for construction personnel, and increased air-polluting activities of supporting businesses could have impacts on air quality. Construction equipment would comply with all applicable emissions and fuel-efficiency standards to minimize combustion emissions and associated air quality impacts. The total estimated construction emissions of each pollutant are summarized in Table 3.4.1-5.

Emissions from construction activities would vary throughout the construction and installation of offshore components. Emissions from offshore activities would occur during pile and scour protection installation, offshore cable laying, turbine installation, and OSS installation. Offshore construction-related emissions also would come from diesel-fueled generators used to temporarily supply power to the WTGs and OSSs so that workers could operate lights, controls, and other equipment before cabling is in place. There also would be emissions from engines used to power pile-driving hammers and air compressors used to supply compressed air to noise-mitigation devices during pile-driving (if used). Emissions from vessels used to transport workers, supplies, and equipment to and from the construction areas would result in additional air quality impacts. The Project may need emergency generators at times, potentially resulting in increased emissions for limited periods. Overall, emissions from offshore Proposed Action construction would be measurable but unlikely to cause NAAQS violations and, thus, would have minor to moderate impacts on air quality.

During construction, the total emissions of criteria pollutants and O_3 precursors from all offshore wind projects, including the Proposed Action, proposed within the air quality geographic analysis area, summed over all construction years, would include 2,346 tons of CO, 10,313 tons of NO_x, 280.8 tons of PM_{10}, 275.9 tons of $PM_{2.5}$, 221.2 tons of SO_2, 202.5 tons of VOCs, and 664,987 tons of CO_2e. Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases.

Proposed Action construction would contribute an average of approximately 44 percent of the total offshore wind project emissions in the geographic analysis area, depending on the pollutant and the exact ports used for construction. Proposed Action construction activity would occur at different locations and could overlap temporally with activities at other locations. As a result, air quality impacts would shift spatially and temporally across the air quality geographic analysis area. The largest combined air quality impacts from offshore wind would occur during overlapping construction of multiple offshore wind projects. The Proposed Action is anticipated to overlap with the Skipjack and GSOE 1 projects for 4 years of construction in 2024 to 2027. Proposed Action vessel activity could overlap with these and other projects at construction ports (Baltimore, Maryland, Paulsboro, New Jersey, Ocean City, Maryland and Portsmouth (Hampton Roads area), Virginia throughout the 2024 to 2027 Proposed Action construction period. Most air quality impacts would remain offshore because the highest emissions would occur in the offshore region and the westerly prevailing winds would result in most emission plumes remaining offshore. Although OCS sources in the Atlantic are subject to CAA requirements, including requirements not to violate any NAAQS, the amount of human exposure offshore is typically very low. O_3 and some particulate matter are formed in the atmosphere from precursor emissions and can be transported longer distances, potentially over land.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute to the combined impacts on air quality from ongoing and planned activities, including offshore wind, which would be minor to moderate during construction. Impacts would be greatest during overlapping construction activities, but these effects would be short term as the overlap in the air quality geographic analysis area would be limited in time.

3.4.1.5.2 Operations and Maintenance

3.4.1.5.2.1 Onshore Activities and Facilities

Air emissions: Emissions from onshore O&M activities would be limited to periodic use of construction vehicles and equipment. Onshore O&M activities would include occasional inspections and repairs to the onshore substation and splice vaults, which would require minimal use of worker vehicles and construction equipment. US Wind intends to use port facilities in Baltimore, Ocean City, and Portsmouth to support O&M activities. BOEM anticipates air quality impacts due to onshore O&M from the Proposed Action alone would be minor to moderate, intermittent, and short term.

3.4.1.5.2.2 Offshore and Inshore Activities and Facilities

The Project's WTGs, OSSs, Met Tower, and offshore cables would produce minimal air pollutant emissions during normal operations from accidental releases, vessel emissions, and maintenance and testing. During O&M, air quality impacts are anticipated to be smaller in magnitude compared to construction. Offshore O&M activities would consist of WTG operations, planned maintenance, and unplanned emergency maintenance and repairs. Emergency generators on the WTGs and OSSs are estimated to operate for a maximum of 500 hours per year, during emergencies or testing. Actual operation is expected to be lower, with testing limited to 100 hours per year and remaining hours dependent on the number and duration of emergencies; therefore, emissions from these sources would be small and transient. Pollutant emissions from O&M mostly would be the result of operations of ocean vessels and helicopters used for maintenance activities. Crew transfer vessels and helicopters would transport crews to the Lease Area for inspections, routine maintenance, and repairs. Jack-up vessels, multipurpose offshore support vessels, and rock-dumping vessels would travel infrequently to the Lease Area for significant maintenance and repairs. Table 3.4.1-6 summarizes the Proposed Action's annual offshore emissions during operations. The COP (Volume I, Section 6.1 and Volume II, Appendix C1; US Wind 2023) provides a more detailed description of offshore and onshore O&M activities.

Table 3.4.1-6. Annual O&M emissions (tons)

Period	NO_x	VOCs	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	HAPs
Lifetime (25 years)	2,146.3	28.7	504.7	42.7	41.4	82.7	138,271.2	0.5	0.1	138,317.7	4.0

Source: Notice of Intent (NOI) to Submit an Application for an Outer Continental Shelf Air Permit, Appendix A; US Wind 2022
CH_4 = methane; CO = carbon monoxide; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; HAP = hazardous air pollutant; N_2O = nitrous oxide; NO_x = nitrogen oxide; O&M = operations and maintenance; $PM_{2.5}$ = particulate matter smaller than 2.5 microns; PM_{10} = particulate matter smaller than 10 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound

The estimated O&M emissions presented in Table 3.4.1-6 are currently under review as part of the OCS air permit submitted to MDE as the permitting authority for US Wind's OCS air permit. Further analyses resulting from that review will be presented in the Final EIS. Based on the data in Table 3.4.1-6, BOEM anticipates air quality impacts from O&M of the Proposed Action would be minor to moderate, occurring for short periods of time several times per year during the proposed 25 years.

Planned activities, including the Proposed Action, are estimated to emit 98.68 tons per year of CO, 418.8 tons per year of NO_x, 12.61 tons per year of PM_{10}, 12.14 tons per year of $PM_{2.5}$, 4.22 tons per year of SO_2, 7.16 tons per year of VOCs, and 27,862 tons per year of CO_2e when all projects are operating. O&M emissions from ongoing and planned activities, including the Proposed Action, could begin in 2024. Emissions would largely be due to the same source types as for the Proposed Action, including commercial vessel traffic, air traffic such as helicopters, and operation of emergency diesel generators. Such activity would result in short-term, intermittent, and widely dispersed emissions.

Anticipated impacts on air quality from O&M emissions would be transient, small in magnitude, and localized. Additionally, some emissions associated with O&M activities could overlap with other projects' construction-related emissions. In summary, the largest magnitude air quality impacts and largest spatial extent would result from the overlapping O&M activities from the multiple offshore wind projects within the air quality geographic analysis area. A net improvement in air quality is expected on a regional scale as wind projects begin operation and offset emissions from fossil fuel sources.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a small increment of the combined impacts of ongoing and planned activities, including offshore wind, which would be minor to moderate.

Increased renewable energy production could lead to reductions in emissions from fossil fuel power plants. Table 3.4.1-7 summarizes the emissions avoided as a result of the Proposed Action, based on BOEM's Wind Tool (BOEM 2021), as described in the COP (Volume II, Tables 5-5 and 5-6; US Wind 2023). The avoided CO_2 emissions are equivalent to the emissions generated by about 2.7 million passenger vehicles in a year (USEPA 2020c). Based on the Project design capacity, accounting for construction emissions and assuming decommissioning emissions would be the same, and including emissions from future operations, operation of the Proposed Action would offset emissions related to its construction and eventual decommissioning within different time periods of operation depending on the pollutant; NO_x would be offset in approximately 4 years of operation, $PM_{2.5}$ in 5 months, SO_2 in 1.5 months, and CO_2 in 1.5 months. If emissions from future operations and decommissioning were not included, or if the maximum PDE capacity was assumed, then the times required for emissions to be fully offset would be shorter. From that point, the Project would be offsetting emissions that would otherwise be generated from another source.

Table 3.4.1-7. Avoided emissions (tons) due to Proposed Action operations

Period	NO_x	SO_2	$PM_{2.5}$	CO_2
1,676 MW (Project design capacity)	51,560	80,447	9,245	107,088,323
2,178 MW (maximum PDE capacity)	67,003	104,543	12,014	139,163,704

Source: COP, Volume II, Tables 5-5 and 5-6; US Wind 2023

CO_2 = carbon dioxide; MW = megawatt; NO_x = nitrogen oxide; PDE = Project Design Envelope; $PM_{2.5}$ = particulate matter smaller than 2.5 microns; SO_2 = sulfur dioxide

The potential health benefits of avoided emissions can be evaluated using USEPA's COBRA health impacts screening and mapping tool as discussed in Section 3.4.1.3. COBRA was used to analyze the avoided emissions that were calculated for the Project (COP, Volume II, Appendix C1; US Wind 2023). Table 3.4.1-8 presents the results of the potential health benefits of avoided emissions.

Table 3.4.1-8. Co-benefits Risk Assessment estimate of avoided health effects with Proposed Action

Discount Rate[1] (2023)	Monetized Total Health Benefits (million U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate[2]	High Estimate[2]	Low Estimate[2]	High Estimate[2]
3 Percent	7,031,945,799	15,851,494,038	631.129	1,428.890
7 Percent	6,276,280,879	14,135,825,671	631.129	1,428.890

[1] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the "time value of money" preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).

[2] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

The overall impacts of GHG emissions can be assessed using "social costs" of carbon, nitrous oxide, and social cost of methane—together, the "social cost of greenhouse gases" (SC-GHG)—which provide estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. The Council on Environmental Quality (CEQ) is currently updating its 2016 guidance document (CEQ 2016) on consideration of GHGs and climate change under NEPA. On January 9, 2023, CEQ published interim guidance to assist federal agencies in assessing and disclosing climate change impacts during environmental reviews. The interim guidance recommends that agencies provide additional context for GHG emissions through best available social cost of GHG (SC-GHG) estimates for weighing the merits and drawbacks of alternative actions. The SC-GHG estimates that follow are presented for purposes of information and disclosure.

For federal agencies, the best currently available estimates of SC-GHG are the interim estimates of the social costs of CO_2, methane, and nitrous oxide developed by the Interagency Working Group (IWG) on SC-GHG and published in its Technical Support Document (IWG 2021). IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. The discount rate accounts for the "time value of money," i.e., a general preference for receiving economic benefits now rather than later, by discounting benefits received later. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are less valuable or are a less significant factor in present-day decisions). IWG developed the current set of interim estimates of SC-GHG using three different annual discount rates: 2.5 percent, 3 percent, and 5 percent (IWG 2021). There are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021).

To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95^{th} percentile of damages estimated, applying a 3 percent annual discount rate for future economic effects. This is a low-probability but high-damage scenario and represents an upper bound of damages within the 3 percent discount rate model. The estimates below follow the IWG recommendations.

Table 3.4.1-9 presents the SC-GHG associated with estimated emissions from the Proposed Action. These estimates represent the present value of future market and nonmarket costs associated with CO_2, methane, and nitrous oxide emissions. In accordance with IWG's recommendation, four estimates were calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and US Wind's estimates of emissions in each year. In Table 3.4.1-9, negative values represent social benefits of avoided GHG emissions. The negative values for net SC-GHG indicate that the impact of the Proposed Action on GHG emissions and climate would be a net benefit in terms of SC-GHG.

Table 3.4.1-9. Estimated social cost of greenhouse gases (2020 U.S. dollars) associated with the Proposed Action

Description	Average Value, 5% Discount Rate	Average Value, 3% Discount Rate	Average Value, 2.5% Discount Rate	95th Percentile Value, 3% Discount Rate
Construction, Operation, and Build-outs[a,b]	$8,435,000	$33,0528,000	$50,4491,000	$100,397,000
Avoided Emissions [a,b,c]	-$1,080,958,000	-$4,255,053,000	-$6,485,552,000	-$12,994,112,000
Net SC-GHG[c]	-$1,072,523,000	-$4,222,001,000	-$6,435,104,000	-$12,893,716,000

CO_2 = carbon dioxide; GHG = greenhouse gas; IWG = Interagency Working Group; SC = social cost

Estimates are the sum of the social costs for all applicable GHGs over the project lifetime as estimated through IWG's recommendations. Costs are rounded to the nearest $1,000.

[a] The following calendar years were used in calculating SC-GHG: construction 2024–2027, operation (25 years) 2028–2049, build-outs 2050, and decommissioning 2050. Note that 2050 is the last available year for calculations per IWG's recommendation. Avoided emissions were calculated through the operating time frame of the project.

[b] CO_2 provides more than 99 percent of total GHG emissions, which are primarily from combustion. Avoided emissions, which are also primarily from combustion, are also assumed to be predominantly from CO_2. As a result, the social costs of methane and nitrous oxide would be negligible. The social costs listed in this table therefore reflect all GHG components but are assumed to be almost entirely associated with CO_2.

[c] Negative cost values indicate benefits.

Climate change: The Proposed Action would produce GHG emissions that contribute to climate change; however, the contribution would be less than the emissions reductions from fossil fuel sources during operation of the Project. Because GHG emissions disperse and mix within the troposphere, the climatic impact of GHG emissions does not depend on the source location. Therefore, regional climate impacts are largely a function of global emissions. Nevertheless, the Proposed Action would have negligible impacts on climate change during these activities and minor beneficial impacts on criteria pollutant and O_3 precursor emissions as well as GHGs, compared to a similarly sized fossil fuel power plant or to the generation of the same amount of energy by the existing grid.

Operation of offshore wind projects, including the Proposed Action, in the geographic analysis area would result in a net reduction in GHG emissions due to the offset of emissions from fossil fuel power plants. While operation of offshore wind projects would contribute small amounts of CO_2 emissions, these emissions would be minimal compared to ongoing and reasonably foreseeable activities other than offshore wind. The Proposed Action would contribute a minimal increment to the combined adverse GHG impacts on air quality from ongoing and planned activities, including offshore wind, and would contribute a substantial increment of beneficial impacts from the net decrease in GHG emissions due to the displacement of emissions from fossil fuel power plants. In the context of reasonably foreseeable environmental trends, the change in GHG emissions from Proposed Action operations would have negligible adverse and minor beneficial impacts on GHG emissions.

3.4.1.5.3 Conceptual Decommissioning

The impacts of onshore and offshore Project decommissioning on air quality would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Decommissioning would require similar types of onshore and offshore vessel and vehicle emissions and port usage. Emissions during decommissioning could be lower than construction if cables are retired in place rather than removed. Therefore, impacts of Proposed Action decommissioning would range from negligible to moderate.

Proposed Action decommissioning would contribute a small increment of the combined air quality impacts from ongoing and planned activities, including offshore wind. In the context of reasonably foreseeable environmental trends, the air quality impacts of decommissioning of the Proposed Action and other ongoing or planned activities would be short term and range from negligible to moderate.

3.4.1.5.4 Conclusions

The Proposed Action would result in a net decrease in regional emissions compared to the installation of a traditional fossil fuel power plant. Although there would be some short-term air quality impacts due to various activities associated with construction, O&M, and eventual decommissioning, these emissions would be relatively minimal in comparison to the avoided emissions from the Proposed Action. The Proposed Action would result in air quality-related health effects avoided in the region due to the reduction in emissions associated with fossil fuel energy generation. As described earlier, the impact from air pollutant emissions is anticipated to be **minor to moderate**, and the impact from accidental releases would be **negligible**. Considering all IPFs together, Proposed Action construction, O&M, and decommissioning would have **minor** to **moderate** adverse air quality impacts and **minor beneficial** impacts, to the extent that energy produced by the Project would displace energy produced by fossil fuel power plants. Per tables 3.4.1-5, 3.4.1-6, and 3.4.1-7, the estimated impact on air quality from the Proposed Action is less than 1% of the avoided emissions. Measures to reduce or avoid emissions during Proposed Action activities would include using low-sulfur fuels and specific engines designed to reduce air pollution to the extent practicable, limiting engine idling times in compliance with international air emission standards for marine vessels, and using engines with add-on emission controls where practicable (COP, Volume II, Section 5.3; US Wind 2023). Due to the relatively small volume of emissions from Proposed Action activities, the fact that emissions would be spread out in time (4 years for construction and then lower annual emissions during operation), and the large geographic area over which emissions would be dispersed (throughout the 80,000-acre [32,374.9-hectare] Lease Area, the Offshore Export Cable Route, and the vessel routes between ports and onshore facilities), air pollutant concentrations associated with the Proposed Action are not expected to exceed the NAAQS.

In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on air quality would range from undetectable to noticeable, with noticeable beneficial impacts. BOEM anticipates the overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities, including offshore wind, would result in **minor to moderate** adverse impacts and **minor beneficial** impacts. The main driver for the adverse impact rating is emissions related to construction activities increasing commercial vessel traffic, air traffic, and truck and worker vehicle traffic. Combustion emissions from construction equipment and fugitive emissions would be higher during overlapping construction activities but short term in nature, as the overlap would be limited in time. Therefore, the adverse impact on air quality would likely be **minor to moderate** because while emissions would incrementally increase ambient pollutant concentrations, they are not expected to exceed the NAAQS. The Proposed Action and other offshore wind projects would benefit air quality in the region surrounding the projects to the extent that energy produced by the projects would displace energy produced by fossil fuel power plants. While the benefit is regional, BOEM anticipates a **minor beneficial** impact because the magnitude of the potential reduction in emissions from displacing fossil fuel power generation would be small relative to total energy generation emissions in the area.

3.4.1.6 Impacts of Alternatives C, D, and E on Air Quality

The impacts associated with the Proposed Action (as described in Section 3.4.1.5) would not change substantially under the other action alternatives. Alternatives C-1 and C-2 would include an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route). Alternative C-2 could have a longer Offshore Export Cable Route. Thus, Alternative C could have marginally larger construction impacts from air emissions. Alternatives D and E could have marginally lower impacts due to the reduced number of installed WTGs, OSSs, and cables. These differences would not change the impact ratings compared to Alternative B and would remain minor to moderate adverse and minor beneficial. Impacts of Alternatives C, D, and E when combined with impacts from ongoing and planned activities, including other offshore wind activities, would not change from the Proposed Action and would remain minor to moderate adverse and minor beneficial.

3.4.1.6.1 Conclusions

While the action alternatives would have marginally different impacts, they would have the same impact magnitudes as Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **minor to moderate** adverse and **minor beneficial**. In the context of reasonably foreseeable environmental trends and planned actions, the action alternatives would occur under the same scenario (Appendix D, *Planned Activities Scenario*) as Alternative B. As stated earlier, the action alternatives would have the same impact magnitudes as Alternative B. Therefore, the overall impact of the action alternatives on air quality when combined with past, present, and reasonably foreseeable activities would be **minor to moderate** adverse and **minor beneficial**.

3.4.1.7 Comparison of Alternatives

Table 3.4.1-10 compares the GHG emissions from the No Action Alternative, the Proposed Action, and the action alternatives.

Table 3.4.1-10. GHG emissions from the No Action Alternative, the Proposed Action, and the action alternatives

Annual Emissions (U.S. tons)	Construction (Total CO_2e Emissions)	Operations (Annual CO_2e Emissions)[1]	Operations (Avoided Annual CO_2 Emissions)[2]	Operations (Annual Net CO_2e Emissions)	Operations (Lifecycle Net CO_2e Emissions)
Alternative A (No Action)	370,372	22,330	5,770,840	-5,748,510	-143,712,750
Alternative B (Proposed Action)	664,987	27,862	11,337,388	-11,309,526	-282,738,150
Alternatives C, D, and E	664,987	27,862	11,337,388	-11,309,526	-282,738,150

CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; U.S. = United States

[1] Operation emissions under the No Action alternative assume that the concurrent projects will operate under the same time frame (25 years) as the Proposed Action alternative.

[2] Avoided emissions only include CO_2 and do not include other GHGs (e.g., methane [CH_4], nitrous oxide [N_2O]). GHG emissions are from fuel combustion. For construction and operations, CO_2 makes up more than 99 percent of the CO_2e emissions. A similar GHG makeup is expected for avoided emissions.

As described in Section 3.4.1.5, the impacts of the Proposed Action, in combination with ongoing and planned activities, would likely be slightly larger than but would have similar impact magnitudes as the No Action Alternative. The Proposed Action would impact air quality primarily through air emissions and climate change. Under the No Action Alternative, these impacts would not occur. The annual GHG emissions reductions achieved by implementation of the No Action Alternative would be equivalent to the energy usage from about 725,000 homes. Under the Proposed Action and other alternatives, the annual GHG emissions reductions would be equivalent to energy usage by 1,430,000 homes.

As stated in Section 3.4.1.6, compared to Alternative B, the action alternatives would have incrementally different impacts on air quality. These differences notwithstanding, the impacts of the action alternatives would likely remain the same as Alternative B: **minor to moderate** adverse and **minor beneficial** impacts on air quality. In the context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternatives on air quality when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **minor** to moderate adverse and **minor beneficial**.

If BOEM requires the mitigation measures beyond the design features described in Section 3.4.1.5, then adverse Project impacts on air quality could be further reduced and beneficial impacts could be increased; however, overall impact magnitudes would remain the same as described in this section.

3.4.2 Water Quality

The reader is referred to Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts* for a discussion of current conditions and potential impacts on water quality from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.5 Biological Resources

3.5.1 Bats

The reader is referred to Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts* for a discussion of current conditions and potential impacts on bats from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.5.2 Benthic Resources

This section discusses potential impacts on benthic resources—other than fishes and commercially important benthic invertebrates—from the Project, action alternatives, and ongoing and planned activities in the geographic analysis area. The benthic resources geographic analysis area (Figure 3.5.2-1) includes a 10-mile (16.1-kilometer) radius/buffer around the Lease Area and a 330-foot (100.6-meter) buffer around the Offshore Export Cable Route. The geographic analysis area is based on where the most widespread impact (i.e., suspended sediment) from the Project could affect benthic resources. This area would account for transport of water masses and for benthic invertebrate larval transport due to ocean currents. Although sediment transport beyond 10 miles (16.1 kilometers) is possible, sediment transport related to Project activities would likely be on a smaller spatial scale. Finfish, invertebrates of commercial or recreational value, and essential fish habitat (EFH) are addressed in Section 3.5.5. Commercial fisheries and for-hire recreational fishing are addressed in Section 3.6.1.

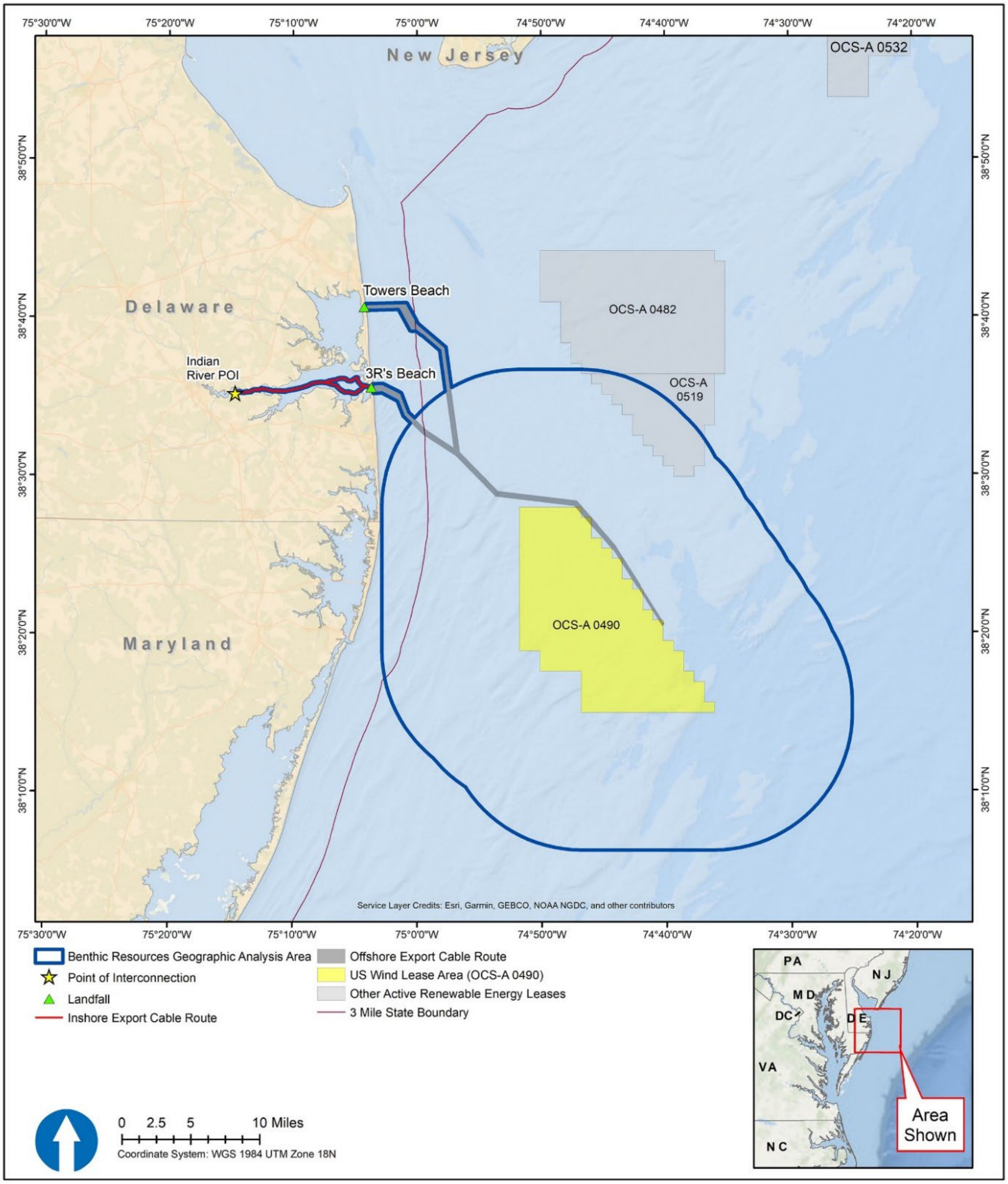


Figure 3.5.2-1. Benthic resources geographic analysis area

3.5.2.1 Description of the Affected Environment and Future Baseline Conditions

This section discusses potential impacts on benthic resources—excluding fishes and commercially important benthic invertebrates—from the Proposed Action, action alternatives, and ongoing and planned activities in the benthic resources geographic analysis area. The benthic resources geographic analysis area, as described in Appendix D, *Planned Activities Scenario*, Table D-1, and shown on Figure 3.5.2-1, includes the Offshore Project area. Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts*, Table F-3, summarizes baseline conditions and impacts, based on IPFs assessed, of ongoing activities, future non-offshore wind activities, and offshore wind activities.

The description of benthic resources in this section is supported by studies conducted by US Wind as well as other studies reviewed in the literature. Descriptions of the benthic resources offshore Maryland are provided in the lease issuance environmental assessment (EA) for New Jersey, Delaware, Maryland, and Virginia (BOEM 2012) and the COP (US Wind 2023) and are incorporated by reference. A larger-scale, non-project-specific study was also undertaken that characterized offshore wind lease areas in northeast Wind Energy Areas (WEAs) (Guida et al. 2017). This study compiled data from numerous sources, including from NOAA National Centers for Environmental Information for bathymetric data, Northeast Fisheries Science Center (NEFSC) for physical and biological oceanography, NEFSC fisheries-independent trawl surveys for demersal fish and shellfish, and the U.S. Geological Survey's usSEABED system for surficial sediment data.

3.5.2.1.1 Offshore Project Area

The benthic resources specific to marine habitats and associated biological assemblages in the Offshore Project area are described in the COP (Volume II, Chapter 7.0; US Wind 2023), prepared in accordance with BOEM site characterization requirements (30 CFR 585.626) and benthic habitat survey guidelines (BOEM 2019). Descriptions of the benthic resources and habitats are supported by project-specific surveys, including the COP appendices (Volume II, Appendices D4 and D5; US Wind 2023). The COP (Volume II, Appendix E1; US Wind 2023) also provides a description of the benthic habitat in the Offshore Project area, which includes portions of the Project components in the Lease Area and Offshore Export Cable Route that could be directly or indirectly affected by construction/installation, O&M, or conceptual decommissioning of the Project. The Lease Area covers approximately 80,000 acres (32,374 hectares) of seafloor, with water depths up to 135 feet (41 meters). Salinities at any given point in the water column are consistent year-round in offshore waters but vary between 27 and 31 PSU near shore (USACE 2016). Water depths along the Offshore Export Cable Route range from 36 to 104 feet (11.1 to 31.8 meters) in federal waters, and 49 feet (15 meters) or less in state waters (COP, Volume II, Appendix K7; US Wind 2023).

Habitat mapping for the Offshore Project area was primarily based on the results from acoustic survey and benthic sampling programs conducted in 2021 (and extending into 2022 for the acoustic survey). Acoustic data sources used include mosaics of multibeam echosounder (MBES) bathymetry and sidescan sonar collected in 2021, 2022, and 2023 (COP, Volume II, Appendix A1, Appendix A2, and Appendix E1, US Wind 2023). The seafloor characteristics of the Lease Area are consistent with the larger Mid-Atlantic

Bight (MAB) region: soft-bottom sediments characterized by sand with patches of gravel and silt/sand mixes. Using the NMFS- modified CMECS framework overall benthic habitat in the Offshore Project area is dominated by soft bottom (60,626 acres [24,535 hectares]) (Table 4, COP Volume II, Appendix E1, US Wind 2023). No muddy sands, sandy muds, or muds were observed (COP Volume II, Appendix E1, US Wind 2023). Heterogenous complex habitat accounts for 12,140 acres (4,913 hectares), with complex as 316.3 acres (128 hectares), and large grained complex as the least common at 9.9 acres (4.0 hectares) Table 4, COP Volume II, Appendix E1, US Wind 2023).

The primary morphological features are sand ripples, amalgamated sand ridges, and major sand ridges. Benthic habitat in the Lease Area is generally characterized by mobile sandy substrates on gentle slopes, with shell hash frequently accompanying mineral substrates (Guida et al. 2017). Based on US Wind survey data major sand ridges (sand waves with wavelengths greater than 250 meters, and 2 meters in height) are present within the southern portion of the Lease Area, while minor sand ridges and sand waves are present along the eastern side of the Lease Area and scattered along the Offshore Export Cable Route. Megaripples were the least widespread benthic feature in the Offshore Project area, confined to the far southeastern corner of the Lease Area. A total of 93 percent of the seafloor slope within the Lease Area and Offshore Export Cable Route is one degree or less. Within the Offshore Export Cable Route, the slope did not exceed five degrees, and is therefore still classified as a gentle slope. Steeper slopes exceeding 20 degrees were identified in the western portion of the Lease Area. These slopes, classified as very steep, would complicate cable-laying activities (COP, Volume II, Appendix K5; US Wind 2023). According to Slacum et al. (2010) ridges with steeper grade had greater abundance of pelagic finfish, pelagic invertebrates, benthic finfish, and benthic invertebrates than those with more gradual slopes.

In 2021 a survey collected benthic grab samples and underwater imagery within the Lease Area and along the Offshore Export Cable Route. Based on the NMFS-modified Coastal and Marine Ecological Classification Standard (CMECS), gravelly substrate was the dominant (40 percent) substrate group observed within the Lease Area, followed by sand (39 percent) and gravel mixes 21 percent) (COP, Volume II, Appendix E1; US Wind 2023). The substrate classification within the Offshore Export Cable Route followed similarly with 46 percent, gravelly, 33 percent sand, and 17 percent gravel mixes. Unlike the Lease Area, the Offshore Export Cable Route contained 3 percent classified as gravel (COP Volume II, Appendix E1, US Wind 2023). Some complex habitats contained a high enough fraction of shell to be classified as shell hash. Solitary boulders and cobble-size clasts were also occasionally observed on underwater imagery dominated by sand, gravelly substrates, or gravel mixes. Large gravel clasts (cobble and boulders) were rare but sometimes harbored stony corals (*Astrangia poculata*), sea whips (*Leptogorgia virgulata*), and other sessile epifauna (COP, Volume II, Appendix D4; US Wind 2023). Some complex habitats contained a high enough fraction of shell to be classified as shell hash. One transect in the southwestern portion of the Lease Area identified a cobble pile of suspected anthropogenic origin, and the presence of a worm reef was identified along a sandy transect on the western side of the Lease Area (COP, Volume II, Appendix D4; US Wind 2023). Although regional studies have documented muddy sands within portions of the central Lease Area, the most recent sediment sampling for the COP did not observe any fine substrates (i.e., muddy sands, sandy muds, and muds) (COP, Volume II, Appendices D4 and E1; US Wind 2023). Subsurface sediments are predominantly sands with occasional interlays of clay and gravel. Overall, although variations in sediment have been observed over small spatial scales within the Lease Area, few hard-bottom patches are believed to be present (Cutter et al. 2000; Guida et al. 2017; COP, Volume II, Appendix D4; US Wind 2023). These findings align with previous surveys, which indicate that hard-bottom benthic habitats are rare in the Lease Area and primarily occur as gravel- or cobble-dominated substrates (National Ocean Service 2015; Guida et al. 2017).

In summary, as shown in Figure 3.5.2-2, 56,089.2 acres (22,699.0 hectares) of the Lease Area is characterized as soft bottom, followed by heterogenous complex with 10,131.1 acres (4,100.0 hectares), 197.68 acres (80.0 hectares) as complex, and lastly 7.4 acres (3.0 hectares) as large grained complex (COP, Volume II, Appendix E1; US Wind 2023).

Within the Offshore Export Cable Route 4,534.3 acres (1,835.0 hectares) are classified as soft bottom habitat, with 2,011.4 acres (814 hectares) as heterogenous complex, and lastly 118.6 acres (48.0 hectares) of complex habitat. No large grained complex habitat is documented in Offshore Export Cable Route (Table 4, COP Volume II, Appendix E1; US Wind 2023), as shown in Figure 3.5.2-3. Additionally, benthic habitat maps at a finer scale can be found in Appendix E1 (US Wind 2023).

A total of 99 marine invertebrates were found within benthic samples (COP, Volume II, Appendix D4; US Wind 2023). The benthic macrofaunal community present in the Lease Area samples is influenced by the mobile sand wave geoforms. Polychaetes (e.g., *Polygordius* sp., Cirratulidae, *Scoletoma* sp., Syllidae) were the dominant invertebrate in the benthic samples (COP, Volume II, Appendix D4, US Wind 2023) and were also the most abundant taxonomic group observed during benthic sampling conducted historically within the Maryland WEA (Cutter et al. 2000; Guida et al. 2017). Polychaetes, representing 26 taxonomic families, contributed roughly 45 to 50 percent of the observed total macroinvertebrate abundance. Oligochaete worms, mollusks, nemertean worms, and lancelets were also commonly present in the macrofaunal assemblage (Guida et al. 2017; COP, Volume II, Appendix D4, US Wind 2023). Crustaceans and mollusks each accounted for approximately 25 percent of the infauna taxa in the Lease Area samples. Video surveys and survey trawls of the Lease Area suggest that the primary benthic epifaunal taxa include common sand dollar (*Echinarachnius parma*), sea stars (*Asterias* spp.), tube anemones (*Cerianthus* sp.), hermit crabs (*Pagurus* sp.), rock crab (*Cancer* spp.), moon snails (Naticidae), and nassa snails (*Ilyanassa* [*Nassarius*] spp.). Surfclams (*Spisula solidissima*), sea scallops (*Placopecten magellanicus*), penaeid shrimps (Penaeidae), sand shrimps (*Crangon septemspinosa*), horseshoe crabs (*Limulus polyphemus*), and ocean quahogs (*Arctica islandica*) were also occasionally recorded in survey trawl data (Guida et al. 2017). These findings are supported by 2021 sampling (COP, Volume II, Appendix D4; US Wind 2023), which also observed sand dollars and ascidians congruently with the macrofauna.

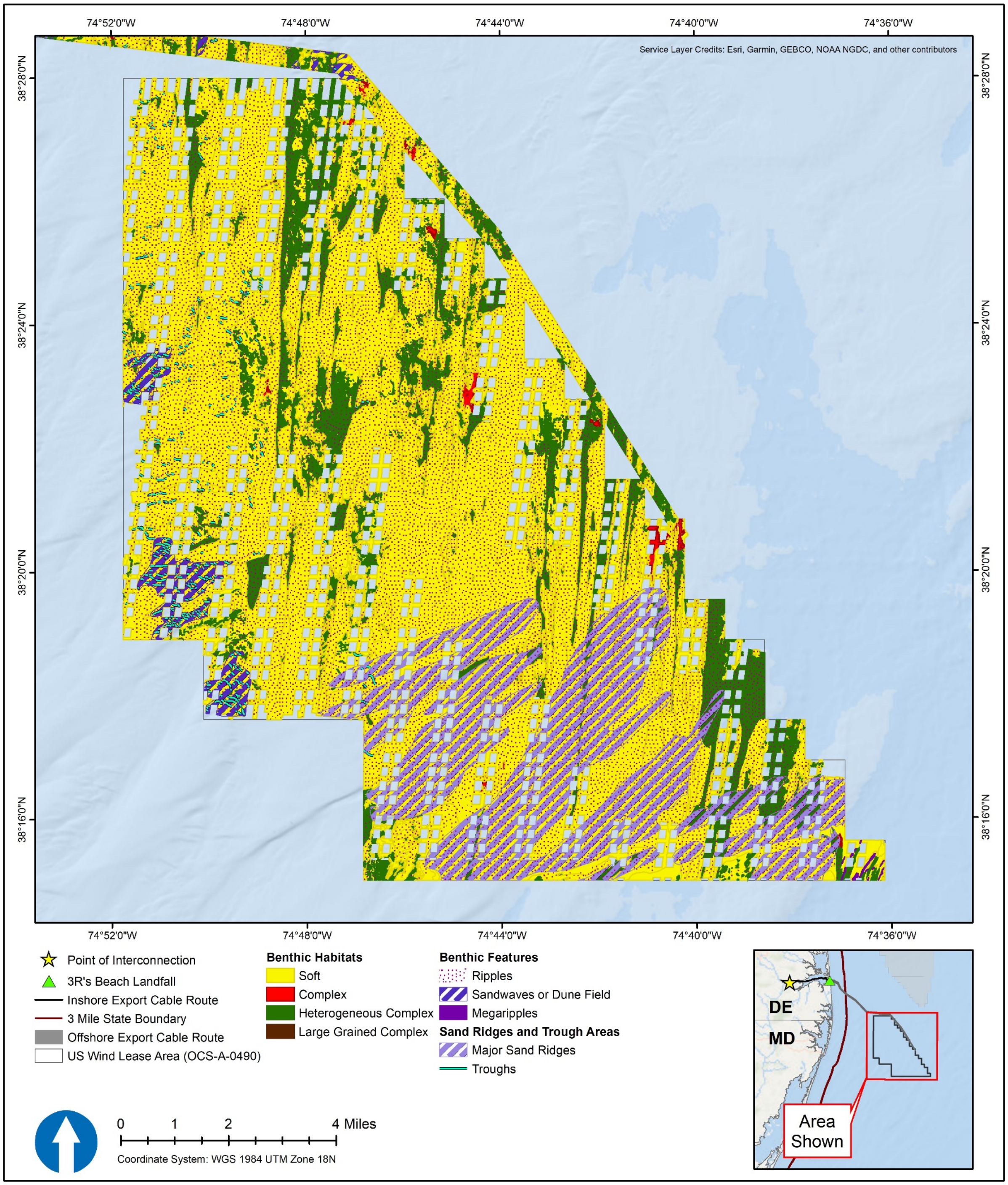


Figure 3.5.2-2. Benthic habitats mapped within the Lease Area

Source: Data from COP, Volume II, Appendix E1; Information to Support EFH, US Wind 2023

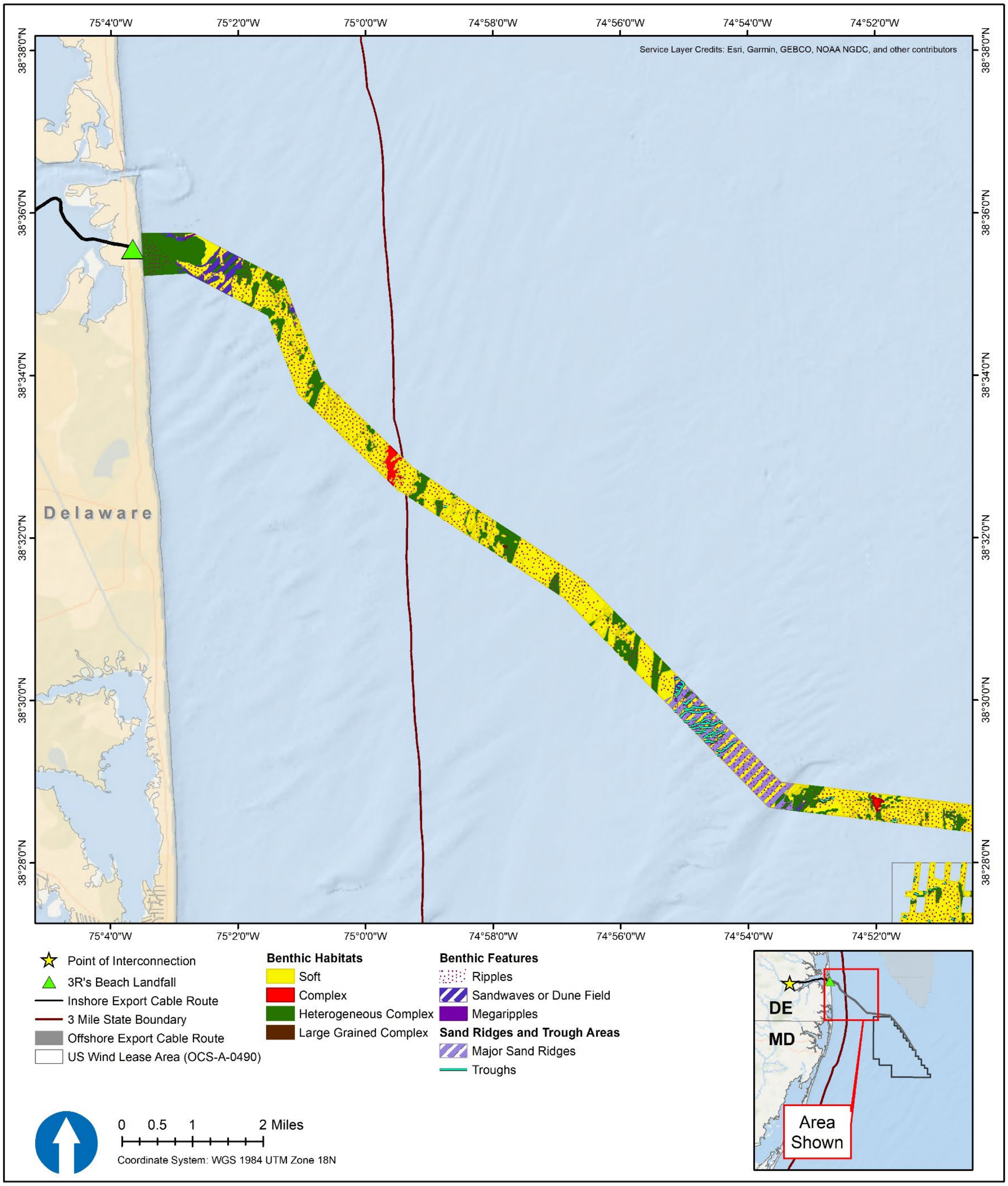


Figure 3.5.2-3. Benthic habitats mapped along the Offshore Export Cable Route

Source: Data from COP, Volume II, Appendix E1; Information to Support EFH, US Wind 2023

Taxa collected in grab samples were typical of soft-sediment coastal shelf habitats of the MAB. Most benthic macrofaunal taxa observed in the grab samples were small burrowing or tube-building taxa. Widespread or abundant organisms included polychaete worms, oligochaete worms, amphipods (e.g., *Unciola* sp., *Byblis serrata*), and nemertean ribbon worms. In substrates classified as gravel and gravel mixes, common Atlantic slipper shells (*Crepidula fornicata*), blue mussels (*Mytilus edulis*), *Astarte* clams (*Astarte* spp.), mollusks, and crustaceans were abundant. Another notable but uncommon and highly localized feature observed was the presence of a worm reef that may have been formed by spionid polychaetes, which were identified in a nearby benthic grab sample, and video transect VT-LA-Z017 in the northern central portion of the Lease Area (COP, Volume II, Appendix D4; US Wind 2023). Through the imagery, at least 14 macrofauna species were observed (COP, Volume II, Table 7-9; US Wind 2023); epifauna species such as hermit crabs, sand dollars, and slipper snails were most common. Tunicates, bryozoans, sea whips, and stony corals were observed attached to cobble, boulders, or in patches of hard bottom. More detailed summaries of the methodology and the results of the benthic field survey are presented in the COP (Volume II, Appendices D4 and E1; US Wind 2023). Benthic infaunal and video transect data collected during the 2021 benthic survey of the Lease area and Offshore Export Cable Routes suggest that benthic habitat in these areas is likely to support a similar biological assemblage whether the substrate is sand, gravelly, or gravel mix. Figure 3.5.2-3 shows the benthic habitats mapped along the Offshore Export Cable Route for the Project.

The regional oceanography is driven by multiple factors, with currents below the surface as the most influential. The Gulf Stream waters move warm water from the south northward along the shelf, and the cold waters of the Labrador Current move south along the coast. This combination creates consistent eddies and gyres in the MAB. Freshwater flow from Delaware Bay also influences regional currents. The cold northern waters sink under the warmer waters, creating the MAB Cold Pool. The Cold Pool develops in the spring and ensures vertical stratification through the summer and fall (Lentz 2017; Friedland et al. 2022; Miles et al. 2021).

The inner continental shelf is characterized by a counterclockwise gyre created by large tropical and extra-tropical storms, circulating the ocean currents. This in turn causes the north-to-south coastal currents and forms sand shoals oriented north-northeast/south-southwest. This predominant morphological feature of the inner shelf can run tens to hundreds of miles/kilometers long, with wavelengths of 6.6 to 16 feet (2 to 5 meters) and crest height up to 33 feet (10 meters). Shoals may be spaced 1.2 to 2.5 miles (2 to 4 kilometers) apart and extend tens of miles/kilometers from end to end. Maximum relief of the ridges is 16 to 33 feet (5 to 10 meters). The Offshore Export Cable Routes traverse the northern periphery of these ridges where the relief is generally less pronounced and takes the form of broad flats in some areas. The western third of the Lease Area lies within these shoals (COP, Volume II, Appendix A1; US Wind 2023). Surficial sediment types are generally sands of varying coarseness, with mixtures of silt or gravel (MMS 1999).

Offshore shoal complexes (two or more shoals and the trough separating them) provide habitat and micro-habitat for adults, settled juveniles, and larvae for multiple fish and invertebrate species that use these shoal complexes for spawning, larval recruitment, foraging, and migration (Rutecki et al. 2014). However, a 2-year study conducted on the inner continental shelf of the MAB showed greater species diversity, abundance, and richness in flat-bottom habitats than in shoal habitats. Seasonal trends with lower values of all those indices were recorded during the winter than in the spring through fall (Slacum et al. 2010). Shoal habitats occur in high-energy environments and migrate in a generally southwest direction within the MAB (Rutecki et al. 2014). Along with sand ridges, sand ripples and waves were observed over a large portion of the Lease Area. The Project has been sited to avoid sensitive or rare habitats, such as artificial reefs, clam beds, submerged aquatic vegetation (SAV) beds, and hard-bottom habitats, where practical. Sections 3.5.5 and 3.6.1 provide additional information regarding fish species, habitat and fisheries.

Horseshoe crabs are found along the east coast of North America from Mexico to Maine, Delaware Bay is the only place with populations of horseshoe crabs reaching into the millions (Dybas 2019).The Carl N. Shuster Jr. Horseshoe Crab Reserve, located outside of Delaware Bay, is a marine protected area where the harvest of horseshoe crabs is prohibited (Smith et al. 2017) In an effort to maintain sufficient numbers of horseshoe crab eggs to feed migratory shorebirds. The reserve is 1,593 square miles (4,127 square kilometers). The northern half of the Lease Area (approximately 41.9 square miles [108.6 square kilometers]) is located within the southern portion of the reserve. Horseshoe crabs were not observed during benthic field studies but are known to be present in the Project area along the Offshore Export Cable Route, which traverses approximately 25 to 33 miles (40 to 52 kilometers) of the southwestern portion of the Carl N. Shuster Jr. Horseshoe Crab Reserve, depending on the final route selection. Horseshoe crabs likely use areas in the vicinity of the Offshore Export Cable Route for overwintering habitat (Smith et al. 2017), and individuals may cross the Offshore Export Cable Route during annual migrations between breeding beaches and offshore areas.

In 2016, US Wind contractors conducted surveys along a portion of the Offshore Export Cable Route and within Indian River Bay (discussed in *Inshore Project Areas* below). Seafloor sediments characterized along this portion of the Offshore Export Cable Route range from silt-clay, sand, gravel, cobbles, and possible small boulders. The sediment grab samples predominantly recovered fine- to coarse-grained sand, with some gravel and with occasional cobble. Fine-grained silt-clay was also observed. Sediment vibracore samples recovered silt, clay, peat, organics, sand, and gravel, confirming the sub-bottom data. Side-scan sonar also identified possible marine debris (e.g., tires, fishing gear). Of the six vibracores collected, one was found to exceed current the DNREC Division of Waste and Hazardous Substances screening levels for the polycyclic aromatic hydrocarbons (PAHs) naphthalene and acenaphthene. Arsenic was commonly found at low concentrations of 1 to 40 mg/kg throughout, likely from pesticide use on land and waste from metal refineries. The subsequent erosion, along with the natural environmental drivers of wind and rain, carried these contaminants into the waterways. Arsenic and nickel both exceeded the Delaware Ecological Marine Sediment Screening Level and the NOAA effects range-low level for nickel. US Wind also conducted sediment sampling along the Offshore Export Cable Route and included both the northern and southern shore approach. The results of these samples will be provided at a future date.

Glauconite, a potassium, iron, aluminum silicate mineral, can be of concern to offshore wind development due to its mineral properties which cause high friction during pile-driving, making it challenging to drill (Bruggeman et al. 2023). Glauconite generally forms in shallow marine environments which includes estuaries such as Indian River Bay but can also be found along the OCS in water depths of 164 to 1,640 feet (50 to 500 meters). Glauconite within the sand was not mentioned within the COP or any of the Project-specific geotechnical survey results including the CPT sampling in 2015 (COP Volume II, Section 3.1.2; US Wind 2023), however it may be present within the Project area.

Notable fishing grounds are scattered along the MAB, including the Old Grounds, which is located north of the Lease Area. Located approximately 18 miles south of Cape May, New Jersey in water depths ranging from 90 to 120 feet (27.4 to 36.6 meters) this area is known for its rocky bottom and corals (COP, Volume II, Section 17.5.1, US Wind 2023). For more details, see Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, and Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*.

The Lease Area, in its entirety, is within the U.S. Navy Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES), which was established in 1977 with many missions, including the scheduling, controlling, and overseeing of military operating areas, training routes, and bombing ranges for the northeastern U.S. (Commander Naval Air Force Atlantic 2022). Section 3.6.7, *Other Uses*, contains more details.

Several sand borrow areas have been identified off the coast of Delaware, ranging from area expansions, area restrictions, active, and inactive borrow areas. The primary function of BOEM's marine minerals program is identifying and mining sand on the OCS to be used for beach nourishment and coastal restoration projects (BOEM 2011). Most of the seafloor between the Lease Area and the Submerged Lands Act boundary is considered to contain sand resources. Section 3.6.7, *Other Uses*, contains more details.

3.5.2.1.2 Inshore Project Areas

The Inshore Export Cable Route originates at 3R's Beach landfall and crosses through Indian River Bay, west into the upper estuary (i.e., the Indian River) to the POI in Millsboro, Delaware. Water depths in Indian River Bay are generally less than 6.6 feet (2 meters), but the inlet to the bay is an artificially stabilized channel with a mean depth of approximately 65.6 feet (20 meters) (Xu et al. 2006). The Inlet is a dredged channel with extremely high currents at both peak flood and peak ebb tides. The tidal range in Indian River Bay varies with proximity to the inlet. The mean tidal range at the inlet according to USGS tide level gauges, is approximately 2.55 feet (0.78 meters). The mean tidal range up Indian River (approximately 7.5 miles [12 kilometers] west of the Inlet), is 1.75 feet (0.53 meters) (COP, Volume II, Appendix B3, US Wind 2023). In Indian River Bay, water salinity levels typically exceed 18 ppt, gradually declining moving westward upriver into the Indian River, generally remaining above 15 ppt (DNREC 2023). Water temperature ranges from approximately 14 degrees Celsius (34 degrees Fahrenheit) in the winter to the mid-20's C (mid-70's) in the summer, with occasionally colder or warmer conditions (DNREC 2023). Salinity generally increases from west to east within Indian River Bay, with the westernmost portions heavily influenced by watershed inputs. Benthic resources and habitats associated with Indian River Bay are described in the COP (Volume II, Section 7.1.3, Appendix B3, and Appendix D5; US Wind 2023) and mapped in Appendix E1 (US Wind 2023).

Local variations in surface sediments occur regularly, especially near the Indian River Inlet, which routinely shoals in with sand from updrift shoreline transport. Seafloor surface sediment texture and profiles in the nearshore and inlet areas of Indian River Bay can change dramatically due to its shallow water and tidal flat conditions. The inlet is characterized as a flood-dominated inlet, exhibiting highly mobile bed conditions and texture changes, particularly due to large coastal storm events or periods of high river discharge to the lower estuary. Benthic habitat along the Inshore Export Cable Route was dominated by soft-bottom habitat, covering the entire area mapped (COP, Volume II, Appendix E1; US Wind 2023). Soft-bottom habitat consisted of sand, muddy sand, sandy mud, and mud. Hard-bottom habitats, including complex, heterogeneous, and large-grained habitats as well as biogenic and SAV, were not observed along the Inshore Export Cable Route (Figure 3.5.2-4).

Historical data from samples collected near the POI contained an average of 19 species, dominated by polychaetes (49 percent) and crustaceans (34 percent). A similar assessment of the Indian River Bay benthic community from 1993 reported higher species densities, and crustaceans accounting for 75 percent of the total abundance, though polychaetes were the most taxonomically rich group with 60 species present (Chaillou et al. 1996).

An assessment of the Ecological Condition of the Delaware and Maryland Coastal Bays concluded that approximately 77 percent of Indian River Bay is characterized by degraded benthic habitat. Poor water quality in the upper and lower reaches of Indian River Bay is reportedly attributed to increasing runoff in the upper watershed (Chaillou et al. 1996). See Section 3.4.2, *Water Quality* for more information. Additionally, Delaware's 2020 *Combined Watershed Assessment Report* (DNREC 2020) listed both Indian River and Indian River Bay as impaired. Water quality impairments include bacteria, nutrients, temperature, and total suspended solids. Many of the shellfish beds in the Indian River close to commercial and recreational shell fishing, particularly in the summer season (April 16 through November 30) (DNREC 2022). In 2020, 43 acres were leased in Delaware's inland bays (Rehoboth Bay, Indian River Bay, and Little Assawoman Bay), for Eastern oyster (*Crassostrea virginica*) within Indian River Bay and Rehoboth Bay, and hard clams (*Mercenaria mercenaria*) further south in Little Assawoman Bay. However, at the end of 2020, no acres were leased within Indian River Bay, while 38 acres were leased in Rehoboth Bay, and 5 in Little Assawoman Bay (DNREC 2021).

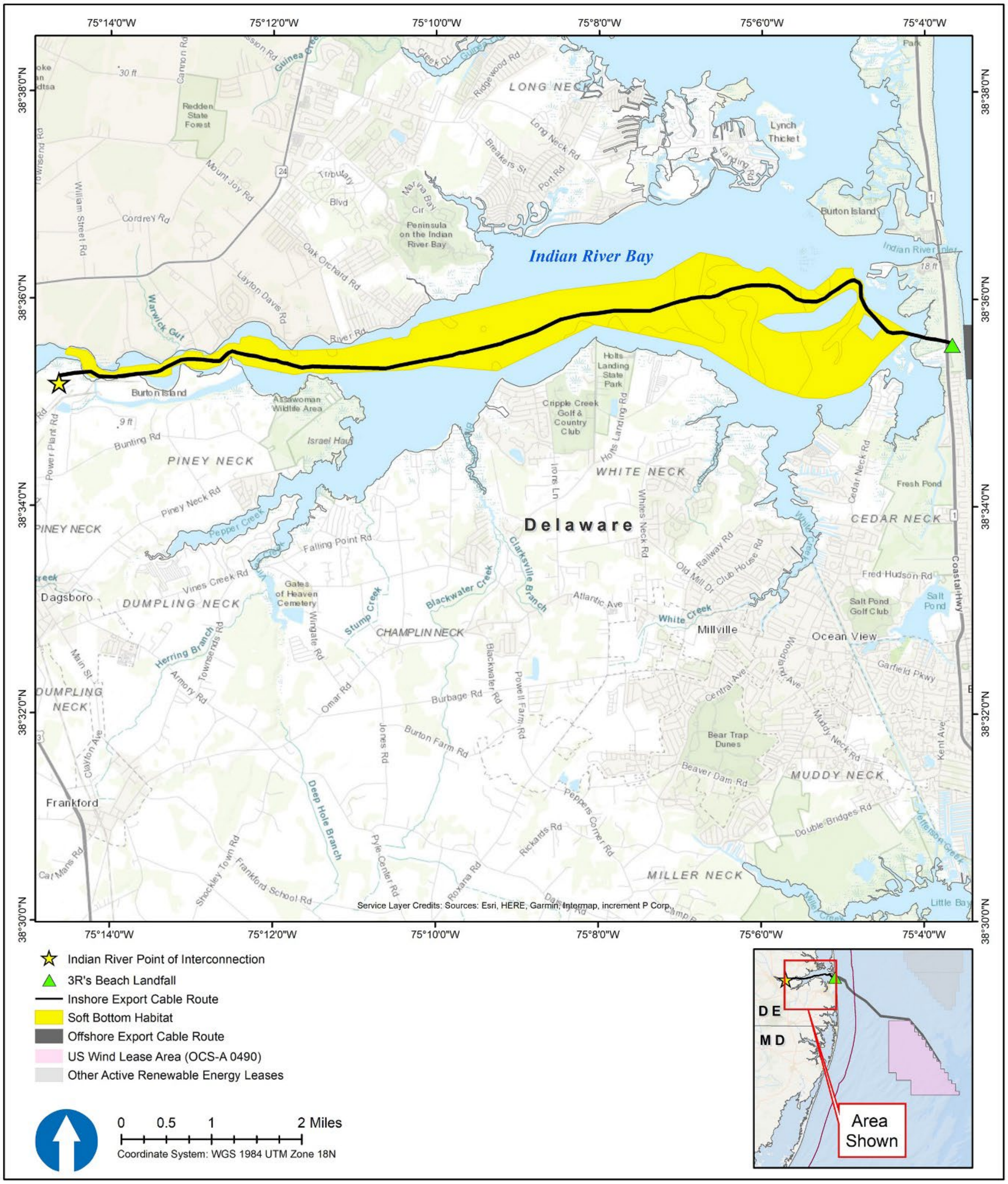


Figure 3.5.2-4. Benthic habitats mapped along Inshore Export Cable Route through Indian River Bay

Source: Data from COP, Volume II, Appendix E1; Information to Support EFH, US Wind 2023

Benthic surveys within Indian River Bay were also conducted by US Wind contractors in 2016. Further sampling in 2022 and 2023 provided results consistent with the 2016 survey findings. All 2,228.8 acres (902 hectares) classified within Indian River Bay and Indian River was soft bottom consisting of sand, muddy sand, sandy mud and mud. Neither hard bottom, biogenic, nor SAV were observed (COP Volume II, Appendix E1; US Wind 2023). The bathymetry indicated that the bottom of Indian River Bay is relatively flat, with an elevation range between 2.3 and 30.5 feet (0.7 and 9.3 meters). Possible marine debris or fishing gear was also identified. The sediment grab samples recovered predominantly silty-sand with some medium- to coarse-grained sand. Similar to the formerly considered offshore corridor samples, sediment vibracore samples recovered silt, clay, peat, organics, and sand; however, no gravel was found. The vibracore data align with the sub-bottom data collected. Sediment samples from landward reaches of Indian River Bay generally contained higher organic matter (0.6 to 57.0 percent versus 0.3 to 3.8 percent). Elevated concentrations of arsenic and nickel were found in most samples collected from the Upper Indian River Bay, which may indicate metal loading from surrounding land use and agricultural runoff (COP, Volume II, Appendix E1; US Wind 2023). In 2019 sampling of the Indian River sediment west of the Indian River Power Plant, arsenic concentrations were found to exceed the DNREC soil screening levels for the protection of human health with concentrations of 11.4 mg/kg and 13.9 mg/kg at the surface and subsurface of composited sediment samples (Cargill and Pratt 2020). The range of concentrations are within the range of sediment values detected regionally in Inland Bays, however (Cargill and Pratt 2020). PCBs were also detected however in concentrations low enough that toxicity to aquatic life is not expected (Cargill and Pratt 2020).

In 2017, surveys within Indian River Bay collected underwater video and still photos as well as benthic grab samples; however, due to high turbidity, the imagery was of limited use (COP, Volume II, Appendix D5; US Wind 2023). Although scattered patches of macroalgae were observed, no SAV beds or epibenthic macrofauna were discernable. The benthic community observed in the grab samples was dominated by polychaete worms, which constituted approximately 88 percent of all organisms and 49 percent of all taxa. Total taxa richness in the Indian River Bay samples was somewhat lower than observed in the 1993 studies, although taxonomic richness per sample was similar. The benthic taxa found in the surveys are consistent with soft-sediment estuarine habitats of the Mid-Atlantic coastal regions. The COP (Volume II, Appendix A1; US Wind 2023) contains details about geophysical and geotechnical surveys conducted prior to 2020.

In 2022, benthic samples were collected in Indian River Bay to support siting of the Inshore Export Cable Route (COP, Volume II, Appendix D5; US Wind 2023). In addition, 13 shallow-water locations were selected for shellfish density. In the western portion of the Indian River, near the POI, the cable route was referred to as the common corridor. As the corridor continued to the east into Indian River Bay, sampling occurred on both a northern and southern cable route, both within the Inshore Cable Route. Although few discernable statistical geographic trends existed in the results of univariate community metrics, multivariate analyses indicated that the macrofaunal community differed between the common route (in the west) and samples from either the northern or southern routes in the eastern (main) portion of Indian River Bay. For example, polychaetes (orbiniid and capitellid) were present in higher densities, while tellin clams were in lower densities in the common route than either the north or south routes. The community-level differences of benthic organisms observed are likely attributed to the differences in water salinity and sediment composition. The benthic organisms in the common route were indicative of mud environments with lower salinity, consistent with the finer sediment samples obtained. The sediment samples from the northern route had a higher percentage of sand, while the southern route was evenly split between sand, muddy sand, and sandy mud (Section 3.4.1 of COP Appendix D5 US Wind 2023). However, communities in all samples are typical of soft-sediment estuarine habitats. Many of the most widespread and abundant taxa are adapted to periodic disturbance events, and several are also generally tolerant of contamination and organic enrichment. No rare species or taxa indicative of sensitive habitats (e.g., hard-bottom habitat, SAV) were present in any of the samples, and no SAV was observed during the survey (at sample locations or during transit).

The mouth of Indian River Bay is a mix of muddy sand and sand, while sandy mud transitions to mud farther inshore (west) to the POI. Taxa richness was highest in the eastern part (in the open water, not directly at the mouth), as was density. Polychaetes accounted for the greatest percentage of total organism abundance, averaging 74 percent across Indian River Bay (86 percent in the western portion and 68 percent averaged across the two regions sampled in the eastern portion) (COP, Volume II, Appendix D5; US Wind 2023). Crustaceans and mollusks were also present. No taxa indicative of sensitive habitats (e.g., hard-bottom areas, cold water coral reefs, seagrass beds) were observed in the samples collected in the vicinity of the Inshore Export Cable Route, and no SAV was observed during sample collection.

Hard clams were observed in all sampled portions of Indian River Bay, however sparingly. In a 2011 survey by the DNREC (Bott and Wong) clam densities in Indian River Bay were found to be stable despite commercial harvest. This survey found the highest density of hard clams near the Indian River Bay inlet where sand substrate is present. Although not part of this study, their findings confirmed the theory that substrate type appears to be the greatest variable in clam densities with higher densities found in substrates composed of shell or sandy mud compared to mud or gravel. Bott and Wong also noted that substrate is believed to affect survival and predation rates of young clams, particularly from crabs, gastropods, fish and birds (Kraeuter et al 2009). Predation based on substrate may be a primary factor driving clam densities In the Inland Bays.

Total suspended solids data for the tidal portions of Indian River Bay have a seasonal average of 20 mg/L from March to the end of October. In the past two decades, a wide range has been documented, from 6 mg/L to more than 150 mg/L in the course of one year. The water clarity is too low in the Indian River to support growth of SAV, though it does improve in the eastern portion of Indian River Bay (COP, Volume II, Section 4.1.2; US Wind 2023).

Horseshoes crabs were not observed in Indian River Bay but are known to be present during the spawning season (May to June), when they deposit large numbers of eggs on nearby sandy beaches. Delaware has designated portions of Indian River Bay as shellfish aquaculture development areas for oyster production, although natural oyster reefs are no longer present (Ewart 2013). Other nearshore and onshore activities and facilities are covered under Section 3.5.4, *Coastal Habitat and Fauna*, and shellfish species of recreational and commercial concern are covered in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*.

3.5.2.2 Impact Level Definitions for Benthic Resources

Definitions of impact levels are provided in Table 3.5.2-1. Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts*, Table F-4, identifies potential IPFs, issues, and indicators to assess impacts to benthic resources.

Table 3.5.2-1. Impact level definitions for benthic resources

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

3.5.2.3 Impacts of Alternative A – No Action on Benthic Resources

Under the No Action Alternative, baseline conditions for benthic resources would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities within the geographic analysis area that contribute to impacts on benthic resources are generally associated with inshore dredging, coastal development, offshore construction including bottom disturbance and habitat conversion, and climate change. Impacts associated with climate change could alter species distributions and increase individual mortality and disease occurrence. When analyzing the impacts of the No Action Alternative on benthic resources, BOEM considered the impacts of ongoing and planned non-offshore wind activities.

Benthic resources are subject to pressure from ongoing activities and conditions, especially climate change, commercial fishing using bottom-tending gear (e.g., dredges, bottom trawls, traps/pots), undersea cables, pipelines, and conduits, and sediment dredging; these activities are anticipated to continue for the foreseeable future and could noticeably affect the habitat, abundance, diversity, community composition, and percent cover of benthic fauna and flora.

Accidental releases: Accidental releases would continue to occur as a result of ongoing and planned activities. The anticipated increase in vessel traffic over the next 30 years increases the risk of accidental releases. Releases of hazardous materials (hazmat) do occasionally occur, although mostly consist of fuels, lubricating oils, and other petroleum compounds that tend to float in seawater. Accidental releases occur at or near the ocean surface in association with vessel operations and degrade rapidly making them unlikely to come in contact with benthic resources. Invasive species can be accidentally released, especially during ballast water and bilge water discharges from marine vessels.

The trans-oceanic shipping industry has also contributed to the spread of invasive species. Invasive species are accidentally released periodically, especially during ballast water and bilge water discharges from marine vessels. As documented in observations of colonial sea squirt (*Didemnum vexillum*) at the Block Island Wind Farm (HDR 2020), the impacts of invasive species on finfish, invertebrates, and EFH could be strongly adverse, widespread, and permanent if the species were to become established and out-compete native fauna or modify habitat. At present, the commercial shipping industry relies heavily on the designated traffic lanes of the Mid-Atlantic, including through Delaware waters. Although the mid-Atlantic does not currently have any offshore oil drilling, some large crude and refined oil spills have occurred in the Delaware and Chesapeake Bays. Small fuel spills have occurred from ships en route to Mid-Atlantic ports, military bases, or grounded fishing vessels. Accidental releases of hazmat, trash and debris may occur from vessels; however, the impacts on benthic resources would be negligible due to their small scale.

Anchoring: Ongoing and planned activities include vessels anchoring within the inshore and offshore geographic analysis area. Anchoring from vessels related to ongoing commercial, recreational activities, and military use, would continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. Impacts can include mortality and physical damage to the habitat. Sessile and slow-moving species (e.g., corals, sponges, sedentary shellfish) would be most likely to be impacted. Impacts from anchoring would be localized with temporary elevated turbidity and mortality of soft-bottom benthic resources that are likely to recover relatively quickly (Dernie et al. 2003). Anchoring on hard-bottom (e.g., boulder piles, corals) substrates, may impart somewhat longer impacts. Given the relatively small amount of seafloor affected by anchoring and the expected and documented recovery, benthic impacts would be negligible.

Cable emplacement and maintenance: Submarine cables carry more than 95 percent of international communications (Xu et al. 2022). This critical infrastructure allows global communications and regional energy transfer. Prior to cable installation, route clearance activities would be conducted including a pre-installation survey and grapnel run to remove marine debris such as lost fishing nets, pots, or other objects from the construction path that may alter the seafloor profile. Submarine cable installation would produce sedimentation as would any ongoing cable maintenance activities which contact the seafloor. The sedimentation tolerance for benthic organisms varies among species, with sensitivity to burial determined primarily by infaunal feeding and motility type (Trannum et al. 2010; Jumars et al. 2015). The sensitivity threshold for shellfish varies by species but can be generalized as deposition greater than 0.79 inches (20 millimeters) (Essink 1999; Colden and Lipcius 2015; Hendrick et al. 2016). Smit et al. (2008) evaluated the significance of depositional thickness on impacts on benthic communities. Estimates from that study indicated median (50 percent) and low (5 percent) effect levels of 2.13 inches (54 millimeters) and 0.25 inches (6.3 millimeters) of sediment deposition, respectively. That is, an estimated sediment deposition of 2.13 inches (54 millimeters) affected 50 percent of the benthos in the study, and a sediment burial thickness of 0.25 inches (6.3 millimeters) affected 5 percent of the studied benthos. The level of impact from sediment deposition and burial would also depend on the time of year that it occurs, especially if it overlaps temporally and spatially with sites characterized by high benthic organism abundance and diversity. Sedimentation caused by dredging or other pre-installation clearing methods would result in local and short-term disturbances, which could have long-term negative effects on eggs and larvae of demersal species and benthic invertebrates. Due to the life cycles of demersal finfish and invertebrate species, adverse impacts may be far-reaching (Section 3.5.5).

Cable protection measures are required to guard exposed cables and prevent abrasion with other cables. Cable protection approaches include concrete mattresses, rock dumping, and articulated pipes. The magnitude of impacts would depend on the temporal (season) and spatial (habitat type) factors, of the planned activities. The presence of these introduced hard surfaces may result in new habitats for hard-bottom species and result in increases in biomass for benthic fish and invertebrates (Raoux et al. 2017; Kerckhof et al. 2019). The addition of new hard-bottom substrate in a predominantly soft-bottom environment will enhance local biodiversity; enhanced biodiversity associated with hard-bottom habitat is well documented (Coolen et al. 2022; Degrear et al. 2020). This indicates that marine structures would generate beneficial impacts to the benthic community. However, some impacts such as the loss of soft-bottom habitat may be adverse. Although soft bottom is the dominant habitat type in the region, the species that rely on this habitat are not likely to experience population-level impacts (Greene et al. 2010; Guida et al. 2017). A successional sequence of impacts on benthic resources by the presence of artificial hard substrates is likely but might not be foreseeably defined due to our current lack of knowledge, particularly on long-term changes and large-scale effects (Dannheim et al. 2020).

The fine- and medium-grained sand that makes up most of the region provides uniform and simple (non-complex) habitat (e.g., sand ripples, sand waves, ridges) for benthic infaunal organisms typical of the MAB. The sand shoals have a complex morphology that is superimposed with smaller scale bedforms, sand waves. This is suggestive of active sediment transport with frequent sediment mobilization, resuspension, and deposition occurring due to tides, currents, and storm activity. The sediment composition from the crest to the trough varies and each microhabitat supports different benthic invertebrates (Rutecki et al. 2014). Impacted sand ridge microhabitats are likely to recover faster than trough microhabitats (Rutecki et al. 2014). Past studies following sand mining operations showed that the time scales for recolonization also vary by taxonomic group, with polychaetes and crustaceans recovering in the first several months and deep burrowing mollusks recovering within several years (Brooks et al. 2006). These sand-dominated substrates are resilient by nature and are capable of tolerating disturbances because the sediment is regularly disturbed by wave action, nor'easters, offshore storms and hurricanes (Rutecki et al. 2014). Wave action may also affect sediment transport in water depths shallower than approximately 66 feet (20 meters). During these periods of naturally induced sediment transport, short-term increases in turbidity affecting water quality may occur (Section 3.4.2). Overall disturbance of sand waves and sand shoal troughs would be temporary, given that sand waves and shoals are dynamic, adaptable features, with sand ridges requiring more time for full recovery than sand troughs, though still deemed a temporary impact. No future cable emplacement activities have been identified in the geographic analysis area for benthic resources.

Climate change: Potential effects to benthic resources from climate change include ocean acidification and warming, sea level rise, altered habitat and function, storm frequency and intensity, and nutrient availability. Ocean acidification caused by atmospheric CO_2 may contribute to reduced growth or the decline of benthic resources with calcareous shells (Findlay et al. 2011). Warming of ocean waters is expected to influence the distribution and migration of some benthic species and may influence the frequencies of various diseases (Hoegh-Guldberg and Bruno 2010; Brothers et al. 2016). Climate change-induced warming of bottom water temperatures on the Mid-Atlantic continental shelf is expected to continue, with a corresponding range shift for sessile and sedentary benthic species to the north and possibly offshore in response (Powell et al. 2020). These changes in the distribution and abundance of benthic species to the north and south will affect community structure and function (Hale et al. 2017). Based on trends in the Northeast and Mid-Atlantic regions over the last 35 years, some benthic fish and invertebrate species have moved to the north or farther offshore into deeper waters (Poloczanska et al. 2013). Additionally, warming ocean temperatures and other climate change-related factors may induce favorable environmental conditions for invasive species (Zhang et al. 2020).

Additionally, ocean-atmosphere numerical models generally predict a weakening of the Atlantic meridional overturning circulation (AMOC) from the effects of climate change (Dima et al. 2021). The AMOC currents are the main driver of the distributions of nutrients, heat, and carbon present in the ocean, which affect the biogeochemical cycles and ecosystems around the globe (Bakker et al. 2016 Good et al. 2018). During the last glacial period, sizable and sudden climatic shifts occurred in the North Atlantic when major fluctuations occurred in the AMOC (Schmittner 2005). Modeled simulations show a decline of plankton stocks of more than 50 percent, which would have large implications on the productivity of the oceans in the future (Schmittner 2005). Because this IPF is a global phenomenon, impacts on benthic resources through this IPF would be very similar to those in the planned action scenario and ongoing activities.

Discharge/intakes: Increase in discharge and intake would be expected due to an increase in vessel activity within the Mid-Atlantic waters and ports. Permitted offshore discharges would include uncontaminated bilge water, ballast, gray water, and treated liquid wastes. It is generally expected that maritime activity including offshore development, recreation, and shipping would increase in the foreseeable future.

There is the potential for new ocean dumping/dredge disposal sites in the Northeast. Impacts of infrequent ocean disposal to benthic resources are short term because spoils are typically recolonized naturally. In addition, the USEPA has established dredge spoil criteria and it regulates the disposal permits issued by the USACE; these discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated.

Accidental intake occurs when using water withdrawals (e.g., suction dredging, cable burying). Water withdrawals at the surface or at depth increase the likelihood of entrainment and impingement. This unwanted intake or physical contact with a barrier (screen) due to high intake velocity can negatively impact larval benthic organisms and fish larvae. Benthic larvae and other larval benthic organisms would experience unavoidable mortality within a small range of the activity. There is no evidence that the volumes and extent of anticipated discharges would have any impact on benthic resources; impacts of discharges on benthic resources would be negligible.

EMFs and cable heat: EMF would continue to result from existing and new transmission or communication cables. The potential impact of EMFs and cable heat on benthic invertebrates is an ongoing topic of interest that will require further study (Hutchison et al. 2021). EMF effects from these projects on benthic habitats would vary in extent and significance depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., HVAC or HVDC, transmission voltage). Transmission cables using HVAC emit ten times less magnetic field than HVDC (Taormina et al. 2018); therefore, HVAC cables are likely to have less EMF impacts on benthic species. Future designs could use HVDC due to the higher capacity, and decreased loss over long distances (Hogan et al. 2023). EMF strength diminishes rapidly with distance, and potentially meaningful EMF that could elicit a behavioral response in an organism would likely extend less than 50 feet (15.2 meters) from each cable (McCormick et al. 2008).

Impacts of EMF on benthic habitats is an emerging field of study; as a result, there is a high degree of uncertainty regarding the nature and magnitude of effects on all potential receptors (Hogan et al. 2023; Gill and Desender 2020). Sensitivity ranges, likely encounter rates and the varying potential effects based on life stages remain gaps in our knowledge (Hogan et al. 2023). Currently, there are no published studies within the U.S. on potential effects of EMF on commercial scallops, clams, or squid (Hogan et al. 2023). Recent reviews by CSA and Exponent (2019), Albert et al. (2020), Gill and Desender (2020), and Bilinski (2021) of the effects of EMF on marine organisms in field and laboratory studies concluded that measurable, though minimal, effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. One recent study documented subtle but statistically significant changes in the behavior of American lobster (*Homarus americanus*) when exposed to a 330 MW DC submarine cable (Hutchison et al. 2018). In Europe, monitoring studies of EMF from wind farms have shown minimal, if any, effects on marine organism behavior or movement. This is in part because magnetic fields produced by electrical cables tend to be restricted to an area of several meters from the cable (Sharples 2011). No biologically significant impacts on benthic resources have been reported from EMF from AC cables (Thomsen et al. 2016; CSA Ocean Sciences Inc. and Exponent 2019). A field study in southern California near an energized cable (not buried) showed no significant differences in the species diversity or density in the fish or benthic invertebrate communities compared to the control (unenergized cable or natural habitat) (Love et al. 2016), and a review of recent studies indicates that benthic communities located along cable routes are generally similar to nearby undisturbed habitats (Gill and Desender 2020). Additionally, no long-term impacts of EMF on clam habitat have been observed as a result of existing power cables connecting mainland Massachusetts and Nantucket (Hutchison et al. 2021).

Cable heat is also a topic that requires further studies. Thermal radiation is produced from the cables and may increase the temperature in the surrounding environment (Taormina et al. 2018). The maximum current (amps) that a cable can carry without exceeding its temperature rating, ampacity, is strongly influenced by the heat transfer in the surrounding marine environment (Callender et al. 2021). Models have demonstrated that the permeability of the sediment where the cable is placed is an important factor. Parameters such as ambient water temperature, burial depth and spacing between cables affect the ampacity of DC submarine cables (Mardiana 2011; Hutchison et al. 2021). The effects of EMF and heat on most invertebrate taxa (e.g., embryonic and juvenile crustaceans and mollusks, horseshoe crabs) remain understudied (Gill and Desender 2020).

At this time no future cable emplacement activities have been identified in the benthic resources geographic analysis area other than the ongoing activities.

Gear utilization: Ongoing commercial and recreational fishing would continue within the geographic analysis area. Commercial and recreational regulations for finfish and shellfish within the geographic analysis area are implemented and enforced by the Maryland and Delaware municipalities and or NOAA, depending on the jurisdiction and species. From 2008 to 2019, clam-dredging and bottom-trawling within the Lease Area landed 342,00 and 474,000 pounds (155,129 and 215,003 kilograms), respectively, producing $329,000 and $554,000 (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*). Gear utilization would continue to affect benthic resources by modifying the nature, distribution, and intensity of fishing-related impacts, including those that disturb the seafloor (e.g., trawling, dredge fishing). Disturbance of benthic invertebrate communities by commercial fishing activities can adversely affect community structure and diversity and limit recovery (Avanti Corporation and Industrial Economics 2019), although this impact is less notable in sandy areas that are strongly influenced by tidal currents and waves (Nilsson and Rosenberg 2003; Sciberras et al. 2016). This repetitive impact of bottom-tending fish gear would be moderate.

Noise: The two primary components of underwater noise impacts include pressure and particle motion. Pressure can be characterized as the compression and rarefaction of the water as the noise wave propagates through it. Particle motion is the displacement, or back and forth motion, of the water molecules that create the compression and rarefaction. Both factors contribute to the potential for effects on benthic resources from underwater noise. Further details on underwater acoustics are provided in Appendix B, *Supplemental Information* and Appendix D, *Planned Activities Scenario*,

Table D1-11. Anthropogenic underwater sounds come from many different sources including vessel traffic, seismic surveys, and active sonar used for navigation of large vessels, and chart plotting. These low- and mid-frequency noises in oceanic waters (Henderson et al. 2008), dominate the ambient sound levels in frequencies below 200 hertz (Arveson and Vendittis 2000). Construction noise occurs frequently along populated areas in the Mid-Atlantic nearshore, but infrequently offshore. Noise from nearshore construction is expected to gradually increase in line with human population growth along the coast. New or expanded cables and pipelines are likely over the next 30 years and would add noise to the local environment during their installation. In addition, the general trend increase in global shipping traffic along the Mid-Atlantic coast is expected to grow, which may require port modifications and the associated noises. The extent of the impact depends on equipment used, noise levels, and local acoustic conditions. Noise from pile-driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can cause injury or mortality to benthic resources in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The intensity and extent of noise from construction are difficult to generalize, as they depend on the pile size, hammer energy, and local acoustic conditions. Based on the available literature anticipated impacts on benthic communities would be local and temporary. Activities from ongoing site characterization surveys and scientific surveys produce noise around sites of investigation, usually offshore. These activities would disturb benthic species in the immediate vicinity of the investigation.

There remains a vast gap in our knowledge about sound thresholds and recovery from impact in almost all invertebrates (Carroll et al. 2017) which confounds the ability to assess potential impacts on benthic resources from exposure to noise. English et al. (2017) reported marine invertebrates to be considered less susceptible than mammals and fish to loud noise and vibration, as their bodies do not generally possess air-filled spaces, but also reported that noise at high levels can cause short-term behavioral responses in marine invertebrates. Hawkins and Popper (2014) identified various informational gaps concerning effects of noise on invertebrates (e.g., mechanisms for sound detection) that suggest assessment of impacts to benthic species from noise is speculative and would likely be negligible.

Port utilization: Port utilization and maintenance are expected to increase from ongoing and planned activities (Appendix D, *Planned Activities Scenario*, Table D1-11). There are several port improvement projects within the MAB, but none within the geographic analysis area. Shipping has been a large economic driver in Maryland since the colonial days. The Port of Baltimore is one of the busiest ports in the Mid-Atlantic, moving millions of tons of freight cargo every year. In order to allow this routine transit, every year roughly 4.5 million cubic yards of sediment are dredged (Independent Technical Review Team 2009). Equally, in Delaware, millions of dollars are used to implement dredging activities and expand ports to better accommodate the increase in vessel traffic and maintenance of navigable waterways. Delaware’s congressional delegation approved more than $51 million for improvements to ports and waterways, with more than $43 million designated for the Indian River Inlet (MacArthur 2022). These proposed and ongoing dredge projects and port expansion projects may impact benthic communities by an increase in noise as construction takes place, as well as dredge effects. Dredging of navigable waterways can cause localized short-term impacts (e.g., habitat alteration, injury, mortality) on benthic resources, alter the seafloor profile, as well as increase sediment deposition. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season. Dredging typically occurs in sandy or silty habitats, which are abundant in the benthic resources geographic analysis area and are quick to recover from disturbance. Although these habitats are quick to recover from disturbance, full recovery of the benthic faunal assemblage may require several years (Boyd et al. 2005). If continual maintenance occurs frequently, the benthic community may not be able to recover in the same location as the impact. Although local impacts would likely be fatal for the organisms directly impacted by construction or dredging activities, overall a limited spatial and temporal impact on benthic resources in the geographic analysis area is expected.

Presence of structures: Installation of major structures other than those supporting offshore wind projects are not anticipated within the geographic analysis area. Existing structures, including docks, shipwrecks, artificial reefs, and meteorological buoys or towers, would continue to influence benthic resources through entanglement and gear loss or damage, hydrodynamic disturbance, fish aggregation, and habitat conversion. There is the potential for new small-scale structures such as docks and coastal infrastructure to be constructed. Should any new structure be installed within the geographic analysis area, temporary impacts to the benthic community would include, increased sedimentation, turbidity, with more long-term impacts including novel space for recruitment and colonization. Secondary impacts include hydrodynamic disturbances, fish aggregation leading to a reef effect, and the reduction of soft-bottom habitat. This would lead to a faunal assemblage shift and changing the local food web dynamics. Some of the moderate adverse impacts listed would also produce moderate beneficial impacts on the benthic community.

There are no benthic organisms which are listed as endangered species, therefore endangered species will not be addressed in this section.

3.5.2.3.1 Future Offshore Wind Activities (without Proposed Action)

All offshore wind leasing activities that BOEM considers reasonably foreseeable, by lease area and project, are presented in Appendix D, *Planned Activities Scenario*, Table D2-2, including more than 30 planned projects for an approximate total of 3,081 WTG and OSS foundations. The geographic analysis area for the Project includes a 10-mile (16.1-kilometer) buffer around the Lease Area and a 330-foot (100.6-meter) buffer around the Offshore Export Cable Route. There are currently two offshore wind lease areas to the north of the Project area that could overlap benthic resource impacts. Skipjack Offshore Energy, LLC (OCS-A 0519), and GSOE I, LLC (OCS-A 0482). Though both offshore Delaware, Skipjack Offshore Energy is roughly 10 miles (16.1-kilometers) from the US Wind Lease Area and is therefore the closest to the planned project. Skipjack Wind I is expected to have 16 WTGs constructed in 2024 (Appendix D, Table D2-2).

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

Accidental releases: Accidental releases may increase as a result of future offshore wind activities. The risk of any type of accidental release would be increased primarily during construction or conceptual decommissioning but may also occur during O&M of offshore wind facilities. Based on data gathered from the Western and Central Gulf of Mexico Planning Areas, most diesel spills from OCS activities (e.g., from associated vessels or maintenance activities) are relatively rare and small with the median size for spills ≤1 barrel (42 gallons) to be 0.024 barrels (approximately 1 gallon) (Anderson et al. 2012). Accidental releases of trash and debris may occur from vessels primarily during construction, but also during operations and conceptual decommissioning. There is no evidence that the anticipated volumes or amounts of trash or debris that may be accidentally lost would have measurable impacts on benthic resources. BOEM assumes all vessels would comply with laws and regulations to minimize releases and implement safe handling, storage, and cleanup procedures should an accidental release occur. The low likelihood and small size of the potential releases along with the cleanup measures in place suggest impacts would be negligible on benthic resources.

Invasive species can be released accidentally, as a result of the increased vessel traffic related to the offshore wind industry primarily during construction and conceptual decommissioning. The increase in this risk related to the offshore wind industry would be small in comparison to the risk from ongoing activities (e.g., transoceanic shipping). Impacts on benthic resources from invasive species, as a result of planned offshore wind activities are considered negligible.

Anchoring: Offshore wind activities would increase vessel anchoring during survey activities and during construction, installation, maintenance, and decommissioning of offshore components. In addition, anchoring or mooring of the Met Tower or buoys could be increased. Vessel stabilization for offshore wind projects frequently utilize spuds, or jack-up legs, therefore little contact with the benthic environment occurs. Any contact with the benthic habitat for vessel stabilization or buoy anchoring would cause increased turbidity levels and could cause mortality of benthic species. Anchor drag would increase impacts, potentially resulting in scarring or additional damage to benthic habitats. Impacts from anchoring would be localized and are likely to recover relatively quickly (Dernie et al. 2003). Anchoring on hard-bottom (i.e., gravelly) substrates may impart somewhat longer impacts. Given the relatively small amount of seafloor affected by anchoring and short-term turbidity, benthic impacts from offshore wind activities would be negligible.

Cable emplacement and maintenance: New construction of offshore submarine cables for offshore wind activities would cause short-term disturbance of seafloor habitats and injury and/or mortality of benthic resources in the immediate vicinity of the cable emplacement activities. New operating transmission cables would be needed to connect the offshore WTGs and substations to shore facilities. Impacts would be expected but the impacted areas would recover resulting in minor benthic impacts.

As stated previously, sediment dredging or other pre-installation clearing methods would result in sediment deposition, which could have long-term negative effects on eggs and larvae of demersal species and benthic invertebrates. Where needed, cable protection creates new habitat which is likely to attract hard-bottom species thereby increasing biomass and diversity, although it may also attract invasive species. Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Greene et al. 2010; Guida et al. 2017). Where substrate does not allow cable burial, cable protection would be required. Cable protection would also be needed at cable crossings.

The level of impact from seafloor profile alterations would depend on the time of year that they occur, particularly in nearshore locations, and especially if they overlap temporally and spatially with sites characterized by high benthic organism abundance and diversity. Avoiding spring and summer cable burial activities that correspond with spawning season of some invertebrates may help minimize potential impacts of offshore wind to benthic resources.

Climate change: Offshore wind activities are taking place to attempt to offset the effects of climate change. As stated previously, potential effects to benthic resources from climate change include ocean acidification and warming, sea level rise, altered habitat and function, storm frequency and intensity, and nutrient availability. This would continue to alter the distribution of benthic resources and biological interactions.

Discharges/intakes: There would be increased potential for discharges from vessels during construction, O&M, and conceptual decommissioning of offshore wind activities. Permitted offshore discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges as well as entrainment, and impingement, particularly during construction and conceptual decommissioning of offshore wind. Impacts would be staggered over time and localized. There is no evidence that the volumes and extent of anticipated discharges or entrainments from offshore wind activities would have any impact on benthic resources; impacts of discharges on benthic resources would be negligible.

EMFs and cable heat: EMFs and cable heat would emanate from new operating transmission cables and existing cables connecting the offshore WTGs and substations to shore facilities. EMF production from power transmission cables can be detected by some benthic species but does not appear to present a barrier to movement. EMF strength diminishes rapidly with distance, and potentially meaningful EMFs would likely extend less than 50 feet (15.2 meters) from each cable (McCormick et al. 2008). Some benthic species can detect EMFs, although they do not appear to present a barrier to animal movement. Copping et al. (2016) reported that although burrowing infauna may be exposed to stronger EMFs from offshore wind activities, there was no evidence that the EMFs anticipated to be emitted from those devices would affect any species.

As stated previously ambient water temperature, sediment permeability, burial depth, and spacing between cables all affect heat emitted from the cables. To minimize this impact, cables can be buried or trenched. Submarine power cables in the geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential electric and magnetic fields to low levels.

Gear utilization: The presence of structures from offshore wind activities would increase the risk of gear loss/damage by entanglement. The lost gear, moved by currents, could disturb, injure, or kill benthic resources. The intermittent impacts at any one location would likely be measurable and the risk of occurrence would persist while the structures and debris were present. Impacts on benthic resources from future offshore wind activities, are expected to be negligible.

Noise: Noise from construction, pile-driving, geological and geophysical (G&G) survey activities, O&M, and trenching/cable burial may have impacts on benthic resources, but they would likely be undetectable. Due to the lack of information regarding basic neurological and physiological responses for most species at realistic exposure levels, inferences about the effects of impulsive sound source activity, like pile-driving and G&G survey activities, on marine invertebrates can be challenging and fraught with uncertainty (Carroll et al. 2017). As previously stated, a recent summary of knowledge on how offshore wind activities affect the benthic environment indicated that the impact of sound on epibenthos is poorly understood and is generally lacking (Dannheim et al. 2020). Hawkins and Popper (2014) identified various informational gaps concerning effects of noise on invertebrates (e.g., mechanisms for sound detection) that suggest assessment of impacts to benthic resources from noise is speculative and would likely be negligible.

Port utilization: Port improvement and expansion projects within the Mid-Atlantic region are ongoing. Port utilization and maintenance are expected from other offshore wind activities and increased vessel traffic. As previously stated, proposed and continuing dredge projects are necessary to maintain navigable waterways. The impacts of dredging on benthic resources can cause localized, short-term impacts, alter the seafloor profile, and increase sediment deposition. These impacts vary seasonally, therefore most sediment-dredging projects have time-of-year restrictions to minimize impacts on benthic resources. Individual offshore wind activities would have benthic impacts associated with dredging and port improvements and expansion, would be localized. An increase in vessel traffic would be at its peak during construction activities and would decrease during operations. Vessel traffic would increase again during conceptual decommissioning. Impacts on benthic resources are expected be unmeasurable and negligible.

Presence of structures: The presence of structures from offshore wind activities can lead to impacts on benthic resources through entanglement and gear loss/damage, hydrodynamic disturbance, fish aggregation resulting in increased predation on benthic resources, and habitat conversion. These impacts may arise from foundations, scour/cable protection, buoys, and the Met Tower. Human-made structures, especially tall vertical structures such as foundations, alter local water flow (hydrodynamics) at a fine scale, and increase seafloor scour, which may alter sediment grain sizes and benthic community structure (Lefaible et al. 2019). The consequences for benthic resources of such hydrodynamic disturbances are anticipated to be localized. These marine structures, (e.g., tower foundations, scour protection, cable protection) create uncommon vertical relief in a predominantly soft-bottom seascape. The marine structures create turbulence that transports nutrients upward toward the surface, increasing primary productivity at localized scales (Danheim et al. 2020). These changes have been reported to increase food availability for filter-feeders on and near the structures creating a beneficial impact (Degrear et al. 2020). The consequences for benthic resources from such hydrodynamic disturbances are anticipated to be localized, to vary seasonally, and have minor impacts.

Structure-oriented fishes would be attracted to these locations as they create reef-like habitats (Mavraki et al. 2021). With an increase in structure-oriented species, predation in the vicinity of these structures could increase, negatively affecting these benthic habitats (Raoux et al. 2017). These impacts are expected to be localized but long term, continuing for as long as the structures remain in place.

Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by local municipalities, NOAA, or both depending on the jurisdiction, affect benthic resources by modifying the nature, distribution, and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing). Offshore wind activities could indirectly influence fishing regulations and effort. Certain fishing methods, in particular the use of bottom-tending gear, have adverse impacts on benthic resources and are likely to result in minor impacts, as long as impacts to sensitive habitats are avoided.

Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood. Any new cables, towers, buoys, or piers would also create relief. Benthic species dependent on hard-bottom habitat could benefit from an increase in hard surfaces and increase benthic diversity. However, such high initial diversity levels may decline over time as early colonizers are replaced by successional communities (Degraer et al. 2018). This novel habitat could also be colonized by invasive species (e.g., certain tunicate species). Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Greene et al. 2010; Guida et al. 2017) and would result in a minor impact.

3.5.2.3.2 Conclusions

Under alternative A, the No Action Alternative, benthic resources would continue to follow current regional trends and respond to current and future environmental and human activities. Future offshore wind activities, and future non-offshore wind activities would continue to have temporary to long-term impacts (disturbance, injury, mortality, habitat degradation, habitat conversion) on benthic resources, primarily through anchoring, new cable emplacement, the presence of structures, construction noise, climate change, and ongoing dredging and fishing using bottom-tending gear. Throughout the geographic analysis area for benthic resources, as previously discussed, impacts from ongoing activities, especially seafloor disturbances caused by sediment dredging and fishing using bottom-tending gear, would be **moderate**. Reasonably foreseeable activities other than offshore wind include increasing vessel traffic, increasing construction, marine surveys, marine minerals extraction, port expansion, channel deepening activities, and the installation of new towers, buoys, and piers, would also result in **minor** benthic impacts. The combination of ongoing activities and reasonably foreseeable activities other than offshore wind would result in **moderate** impacts on benthic resources. Future offshore wind activities in the geographic analysis area are expected to contribute to several IPFs, primarily new cable emplacement, the presence of structures (i.e., foundations, scour/cable protection), and added noise to the marine environment and could include **moderate beneficial** impacts, although only in the northern section of the benthic resources' geographic analysis area where offshore wind structures may be erected in the foreseeable future.

Considering all the IPFs together, the overall impacts associated with ongoing and planned non-offshore wind activities and future offshore wind activities in the geographic analysis area are expected to be **moderate** adverse impacts and could include **moderate beneficial** impacts due to habitat creation from other offshore wind projects.

3.5.2.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on benthic resources:

- The total amount of scour protection for the foundations, inter-array cables, and offshore export cables that results in long-term habitat alteration;
- The installation method of the export cable in the Offshore Export Cable Route and for inter-array cables in the Project area and the resulting amount of habitat temporarily altered;
- The number and type of foundations used for the up to 121 WTGs, 4 OSSs, and 1 Met Tower;
- The methods used for cable laying and landfalls, as well as the types of vessels used and the amount of anchoring;
- The amount of pre-cable-laying dredging or preparation, if any, and its location; and
- The time of year when foundation and cable installations occur.

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

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

3.5.2.5 Impacts of Alternative B – Proposed Action on Benthic Resources

3.5.2.5.1 Construction and Installation

3.5.2.5.1.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

The Inshore Export Cable Route traverses Indian River Bay, which is entirely classified as soft bottom. Due to the silting of Indian River Bay, a navigational channel has and will continue to be dredged. Therefore, the benthic habitat within Indian River Bay has and would continue to be disturbed. During the 2017 field survey the water was so turbid that collected imagery was of little use, though it did confirm scattered sea lettuce (*Ulva lactuca*) growth and did not discern any SAV present. Follow up surveys in 2022-2023 did not collect underwater imagery due to high turbidity. The IPFs that would have the greatest impact on benthic resources within Indian River Bay are anchoring, cable emplacement, noise, and port utilization. Impacts from accidental releases, climate change, discharges/intakes, EMF and cable heat, and gear utilization would remain the similar to those described in the Offshore impact IPF sections. The presence of structures from inshore activities would only have impacts during the construction phase. Once the cables are in place any materials associated with the gravity cells or HDD operations would be removed.

Anchoring: Anchoring from the Proposed Action would take place within Indian River Bay. It is expected that the barges used for cable installation will be moved along the Inshore Export Cable Route using a six-point anchor system, assisted by an anchor handling tug, in combination with spud piles. The cable barge will lay and bury the cable between the two end points maneuvering along the cable route using its anchoring system and positioned using spuds as required. These activities would disturb the benthic resources, suspend sedimentation and increase short-term turbidity. Anchor drag would increase impacts, potentially resulting in scarring or additional damage to benthic habitats. Impacts from contact with the anchor would be localized and although some organisms would be killed by the contact, or increased sediment deposition. Motile species may be able to avoid this direct mortality, and the benthic community is likely to recover relatively quickly in this soft sediment habitat (Dernie et al. 2003).

Cable emplacement and maintenance: New cables through Indian River Bay would connect the offshore cables to the onshore substation in Millsboro, Delaware. Prior to cable installation, route clearance activities would include a pre-installation survey and grapnel run. Grapnel runs would be conducted to remove marine debris such as lost fishing nets, pots, or other objects from the construction path that could impact cable lay and burial. Typically, three passes of pre-lay grapnel runs would occur, one along the centerline and parallel lines to the centerline on either side, to ensure routes are clear. Seafloor preparation such as leveling, pre-trenching, or boulder removal is not expected. There is a potential for unexploded ordnances (UXOs) within Indian River Bay. Avoidance of UXOs is the preferred approach where feasible. Avoidance entails micrositing of WTG foundations and cable routes to avoid UXO hazards. UXO clearance involves relocation, removal, or detonation/incineration in place (Middleton et al. 2021). UXO detonations are not included under the Proposed Action and will not be discussed further (US Wind 2023).

Cable installation includes the cable landfall around 3R's Beach, Indian River Bay entrance via HDD in Old Basin Cove, and the HDD exit location Deep Hole, near the onshore substation. HDD operations would be employed to install cable ducts at transition points between water and land. The cables would be fed to the HDD ducts by small boats where possible. Temporary installation of gravity cells would be used at the end of the HDD ducts to retain cuttings and drilling fluids, and other debris. Prefabricated sections of duct about 24 inches (60 centimeters) in diameter are planned, but final sizing would be determined by cable sizing and the thermal properties of the surrounding soil. For the in-water operations gravity cells are expected to be up to 197 feet (60 meters) long and 33 feet (10 meters) wide. Gravity cell excavation pits would reach approximately 9.8 feet (3 meters) depth and material excavated from the gravity cell would be backfilled, or repurposed. Gravity cells would be needed for each of the four inshore export cables as they enter Indian River Bay and an additional four as they exit for the onshore substation connection. This would disturb 1.78 acres (0.72 hectares). The cable duct would run approximately 8 to 60 feet (2 to 18 meters) below grade from the Ocean to the landfall, and 6.6 to 59 feet (2 to 15 meters) below the Indian River for the Old Basin Cove, and Deep Hole HDD exits, respectively. Specifics about the three HDD exit pits, and cable distances between them are provided in the COP (Volume I, Table 3-3; US Wind 2023). Final HDD lengths depend on factors such as soil conductivity, cable design, and available installation methods to minimize disturbance in the shallow waters. A detailed design will be presented in the FDR/FIR. The maximum length of inshore export cables, four total, would be 42.3 miles (68.1 kilometers), including the length that runs through Indian River Bay. All transmission cables would be contained in grounded metallic shielding to minimize EMFs.

Temporary benthic disturbance due to the cable installation in Indian River Bay would be 168.27 acres (68.10 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Cable-laying operations will be occurring in areas with primarily sand substrate. Installation methods include jet plowing, which combines the excavation of the trench, cable placement, and backfilling as one continuous process. Jet plowing operations in the Indian River Bay were modeled to determine the potential sediment transport. During jet plowing, the sediment is fluidized with the majority returning to the trench, though some will escape the trench and be carried by the current. The results of the Indian River Bay Sediment Transport assessment indicated that most of the fluidized sediments lost to the water column are predicted to quickly settle back to the bay floor and deposition thicknesses greater than 0.2 inches (5 millimeters) will typically occur within 95 feet (30 meters) of the cables (COP, Volume II, Appendix B3; US Wind 2023). Suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 4,600 feet (1,400 meters) from the cables (COP, Volume II, Appendix B3; US Wind 2023). Model results indicate that the suspended sediment plume resulting from jet plowing will have a limited duration. All suspended sediment concentrations greater than 50 mg/L above ambient conditions are predicted to dissipate in less than 12 hours after the passage of the jet plow. Suspended sediment plumes greater than 10 mg/L are predicted to disappear within 24 hours after the completion of jetting operations. The timing of the jet plowing with respect to the tidal cycle will play a large role in determining the direction of the sediment plume. Flushing rates within Indian River Bay are long (approximately 3 days) relative to the anticipated sediment suspension duration (less than 12 hours), making it unlikely the suspended sediment would flush out through the inlet. The sediment transport modeling results concluded that the proposed jet plowing for cable installation would result in short-term and localized effects (COP, Volume II, Appendix B3; US Wind 2023). Due to silting in Indian River Bay, it would continue to be dredged to maintain the navigable channel. The sedimentation caused by burying cables in the area would have similar impacts as dredging.

To achieve the target burial depth US Wind and its contractors have determined dredging would necessarily precede cable installation in locations along the Inshore Export Cable Routes for barge access. Maximum dredging disturbance is assumed to be within 295 feet (90 meters) wide along the route which is within a maximum 633 feet (193 meters) area of temporary construction disturbance. Dredging would be conducted using mechanical, or most likely, hydraulic means. The maximum volume of dredging, assuming all 4 cables installed in a single season, and across the entirety of the 295-foot width of the cable route, would be 916,000 cubic yards. Temporary benthic disturbance due to dredging for barge access in Indian River Bay would be 288.8 acres (116.87 10 hectares) (COP, Vol 1, Section 1.3, US Wind 2023).

It is anticipated that the cable will be entirely subsurface, but up to 10 percent may require cable protection where cable burial is not feasible. Cable segments that cross unavoidable hard substrates and other offshore infrastructure would be laid on the bed surface and covered with some type of cable armoring for protection. Cable protection in the form of concrete mattresses or the equivalent would permanently impact up to 10.10 acres (4.09 hectares) of benthic habitat within Indian River Bay (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Cable protection structures would provide novel surfaces for colonization and recruitment and add relief to the benthic environment. This disturbance would lead to habitat conversion of soft-bottom benthic communities to hard-bottom communities. This habitat conversion in predominantly soft-bottom environments has adverse impacts on species that require soft-bottom habitat, and can enable the habitat expansion of invasive species, but can also enhance local biodiversity (Coolen et al. 2022; Degrear et al. 2020) as no hard-bottom habitat was classified within Indian River Bay or Indian River.

Sessile and slow-moving organisms would be mostly likely to be negatively impacted. Should they come into contact with construction gear in the construction pathway total mortality would occur. The increased turbidity and sediment deposition may kill filter feeding organisms nearby. The ability to tolerate increased turbidity and sedimentation varies by life stage. For example, eggs of hard clams suffered increasing abnormal development with increasing silt concentrations from 0.75 g/L to 3.0 g/L, while growth of larvae was inhibited above 0.75 g/L although were able to survive at 4 g/L (Roegner and Mann 1990). Growth of juvenile and adult hard clams was inhibited at .044 g/L (Roegner and Mann 1990). Many organisms that inhabit these soft sediment habitats are regularly exposed to natural disturbances that create spatial heterogeneity and resource patchiness. These communities are composed of opportunistic species which have high reproductive rates to recolonize disturbed areas. Impacts would be localized and temporary, and communities are expected to recover relatively quickly (Dernie et al. 2003; Boyd et al. 2005). Although benthic community recovery rates specific to cable emplacement for offshore wind projects are not yet known, nearby sediment dredging, and sand borrow projects including near Indian River Bay inlet support recovery times of a few months to a few years (USACE 2013; 2016). BOEM does not expect population-level impacts on benthic species from cable emplacement activities within Indian River Bay. Impacts from new cable emplacement are expected to be notable but resources would recover and impacts would therefore be minor.

Noise: Noise from the installation of the inshore export cable as a result of the Proposed Action would be inevitable. Increased vessel traffic within Indian River Bay could induce physiological stress in invertebrates and lead to acoustic masking in fishes. Several studies have shown an increase in the stress hormone cortisol following simulated vessel noise (Celi et al. 2016; Nichols et al. 2015; Wysocki et al. 2006); however, other studies have shown that the experimental setting may be inducing this increased stress (Harding et al. 2020; Staaterman et al. 2020). Species that are sensitive to acoustic pressure would experience masking at greater distances than those that are only sensitive to particle motion. Rogers et al. (2021) and Stanley et al. (2017) theorize that fish may be able to use the directional nature of particle motion to extract meaning from short range cues (e.g., other fish vocalizations) even in the presence of distant noise from vessels.

The research on invertebrates' response to vessel noise is inconclusive thus far. Some crustaceans seem to increase oxygen consumption (crabs: Wale et al. 2013) or show increases in some hemolymph (an invertebrate analog to blood) biomarkers like glucose and heat-shock proteins, which are indicators of stress (spiny lobsters: Filiciotto et al. 2014). Other species (American lobsters and blue crabs) showed no difference in hemolymph parameters but spent less time handling food, defending food, and initiating fights with competitors (Hudson et al. 2022). While there does seem to be some evidence that certain behaviors and stress biomarkers in invertebrates could be negatively affected by vessel noise, it is difficult to draw conclusions from this work because it has been limited to the laboratory, and in most cases, did not measure particle motion as the relevant cue. Section 3.5.5 presents further details on sound in invertebrates and fish.

The use of cofferdams was previously considered but would not be pursued due to the increased underwater sound. US Wind would compile a preliminary Construction Noise Management Plan to comply with DNREC and local noise regulations prior to construction. The most significant source of noise associated with the Proposed Action is the HDD and gravity cell installation. These sounds are not expected to be do not vary greatly from those associated with construction activities in coastal waters. Impacts from construction noise in Indian River Bay would therefore be localized, short term, and minor.

Port utilization: Port improvement and expansion projects as well as maintenance are expected as a result of the Proposed Action. Current dredging practices within Indian River Bay will continue to ensure navigable waterways. Vessel traffic would increase during the construction and installation phase but decrease during operations. The Proposed Action anticipates utilizing facilities in the Greater Baltimore area, including Sparrows Point. Other port facilities elsewhere on the east coast could be utilized to support the Project and will be considered by US Wind on an as needed basis (Table 2-4).

These activities would cause mortality of any organisms which come into direct contact with machinery, increase turbidity for a short duration, and increase deposition which may smother some benthic organisms at varying life stages.

These impacts would be localized, short-term impacts that vary seasonally, therefore most sediment-dredging projects carry time-of-year limitations to minimize impacts on benthic resources. Impacts on benthic resources within the geographic analysis area are expected be unmeasurable and negligible.

Nearshore and onshore activities and facilities will be covered in further detail under Section 3.5.4, *Coastal Habitat and Fauna.*

Offshore Activities and Facilities

Accidental releases: The risk of accidental releases would increase as a result of the Proposed Action, due to increased vessel traffic to and from, as well as within the Project area. The Lease Area is about 10.1 miles (16.3 kilometers) off the coast of Maryland in water depths that range from 46 to 135 feet (14 to 41 meters). Accidental releases would likely consist of fuels, lubricating oils, and other petroleum compounds that tend to float in seawater as such accidental releases will occur at or near the ocean surface in association with vessel operations. A large spill in the Proposed Action is very unlikely given the fuel storage capacities of Project vessels. US Wind will prepare a Project-specific SPCC Plan and OSRP prior to construction. However, US Wind will still monitor for and report any environmental releases or fish kills to the appropriate authorities (e.g., in Delaware state waters, reports will be made via DNREC 24-hour hotline). Small spills should therefore be expected to be unmeasurable and have a negligible impact on benthic fauna. Larger spills are unlikely but could have a larger impact on benthic fauna due to adverse effects on water quality (Section 3.4.2, *Water Quality*) and the potential for sinking in nearshore shallow marine benthic environments. Due to the nature properties of these potential compounds floating on the water surface, they are unlikely to come in contact with benthic resources.

Accidental releases of trash and debris may occur from vessels during any phase of the Project. Vessel operators, employees and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination"), per BSEE guidelines for marine trash and debris prevention. BOEM assumes all vessels would comply with these laws and regulations to minimize releases.

The low likelihood and small size of the potential releases along with the cleanup measures in place suggest impacts would be negligible on benthic resources. The increase in the risk of accidental releases attributable to the Proposed Action is expected to be negligible.

Invasive species can be accidentally released in the discharge of ballast water and bilge water during vessel activities. Increased vessel traffic throughout the construction phase of the Project would increase the risk of accidental releases of invasive species. Vessels are required to adhere to existing state and federal regulations related to ballast and bilge water discharge, including U.S. Coast Guard ballast discharge regulations (33 CFR 151.2025) and U.S. Environmental Protection Agency National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. Although the likelihood of invasive species becoming established due to offshore wind-related activities is low, the impacts of invasive species could be strongly adverse, widespread, and permanent if the species were to become established and out-compete native fauna. Indirect impacts could result from competition with invasive species for food or habitat and loss of foraging opportunities if preferred prey is no longer available due to competition with invasive species. Such an outcome, however, is considered highly unlikely. The increase in this risk related to the offshore wind industry would be small in comparison to the risk from ongoing activities (e.g., transoceanic shipping). Therefore, impacts on benthic resources from invasive species as a result of the Proposed Action, would be considered negligible.

In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be expected to be localized and temporary due to the likely limited extent and duration of a release and result in negligible impacts.

Anchoring: Vessel anchoring would increase as a result of the Proposed Action. Vessel stabilization during construction and possibly during conceptual decommissioning are assumed to be done using either dynamic positioning, spud barges, or jack-up vessels. The use of DP vessels would preclude the use of anchors, while utilization of jack-up vessels or spud barges would directly affect the benthos. The maximum benthic disturbance from vessel anchoring in relation to the installation of offshore structures is 14.95 acres (6.05 hectares). Impacts on the benthos would be limited to the diameter of the spud cans (through deck pilings) or jack-up legs if spud barges or jack-up vessels are used. If anchors are employed for installation, US Wind will use mid-line anchor buoys. Total mortality would likely occur for benthic organisms within the footprint of each spud can, leg, or anchor. Contact with the sediment will also increase short-term turbidity. Anchor drag would increase impacts, potentially resulting in scarring or additional damage to benthic habitats. Impacts from anchoring would be localized and although some organisms would be killed by the contact, the benthic community is likely to recover relatively quickly (Dernie et al. 2003). Anchoring on hard-bottom (i.e., gravelly, complex habitat) substrates may impart somewhat longer impacts. Potential impacts from anchoring will be minimized by avoiding locations with sensitive habitats and utilizing mid-line anchor buoys. The phased approach of the construction campaigns from 2025 to 2028 will ensure that the vessel anchoring is not all occurring within the same time frame, allowing benthic communities to recover. Given the relatively small amount of seafloor affected by anchoring and short-term turbidity, benthic impacts from offshore wind activities would be negligible.

Cable emplacement and maintenance: New cables would be required as a result of the Proposed Action. Prior to cable installation, route clearance activities would include a pre-installation survey and grapnel run. Grapnel runs would be conducted to remove marine debris such as lost fishing nets, pots, or other objects from the construction path that could impact cable lay and burial. Typically, three passes of pre-lay grapnel runs occur, one along the centerline and parallel lines to the centerline on either side, to ensure routes are clear. Seabed preparation such as leveling, pre-trenching, or boulder removal is not expected. More than 99 percent of the Lease Area had a slope of less than 2 degrees. In the south-western portion of the Lease Area steep slopes of more than 20 degrees were identified. Cable laying equipment cannot operate on slopes of more than 10 degrees, complicating installation operations (COP, Volume II, Appendix K5; US Wind 2023). There is a potential for UXOs within Indian River Bay. Though no benthic impact values were mentioned in the COP (US Wind 2023), potential relocation of UXO may be required and will need further information. US Wind proposes to bury the inter-array cables using a towed or self-driving jet plow to achieve a target depth of 3.3 to 6.6 feet (1 to 2 meters) with a maximum length of 125.6 miles (204.2 kilometers) and 2 feet (0.6 meters) wide. The offshore export cables are planned as 230 to 275 kV AC, three-core cable and have a target burial depth of 3.3 to 9.5 feet (1 to 3 meters), not to exceed 13.1 feet (4 meters). These four total offshore export cables would have a maximum length of 142.5 miles (229.3 kilometers) and maximum width of 2 feet (0.6 meters). The four offshore export cables from the OSSs (one for each OSS), would come together outside of the Lease Area and co-exist within a single Offshore Export Cable Route. The cables within the Offshore Export Cable Route, would make landfall near 3R's Beach in Delaware. The Proposed Action could result in temporary seafloor disturbance from installation of the offshore export (34 acres [13.76 hectares]) and inter-array cables (29.98 acres [12.13 hectares]), in a phased approach from 2025 through 2028 (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2).

Cable installation would use water jetting technology, which is regarded as the most environmentally sensitive installation method, compared to mechanical dredging and other plowing methods. Sediment transport modeling (COP, Volume II, Appendix B2; US Wind 2023) predicts that most sediments suspended by the jet plowing will remain in a narrow corridor along the Offshore Export Cable and Inter-array Cable Routes. The overwhelming majority of the deposition thicker than 0.008 inches (0.2 millimeters) will occur within 300 feet (91 meters) of the proposed cable route. Most of the fluidized sediments lost to the water column are predicted to quickly settle back to the seafloor. Suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 450 feet (137 meters) from the offshore export and inter-array cables. Model results indicate that the suspended sediment plume resulting from jet plowing will have a short duration. The model results show that increases in suspended sediment concentrations more than 10 mg/L over ambient are only of short duration (hours). All suspended sediment plumes are predicted to disappear within 24 hours after the completion of jetting operations. In conclusion, the sediment transport modeling results indicate that the proposed jet plow embedment process for cable installation will result in short-term and localized effects.

As the export cables approach the shoreline, four temporary gravity cells would be used to install the cables, retain cuttings and drilling fluids and ensure the HDD duct remains free of debris. This gravity cell structure will be installed as part of the offshore trenchless installation HDD conduit punchout located 550 feet (167 meters) from shore. Each gravity cell would be up to 197 feet (60 meters) long and 33 feet (10 meters) wide, extending about 5 feet (1.5 meters) above mean higher high water. Gravity cell excavation pits would reach approximately 9.8 feet (3 meters) depth and material excavated from the gravity cell would be backfilled, or repurposed. Approximately 1.19 acres (0.48 hectares) of benthic disturbances would occur for these four nearshore gravity cells (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). US Wind expects to install all of the HDDs in one construction season, normally mid-September to mid-May based on expected recreational and environmental restrictions. Construction may extend into another season if unforeseen circumstances arise such as poor weather, contractor or vessel availability, or challenging subsurface conditions. This will avoid adversely affecting sensitive, shallower, nearshore habitats and avoid the high-impact zone of the beach shoreline. Cable pulls may occur in as many as three seasons, pending Delaware permit conditions and contractor availability.

Although active construction would temporarily disturb benthic habitat, the habitat would rapidly return to pre-Project conditions in non-complex habitats after burial is complete (Boyd et al. 2005). The composition of the benthic invertebrate community is strongly linked with the sediment texture (Rutecki et al. 2014). The 2021 benthic grabs within the Lease Area and the Offshore Export Cable Route most frequently observed the substrate group classification, gravelly sand, at 43 percent followed by sand (very coarse sand all the way to very fine sand) at 37 percent and sandy gravel, 19 percent (COP, Volume II, Appendix D4; US Wind 2023). Some discrepancies of the most frequently classified substrate exist in the 2021 benthic imagery, favoring the sand classification. The sand CMECS subgroup includes very fine sand to very coarse sand and will be referenced as total sand for simplicity. For instance, within the Lease Area 82 percent of transects were classified as total sand, while only 39 percent of the sediment grab samples had the same classification, with gravelly sand just one percent higher (40 percent). This distinction is even more evident in the bulk of the Offshore Export Cable Route, referred to as the common Offshore Export Cable Route. Total sand was classified for an overwhelming 84 percent, yet the sediment grabs only classified 33 percent as total sand, while 53 percent was gravelly sand or gravelly muddy sand (COP, Volume II, Appendix D4; US Wind 2023).

Disturbance of sand waves and ridges would be short-term, given that sand waves and ridges are changing, mobile features. These sand-dominated substrates are resilient by nature and are capable of tolerating disturbances because the sediment is regularly disturbed by wave action, nor’easters, offshore storms and hurricanes (Rutecki et al. 2014). Organisms inhabiting these environments are regularly exposed to natural disturbance due to the motile nature of the sand sediments (Guida et al.

2017). The sediment composition from the crest to the trough varies and each microhabitat supports different benthic invertebrates (Rutecki et al. 2014). Impacted sand ridges are likely to recover faster than the trough microhabitats (Rutecki et al. 2014). Past studies following sand mining operations showed that the time scales for recolonization also vary by taxonomic group, with polychaetes and crustaceans recovering in the first several months and deep burrowing mollusks recovering within several years (Brooks et al. 2006).

Although no hard-bottom substrate was found in the Offshore Project area, localized areas of cobbles are known to occur within the Lease Area (Guida et al. 2017). Patches of gravel and shell hash along with boulder, mounds of smaller boulders and cobbles were identified during 2021 surveys. Pebble/granule was classified in one percent of the benthic grab samples (COP, Volume II, Appendix D4; US Wind 2023).

In areas where seafloor conditions might not allow for sufficient burial depth and at cable crossings, cable protection would be installed. Cable protection methods include concrete mattresses, rock placement of cable protection systems (CPS). CPS will be used for inter-array cable ends close to WTG and OSS foundations, where cable burial is not feasible. Areas with cable protection would span 20 feet (6 meters). A maximum of 10 percent of the Offshore Export Cable Route would require cable protection (including the portion that traverses Indian River Bay), likely to be significantly less. An estimated 10 percent of the inter-array cable route will also require cable protection. Therefore, a maximum of 29.98 acres (12.13 hectares) of the inter-array cables, and 34 acres (13.76 hectares) of the Offshore Export Cable Route would require cable protection (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). The total for offshore cable protection would be 63.98 acres (25.9 hectares) of permanent benthic impacts, conservatively. This acreage would be converted from soft-bottom to hard-bottom species.

The recovery time of benthic invertebrates from offshore wind cable emplacement are not yet known, however recovery rates from sand mining projects and similar benthic disturbances show that in general recovery ranges from a few months to years (Boyd et al. 2005; Brooks et al. 2006; vanDalfsen et al. 2000; Coates et al. 2015; Kraus and Carter 2018), with increased rate of sediment infilling strongly correlated to the recovery rate of the number of individuals within the disturbed area (Dernie et al. 2003). Recovery rates of these disturbed benthic environments would depend on the community composition, their ability to recover, the extent of disturbance, and the nature of the protection material. Cable installation would cause unavoidable mortality, damage, or displacement of invertebrate organisms. Early colonizers would begin to settle shortly after the disturbance cleared and succession would continue (vanDalfsen et al. 2001).

Cable-laying operations will occur in areas with primarily sand substrate and have been sited to avoid known hard-bottom habitats, where possible. Impacts from new cable emplacement are expected to be notable but resources would recover. BOEM does not expect population-level impacts on benthic species from cable emplacement activities; impacts on benthic resources from the Proposed Action are expected to be minor.

Climate change: Offshore wind activities are materializing to help offset the effects of climate change. Because this IPF is a global phenomenon, the impacts of this IPF from the Proposed Action, would be very similar to those in Section 3.5.2.3, including ocean acidification and warming, sea level rise, altered habitat and function, storm frequency and intensity, and nutrient availability. The intensity of impacts resulting from climate change are uncertain but notable and measurable effects on regional benthic resources are anticipated to qualify as moderate.

Discharges/intakes: There would be increased potential for discharges from vessels, which will be more frequent as a result of the Proposed Action. Permitted offshore discharges would include uncontaminated bilge water and treated liquid wastes. Vessels will adhere to USCG guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date OSRPs to prevent, contain, and clean up any accidental spills.

There would be an increase in entrainment, and impingement, particularly during construction and conceptual decommissioning of offshore wind. Impacts would be staggered over time and localized. There is no evidence that the volumes and extent of anticipated discharges or entrainments from offshore wind activities would have any impact on benthic resources; impacts of discharges on benthic resources would be negligible.

EMFs and cable heat: Under the Proposed Action, and the process of transmitting power to onshore infrastructure, a network of cables will need to be installed. Once these cables begin to transmit power, the effects from EMFs and cable heat would initiate. Behavioral impacts have been documented for benthic species (skates and lobster [Nephropidae or Homaridae]) present near operating DC cables (Hutchison et al. 2018). These impacts are localized and affect the animals only while they are within the EMF field. There is no evidence to indicate that EMFs from undersea AC power cables negatively affect invertebrate species (CSA Ocean Sciences Inc. and Exponent 2019).

Impacts of EMF and cable heat will be minimized by proper electrical shielding and cable burial depth, when practicable. EMFs and cable heat will be present throughout most of the Project and, therefore, is discussed in Section 3.5.2.5.2.

Gear utilization: Commercial and recreational fishing will continue within the geographic analysis area while construction for the Proposed Action takes place. This IPF is best described in Section 3.5.2.5.2, as it will primarily affect benthic resources once the structures are in place.

Noise: Noises from construction of up to 121 monopile WTGs (PDE), 4 OSSs, and 1 Met Tower as a result on the Proposed Action would be unavoidable. Pile-driving would produce the most substantial noise within the Project area. Offshore pile-driving noises will be produced from the construction and installation of the offshore structures. The WTG monopiles will be driven into the seafloor by hydraulic impact hammer. Noise from impact pile-driving is transmitted through the water column to the seafloor. The intensity and magnitude of this energy could result in injury to benthic invertebrates in a localized area around each pile. US Wind compiled a preliminary Construction Noise Management Plan that will be used to comply with DNREC and local noise regulations. This plan will be submitted prior to construction and will align with conditions set by NOAA Fisheries. Noise mitigation is planned for both near-field (like a AdBm Technologies Noise Mitigation System and using a damper between the hammer and sleeve to prolong the impact pulse) and far-field (like a large double bubble curtain) to achieve a minimum of 10 dB attenuation, with a target of 20 dB at the source (Appendix G, *Mitigation and Monitoring*). To further minimize impacts, pile-driving will begin by hammering at a low energy level for no less than 30 minutes. This soft start allows motile organisms a chance to retreat from the noise, prior to reaching maximum intensity (Robinson et al. 2007). Pile-driving is planned only during daylight hours between May 1 and November 30. The estimated duration is 120 minutes for impact pile-driving of the monopile assuming one pile is installed per day; and 480 minutes per day for the 9.8-foot (3-meter) skirt piles pin piles assuming up to four could be installed per day; and up to 360 minutes per day for the 5.9-foot (1.8-meter) pin piles assuming up to three are installed per day.

Due to the lack of information regarding basic neurological and physiological responses for most species at realistic exposure levels, inferences about the effects of impulsive sound source activity, like pile-driving on marine invertebrates can be challenging and very ambiguous (Carroll et al. 2017). As previously stated, a recent summary of knowledge on how offshore wind activities affect the benthic environment indicated that the impact of sound on epibenthos is poorly understood and is generally lacking (Dannheim et al. 2020). Hawkins et al. (2014) identified various informational gaps concerning effects of noise on invertebrates (e.g., mechanisms for sound detection) that suggest assessment of impacts to benthic resources from noise is speculative and would likely be negligible. If injury or mortality occurred to benthic organisms, the affected areas would likely be recolonized within the first few years post construction, and no population-level impacts would be expected. Impacts would therefore be localized, short term, and minor.

Port utilization: Port expansions and enhancements are expected as a result of the Proposed Action, with increased vessel traffic in the Offshore Project area. Increased vessel traffic would lead to increased noise input; however, impacts on benthic organisms are not expected to be greater than that of ongoing vessel traffic in the Project area. Port impacts would mostly impact nearshore environments and are therefore addressed in *Onshore Activities and Facilities*. Impacts to the benthic resources in the Offshore Project area would be negligible to benthic resources.

Presence of structures: Under the Proposed Actions, there would be a large construction effort including the WTGs, OSSs, and Met Tower. Impacts from the construction of the offshore structures include increased noise; increased port and vessel traffic; increased turbidity; avoidance by motile organisms; injury, or mortality of benthic organisms within the construction corridor, or by sediment deposition following construction activities. The WTGs will be spaced 0.77 nautical mile (1.43 kilometer) east to west, with 1.02 nautical mile (1.89 kilometer) north to south. Potential micrositing would only occur within 164 to 328 feet (50 to 100 meters) of the planned location. The permanent area displaced by WTGs (PDE of up to 121) under the Proposed Action is expected to be 2.84 acres, with an additional 22.7 acres for scour protection, totaling 25.5 acres (10.3 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2;). Four OSSs would be installed, and though the foundation has not yet been decided the total area of seafloor disturbance is up to 1.7 acres (0.7 hectares), assuming they are also monopile foundations, creating the maximum footprint. The Met Tower would displace an additional 435 square feet (40.41 square meters). In total, about 27.21 acres (10.61 hectares) of seafloor habitat would be permanently affected by the construction and installation of the WTGs, OSSs, and Met Tower foundations for the Proposed Action (Appendix C, Table C-2).

During installation of each monopile foundation US Wind plans to confine bottom disturbance, for example the contact of a jack-up vessel, to an area within a radius of 984 feet (300 meters) from the installation location. If a jack-up vessel is used the installation vessel jacks down and moves to the next foundation position. In the unlikely event that the pile meets a refusal point prior to the desired depth, relief drilling of the pile may be required. Relief drilling would be conducted using a trailing suction hopper dredger which removes soils from the area by suction. All sediment removed would remain at that foundation and be placed where scour protection is later added.

Scour protection would be added to the base of each foundation. Scour protection will consist of a layer of small rocks up to 2 feet (0.5 meters) thick to help stabilize the sand substrate around the pile. After the inter-array cable is pulled into the monopile, a second layer of rocks up to 7 feet (2 meters) will serve as the armor layer to stabilize the scour layer. The permanent benthic habitat that would be impacted from the installation of the scour protection at the WTG foundations (PDE of up to 121) is approximately 22.7 acres (91.9 hectares) and at the OSSs foundations (4) is approximately 0.38 acres (0.15 hectares). Although the OSS foundations have not yet been decided, the monopile design will create the maximum disturbance. A Met Tower will also be installed outside of the WTG array layout to serve as a monitoring station to support the Proposed Action and long-term monitoring. The Met Tower will be supported by a steel braced caisson-style foundation fixed to the seafloor, with a diameter of 6 feet (1.8 meters) that tapers to 5 feet (1.5 meters) above the mudline, with a pair of bracing piles of 5 feet (1.5 meters).

Bathymetric surveys one year post construction activities of the Block Island Wind Farm indicated that 46 percent of the seafloor area that was disturbed (spuds, anchor drag, etc.) recovered to the point that it was no longer discernable from baseline surveys (HDR 2018, 2019). This is consistent with previous studies which showed relatively rapid recovery (Dernie et al. 2003; Boyd et al. 2005). Once in place, impacts of these structures include increased risk of entanglement and gear loss or damage, hydrodynamic disturbance, fish aggregation resulting in increased predation on benthic resources, and habitat conversion. Section 3.5.2.3 provides more details on general impacts. Many of the impacts from these structures are covered in Section 3.5.2.5.2; these impacts remain as long as the structures are in place.

3.5.2.5.2 Operations and Maintenance

3.5.2.5.2.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

US Wind will be responsible for daily operations, which includes planned and unplanned maintenance. The majority of onshore activities and facilities will not impact the benthic resources within the geographic analysis area during O&M. As the Inshore Export Cable Route traverses Indian River Bay, which will continue to be dredged (non-Project related), the benthic habitat would continue to be disturbed. The IPFs that would have an impact on benthic resources within Indian River Bay as a result of the Proposed Action are anchoring, cable maintenance, and EMF and cable heat. Impacts from accidental releases and discharges/intakes would remain similar to those described in the Offshore impact IPF sections. Noise, presence of structures, gear utilization, and port utilization would not be impacted above present conditions in Indian River Bay by the O&M phase of the Proposed Action.

Anchoring: Vessel anchoring would be at its maximum during construction, but Project-related anchoring would still occur during the O&M phase. Benthic organisms that contact anchoring devices and gear would experience mortality, and nearby organisms could be injured or killed due to high turbidity, and deposition. Benthic communities typical of soft-sediment estuarine habitats are adapted to periodic disturbance events. These communities are dominated by infaunal invertebrates, such as the polychaete worms found within Indian River Bay. Given the small scale of disturbance from anchoring in a community that has adapted to periodic disturbance events, and short-term turbidity, benthic impacts from the O&M phase of the Proposed Action would be negligible.

Cable maintenance: The O&M of the installed cables would include inspections and maintenance when needed. The only activities that would impact the benthic community within Indian River Bay would be vessels anchoring. Temporary increases in suspended sediment and resulting depositions would impact benthic communities should cable repairs be necessary. Similar to anchoring, these disturbances would be expected to be on a small scale, localized and short-term. Impacts would be similar or less than installations, therefore O&M activities of onshore cables is expected to be negligible.

EMFs and cable heat: With cables running under Indian River Bay for the life of the Project, benthic species would be exposed to some level of EMFs. The impact of EMFs on benthic invertebrates is still unclear, two studies conducted in 2022 had conflicting results. Albert et al. (2022) found no differences in valve activity or filtration rates (suggesting no hinderance of feeding behaviors) in adult blue mussels exposed to HVDC of 300 microtesla (µT) compared to control. Yet Jakubowska-Lehrmann et al. (2022) found significantly lower filtration rates in cockles (*Cerastoderma glaucum*) that were exposed to 6.4 mT for 8 days. No changes in the respiration were noted but ammonia excretion rates were significantly lower after exposure to EMFs. Further studies are needed to understand the implications of this conflicting information as it applies in natural marine environments. Project-specific modeling resulted in a maximum level of the magnetic field produced from the Offshore Export Cable Route cables through Indian River Bay to be 148 mG (14.8 µT) at the seabed, quickly decreasing to 12 mG (1.2 µT) just 3 feet (1 meter) above the seafloor (Exponent 2023). These values are 3.4 and 42 times lower respectively than EMF levels which have shown no impact (Exponent 2023).

As stated previously ambient water temperature, sediment permeability, burial depth, and spacing between cables all affect heat emitted from the cables. To minimize this impact, cables would be buried or trenched, where possible, and installed with appropriate shielding on the cable to reduce potential electric and magnetic fields to low levels. EMFs would be minimized by shielding and by burying inshore export cables to the target depth of 3.3 to 6.6 feet (1 to 2 meters). Based on the available information BOEM expects the impacts on benthic species from EMF and cable heat to be negligible.

Nearshore and onshore activities and facilities will be covered in depth under Section 3.5.4, *Coastal Habitat and Fauna*.

Offshore Activities and Facilities

Accidental releases: The risk of accidental releases would increase as a result of the vessels needed to support the Proposed Action. The risk of any type of accidental release would be increased primarily during construction or conceptual decommissioning but may also occur during O&M. Materials such as paint, solvents, or lubricants could also be spilled during O&M activities, though in relatively small quantities. Boats may also experience accidental oil spills. These scenarios are unlikely to occur and spill prevention plans will mitigate any impacts (see *Construction and installation*). Because marine discharges are not a part of routine operations for the Project, it is anticipated that they will have a negligible impact.

Anchoring: Vessel anchoring would increase as a result of the Proposed Action and can occur at all phases of the Proposed Action. As stated earlier in *Construction and Installation*, anchors would cause short-term impacts in the immediate area where anchors and chains meet the seafloor. Benthic organisms that contact anchoring devices and gear would experience mortality, and nearby organisms could be injured or killed due to high turbidity, and deposition. During the operational phase of the project, anchors can also pose a threat to the buried cables, and partially damage or completely sever the cables.

Cable maintenance: Offshore O&M includes regular inspections. Cable surveys are anticipated in year 1, year 3, and then every 5 years after. Routine procedures will include checking cable burial depth, especially where sand waves or high fishing activity are present. Underwater ROV surveys will be used to inspect cable protection, cable entry, and cathodic protection, therefore benthic communities will not be altered from bottom-contacting gear. The offshore export cables and inter-array cables would be monitored through distributed temperature sensing equipment. The distributed temperature sensing system would be able to provide a real time monitoring of temperature along the Offshore Export Cable Route, alerting US Wind should the temperature change, which could be the result of scouring of material and cable exposure. If required, only cable repairs would temporarily affect benthic communities in a localized area immediately adjacent to the repairs. Assuming repairs would be infrequent and affecting only small sections of the cables, impacts are expected to have no detectable effects and would be negligible.

Climate change: Impacts from this IPF would not be different than those described in for the construction and installation.

Discharges/intakes: There would be increased potential for discharges from the increased vessel traffic from O&M; however, due to the floating properties of the petroleum compounds that would be the most likely to spill or be discharged, the benthic environment is not likely to be affected. The risk of discharges during O&M would not be as high as the construction and decommissioning phases.

EMFs and cable heat: Under the Proposed Action EMFs and heat would emanate from these new and existing cables connecting the offshore WTGs, substations, and onshore facilities. EMF production from power transmission cables can be detected by some benthic species but does not appear to present a barrier to movement. Due to the importance of the horseshoe crabs and shellfish to the Mid-Atlantic, US Wind has conducted a site-specific study of potential EMF impacts. The modeling study found that the electric field produced would be below the reported detection thresholds for electrosensitive marine organisms (Exponent 2023). The strength of the EMF diminishes rapidly with increasing distance. When operating at peak loading, the maximum level of the magnetic field produced from the Offshore Export Cable Route cables (both offshore and through Indian River Bay) was calculated as 148 mG (14.8 µT) at the seabed, and quickly decreased to 12 mG (1.2 µT) just 3 feet (1 meter) above the seafloor (Exponent 2023). These values are 3.4 and 42 times lower respectively than EMF levels which have shown no impact (Exponent 2023). The maximum EMF levels produced by the inter-array cables at the target burial depth of 3.3 feet (1 meter) was calculated as 49 mG (4.9 µT). At a distance of 10 feet (3 meters) horizontally from all cable types, the EMF decreased to less than 1 mG (0.1 µT) (Exponent 2023).

Copping et al. (2016) reported that although burrowing infauna may be exposed to stronger EMFs from offshore wind activities, there was no evidence that the EMFs anticipated to be emitted from those devices would affect any species. The Proposed Action will use AC cables for the inter-array, offshore and inshore cables. Biologically notable impacts on finfish, invertebrates, and EFH have not been documented for AC cables (Thomsen et al. 2016; CSA Ocean Sciences Inc. and Exponent 2019), but alterations of behavior have been documented for benthic species (skates and lobster) near operating DC cables emitting up to 65.3 µT in a lab setting (Hutchison et al. 2018). The impacts from EMF are localized and affect the animals only while they are within relatively close proximity to the EMF source and did not present a barrier to movement (Hutchison et al. 2018). EMFs would be minimized by shielding and by burying inter-array and inshore export cables to the target depth of 3.3 to 6.6 feet (1 to 2 meters), and offshore export cables to the target depth of 3.3 to 9.8 feet (1 to 3 meters), not to exceed 13.1 feet (4 meters) for the inter-array or offshore export cables. As stated previously ambient water temperature, sediment permeability, burial depth, and spacing between cables all affect heat emitted from the cables. To minimize this impact, cables would be buried or trenched, where possible, and installed with appropriate shielding to reduce potential electric and magnetic fields to low levels. Based on the available information BOEM expects the impacts on benthic species from EMF and cable heat to be negligible.

Gear utilization: The presence of structures from the Proposed Action would increase the risk of gear loss/damage, with a potential secondary impact of entanglement of marine species. The lost gear, moved by currents, could disturb, injure, or kill benthic species, as well as attract scavengers or higher trophic level predators. Routine inspections and or maintenance of the offshore structures would slightly reduce the risk of entanglement from lost gear. The intermittent impacts at any one location would likely be unmeasurable and the risk of occurrence would persist while the structures and debris were present. Impacts on benthic resources from future offshore wind activities from offshore wind activities, are expected to be negligible.

Noise: Underwater routine inspections will be conducted by ROV which does not produce significant noise. Other noise-producing activities under the Proposed Action include HRG survey activity, vessel activity, routine WTG operations, and vessel traffic. Some maintenance activities may require noise-producing equipment, though likely none greater than construction level sounds. Noise from O&M activities as part of the Proposed Action, would likely be undetectable by the benthic resources.

Port utilization: Although Project-related vessel traffic would decrease once construction is complete, regular maintenance activities would still require vessel support, dredging, and port improvements to allow these activities. Impacts on benthic resources are expected be unmeasurable and negligible.

Presence of structures: The presence of structures in the marine environment from up to 119 total structures composing the Proposed Action would impact benthic resources. Raised marine objects increase the risk of gear loss or damage by entanglement. The lost gear, moved by currents, could get caught on cabling, foundation, turbine, and or substation infrastructure, and disturb, injure, or kill benthic resources. Secondary impacts include alterations in local hydrodynamics, predator attraction from the trapped organisms in the entangled gear serving as a food source. The impacts at any one location likely would be localized and short term as routine maintenance activities occur. During the initial operational period of approximately 2 years, foundations will be inspected visually above and below the waterline at least once. The findings of the initial inspections will inform the frequency of inspections to be completed later in the project life cycle, which is expected to be every 4 or 5 years. Underwater portions of the foundations will be inspected by ROV, including cable protection and cable entry, cathodic protection, and scour systems. Non-routine procedures including major repairs and emergencies will have plans in place in advance to mitigate environmental impacts. These plans will be further developed as the Project design in the FDR/FIR process.

Anthropogenic structures, especially tall vertical structures that extend from the seafloor to the surface such as the WTG and OSS foundations, once in place continuously alter local water flow at a fine scale. Although water flow typically returns to background levels within a relatively short distance from a structure and impacts on managed species of finfish and invertebrates are typically undetectable (BOEM 2021), the cumulative effects of the presence of multiple structures on local or regional-scale hydrodynamic processes are not currently well understood (Hogan et al. 2023). A recent study completed by BOEM assessed the “mesoscale” effects of offshore wind energy facilities on coastal and oceanic environmental conditions and habitat by examining how oceanic responses would change after WTGs are installed, particularly with regards to turbulent mixing, bed shear stress, and larval transport (Johnson et al. 2021). This study focused on the Massachusetts-Rhode Island marine areas where proposed wind energy lease areas are in the licensing review process. This modeling study assessed four post-installation scenarios. Two of the managed species that occur within the Lease Area, summer flounder and Atlantic sea scallop, were selected as focal species in this study (silver hake [*Merluccius bilinearis*] was the third focal species assessed in the model but does not have a defined EFH within the Lease Area). The results of this modeling effort indicate that, at a regional fisheries management level, these shifts are not considered overly relevant with regards to larval settlement. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are also not well understood. The presence of structures would also result in new hard surfaces that could provide new habitat for recruitment of hard-bottom species. The increase in food availability for filter-feeders on and near the structures, which in turn leads to increased densities of mobile invertebrates (e.g., crabs, lobsters), attraction of pelagic and demersal fish, and foraging opportunities for marine mammals (Coates et al. 2014; English et al. 2017; Danheim et al. 2020; Degrear 2020). On the other hand, these hard surfaces also provide additional attachment points for non-native species that may be brought through new shipping activities.

The addition of new substrate could provide steppingstones for invasive species colonization. Non-native benthic invertebrates found within the vicinity of the Project area include *Ascidiella aspersa*, *Botrylloides violaceus*, *Diplosoma listerianum*, *Styela clava*, *Botryllus schlosseri*, *Bugula neritina*, *Tricellaria inopinata*, *Membranipora membranacea*, *Ostrea edulis*, and *Diadumene lineata* (Agius 2007; Mass.gov 2022). The invasive tunicate *Didemnum vexillum* has additionally been expanding its presence in New England waters and was identified within the Project area (COP, Volume II, Appendix M2; US Wind 2023). Benthic monitoring at the Block Island Wind Farm have shown that this species is part of a diverse faunal community on morainal deposits and is an early colonizer along the edges of anchor scars left in mixed sandy gravel with cobbles and boulders (Guarinello and Carey 2020). Four years after construction at the Block Island Wind Farm, *D. vexillum* was common on WTG structures (HDR 2020). Studies have shown that activities that cause fragmentation of *D. vexillum* colonies can facilitate its distribution (Lengyel et al. 2009; Morris and Carman 2012). It is important to minimize or eliminate activities that return fragmented colonies of *D. vexillum* to the water column, to reduce the spread of this invasive species (Morris and Carman 2012). WTG and cable installation within hard-bottom habitat where *D. vexillum* is present could fragment the invasive colonies. The addition of new artificial substrate used for cable and scour protection and the presence of WTG structures may provide habitat for this invasive tunicate. It will be necessary to incorporate an invasive species monitoring component into a benthic habitat monitoring plan.

Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Greene et al. 2010; Guida et al. 2017) as there will still be soft bottom habitat in between the WTGs. The potential effects of wind farms on offshore ecosystem functioning have been studied using simulations calibrated with field observations (Raoux et al. 2017; Pezy et al. 2018). These studies found increased biomass for benthic fish and invertebrates. However, some impacts, such as the loss of soft-bottom habitat and increased predation pressure on forage species near the structures, may be adverse. Increased biodiversity and the reef effect created from the presence of the offshore infrastructure is especially beneficial for encrusting, hard-bottom or structure-oriented species (Coolen et al. 2022; Degrear et al. 2020; Hutchison et al. 2020; Inger et al. 2009; Raoux et al. 2017). In light of the above information, BOEM anticipates the impacts associated with the presence of structures may be moderate adverse to moderate beneficial depending on the receptor. The impacts on benthic resources resulting from the presence of structures would persist as long as the structures remain.

3.5.2.5.3 Conceptual Decommissioning

3.5.2.5.3.1 Offshore and Inshore Activities and Facilities

The planned life of the Project is 25 to 30 years, though US Winds intends to request an extension of commercial operations period of the to 30 or 35 years. The majority of onshore activities and facilities will not impact the benthic resources within the geographic analysis area during conceptual decommissioning. Because the onshore cable route passes through Indian River Bay, the benthic habitat would be impacted if the cables are removed. Nearshore and onshore activities and facilities will be covered under Section 3.5.4, Coastal Habitat and Fauna. Offshore and Inshore Activities and Facilities

All foundations and Project components would be removed to 15 feet (4.6 meters) below the mudline (30 CFR 585.910(a)), unless other methods are deemed suitable through consultation with the regulatory authorities, including BOEM. The conceptual decommissioning process for the WTGs and OSSs is anticipated to be generally the reverse of construction and installation, with Project components transported to an appropriate disposal or recycling facility. WTGs, OSSs, and the Met Tower would all be removed, with their foundations removed potentially to 15 feet (4.6 meters) below the seafloor. Based on the approval of the appropriate regulatory agencies, scour protection systems may be left in place to provide seafloor habitat. The inter-array and offshore export cables will be disconnected and either retired in place or removed from the seafloor based on the preferred approach to minimize environmental impacts, based on agency approval.

Accidental releases, anchoring, discharges, noise, and port utilization would all have similar risks or impacts as the construction phase mentioned previously. Short-term and localized sediment suspension, water turbidity, and sediment deposition would occur from the removal of Project structures, and vessel anchoring. Vessel traffic will increase from the O&M phase as the deconstruction and or removal of structures occurs. The increase in vessel traffic increases the risk of accidental releases, and discharges. These activities would temporarily impact benthic species locally and full recovery post decommission is expected (Dernie et al. 2003; Boyd et al. 2005).

3.5.2.5.4 Conclusions

Proposed Action construction activities would likely result in impacts from accidental releases, anchoring, EMFs, new cable placement, underwater noise generated primarily by pile-driving, port utilization, presence of structures, discharges, seafloor profile disturbances, sediment deposition and burial, and climate change. Construction activities would occur in a phased approach, beginning in the western portion of the Lease Area. The temporal spacing of construction activities would allow for a recovery period for impacted benthic seafloor communities. Routine O&M impacts would have minimal impacts on benthic communities and result primarily from localized activities that disturb the seafloor. The benthic impacts resulting from the Proposed Action range from **negligible** to **moderate**. However, overall benthic impacts from the Proposed Action would be **moderate** because the effect would be localized, and the benthic environment would recover completely over time without remedial and mitigation actions. In addition, **moderate beneficial** impacts could result from habitat alteration from soft- to hard-bottom “reefing” habitats which would benefit hard-bottom and structure-oriented species as well as their predators.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including the Proposed Action would range from **negligible** to **moderate** with potentially **moderate beneficial** as well as **moderate** adverse impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including the Proposed Action would range from **minor** to **moderate** benthic impacts in the geographic analysis area, depending on the IPFs. The main drivers for the moderate impact rating are seafloor disturbances caused by sediment dredging and fishing using bottom-tending gear, and the addition of physical structure which will modify benthic ecosystems; minor impacts are expected from the noise from active construction, sediment disturbance and turbidity from burying or protecting the inter-array and offshore export cables, changing the profile of the seafloor, the hydrodynamic disturbances from these structures, marine minerals extraction, and dredging activities. The Proposed Action would contribute to the overall impact rating primarily through the permanent impacts associated with the presence of structures. Therefore, the overall benthic impacts would likely qualify as **moderate** because a measurable impact is anticipated, but the resource would recover when the WTGs are removed, with less time for recovery if remedial or mitigating actions are taken.

3.5.2.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes on Benthic Resources

Alternative C was developed through the scoping process for the Draft EIS in response to comments requesting an alternative to minimize impacts in Indian River Bay. This alternative would result in terrestrial onshore export cable routing that avoids crossing through Indian River Bay or the Indian River and has two proposed sub-alternatives which vary by landfall location and Onshore Export Cable Route to the Onshore substation. Offshore Project components within the Lease Area (WTGs, OSSs, inter-array, and Met Tower) would be like the Proposed Action (Alternative B).

3.5.2.6.1 Offshore and Inshore Activities and Facilities

Alternative C-1 includes the Towers Beach landfall (i.e., exclusion of the 3R's Beach landfall), and a terrestrial Onshore Export Cable Route from the Towers Beach landfall to the Indian River substations (POI) (i.e., Onshore Export Cable Route 2). This would be contingent on selection of Offshore Cable Route 2 (northern route). Under Alternative C-1, the offshore export cables would make landfall at Towers Beach, approximately 5 miles (7.7 kilometer) north of the Indian River Inlet, in an existing parking lot within Delaware Seashore State Park. It should be noted that stony corals were observed along a transect along Offshore Export Cable Route 2 (VT-AC-79), which would need to be avoided if possible (COP, Volume II, Appendix D4; US Wind 2023). When the offshore cables reach the landfall, they will be pulled into a cable duct that positions the cables underground to subterranean transition vaults and then run via Onshore Export Cable Route 2 to the POI utilizing Delaware Department of Transportation (DelDOT) ROWs. Onshore Export Cable Route 2 would cross the Indian River via HDD continue underground to the Onshore substation.

Alternative C-1 would not impact the benthic resources in Indian River Bay since the route from the Towers Beach landfall would be along a terrestrial Onshore Export Cable Route. The impacts of Alternative C-1 in the Offshore Project area would only differ from the Proposed Action in the nearshore portion of the Offshore Export Cable Route. Unlike the Offshore Export Cable Route 1 of the Proposed Action, the substrate along the section of the Offshore Export Cable Route 2 is dominated by heterogenous complex habitats Adverse impacts from the Offshore Project area would range from **negligible** to **moderate** due to the presence of structures, and disturbance of the seafloor. Additionally **moderate beneficial** impacts are expected from the addition of structures, scour protection and cable protection materials. This reefing effect benefits structure-oriented and hard-bottom species as well as their predators, increasing biodiversity.

Alternative C-2 includes the 3R's Beach landfall similar to the Proposed Action (i.e., exclusion of the Towers Beach landfall); however, Alternative C-2 would not impact the benthic resources in Indian River Bay since only terrestrial Onshore Export Cable Routes from the 3R's Beach landfall to the Indian River substation would be considered (i.e., Onshore Export Cable Routes 1a, 1b, and 1c).

While C-2 would have negligible impacts to the benthic resources in the Inshore Project area compared to the Proposed Action, since this alternative also avoids traversing Indian River Bay and Indian River. The impacts of the Offshore Project area for Alternative C-2 would not differ from the Proposed Action, ranging from **negligible** to **moderate**, depending on the IPF and **moderate beneficial**. Although there would be disturbance of the benthic communities and species, recovery is expected. Beneficial impacts are expected from the addition of structures, scour protection and cable protection materials introducing hard-bottom habitats offshore and the reefing effects increasing biodiversity of the benthic community. Alternative C would have an appreciable impact when compared to all ongoing and planned activities.

3.5.2.6.2 Conclusions

Alternative C would decrease or eliminate impacts on inshore habitats (Indian River Bay), producing a measurable benefit for benthic resources. The impacts to the Offshore Project area does not differ from the Proposed Action, and that is where the majority of impacts would occur (presence of structures, and scour protection). Therefore, while both alternatives C-1 and C-2 would alleviate or eliminate benthic disturbance within Indian River and Indian River Bay, potential impacts overall range from **negligible** to **moderate** with potentially **moderate beneficial** impacts, for an overall **moderate** impact.

In the context of reasonably foreseeable environmental trends, the combined impacts on benthic resources from ongoing and planned actions, including Alternative C would be the same as those described under the Proposed Action, with individual IPFs ranging from **negligible** to **moderate**, and the potential for **moderate beneficial** impacts. While Alternatives C-1 and C-2 are designed to minimize impacts on the habitats of Indian River Bay, the overall impacts on benthic resources within the Project would remain **moderate adverse** and **moderate beneficial**.

3.5.2.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts on Benthic Resources

Under Alternative D the WTGs within a 14-mile (22.5-kilometer) buffer from the Maryland coastline would be excluded, eliminating 32 WTGs and 1 OSS. The associated cabling would also be excluded which will result in less impact on benthic habitats than the Proposed Action. Further details about Alternative D are provided in Section 2.1.4.

3.5.2.7.1 Offshore and Inshore Activities and Facilities

The exclusion of 32 WTGs and 1 OSS closest to the Maryland shoreline would not change impacts from inshore component of the Project but would result in a reduction of seafloor disturbance and benthic habitat. The removal of 32 WTGs and 1 OSS from the Offshore Project area would result in appropriately 28 percent reduction in WTGs and 25 percent reduction of OSSs. The removal of these structures would result in a corresponding reduction in temporary construction impacts and well as permanent impacts of the structures. The removed structures occur in primarily in soft bottom habitats and characterized with minor sand ridges and troughs. The result would be fewer benthic organisms would be displaced, and less hard bottom habitat from structures and scour materials would be introduced affecting the ecological functions of the west side of the Lease Area. Removal of structures and avoidance of benthic impacts would functionally benefit the benthic resources within the geographic analysis area. However, the overall impact level would remain moderate, as impacts to the benthic resources would be unavoidable, and permanent as long as the planned 82 WTGS and 3 OSS structures remain.

Within Indian River Bay, benthic impacts would be the same as the Proposed Action (Alternative B). In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative D, would range from negligible to moderate with potentially moderate beneficial impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative D, would result in moderate benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative D would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures. Alternative D would have an appreciable impact when compared to all ongoing and planned activities.

3.5.2.7.2 Conclusions

Alternative D would decrease the number of WTGs, OSSs, and associated inter-array cables which would have a decrease in potential impacts on benthic resources. Avoidance of the sand ridges and troughs on the western side of the Lease Area would benefit benthic communities as they provide valuable refuge, feeding and spawning grounds for many fish and invertebrate species in the geographic analysis area. BOEM expects the impacts resulting from Alternative D would be similar to the Proposed Action in a lesser degree and would range from temporary to long term with individual IPFs leading to impacts ranging from **negligible** to **moderate** with potentially **moderate beneficial** impacts, and overall impacts being **moderate**.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative D, would range from **negligible** to **moderate** with potentially **moderate beneficial** impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative D, would result in **moderate** benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative D would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures.

3.5.2.8 Impacts of Alternative E – Habitat Impact Minimization on Benthic Resources

Alternative E was identified through the scoping process for the Draft EIS in response to comments received requesting an alternative to minimize impacts on offshore benthic habitats. NMFS identified six AOCs characterized by large, landscape scale features such as high-relief sand ridge and trough complexes and deep holes/drop-offs, where development and conversion of the bottom may result in significant impacts.

This alternative would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), realignment of the offshore export cables, and relocation of the Met Tower.

The impacts to benthic resources along the Inshore Export Cable Route (Indian River Bay) and along most of the Offshore Export Cable Route would be on the same as the Proposed Action.

3.5.2.8.1 Offshore and Inshore Activities and Facilities

Alternative E, the Habitat Impact Minimization Alternative was developed through the scoping process in response to comments about minimizing impacts on offshore benthic habitats. Alternative E would result in the removal of 11 WTGs, associated inter-array cables, and repositioning the offshore export cable to avoid sensitive benthic habitats, including sand waves (Figure 2-9 in Section 2.15).
NMFS identified six habitat areas using data provided by US Wind and previously collected data and reports (e.g., Guida et al. 2017). These areas are characterized by large, landscape scale features such as high-relief sand ridge and trough complexes and deep holes/drop-offs, where loss of habitat and conversion of the bottom may result in adverse impacts. These areas produce habitat value for fish and shellfish through vertical relief, high rugosity, stratification of sediments, presence of other benthic features, and other characteristics that result in high habitat heterogeneity and complexity on various spatial scales (from sub-meter to many kilometers). BOEM expects the impacts resulting from Alternative E would be similar to the Proposed Action to a lesser degree. A roughly 10 percent reduction in WTGs would decrease the duration of construction activities along with noise exposure from pile-driving or jet-plowing operations, turbidity levels, and sediment deposition. This alternative would have 11 fewer WTG foundations, scour protection and associated reduction in inter-array cables reducing the impacts to sensitive benthic habitats. This would reduce the disturbance to sand ridge and trough features that support diverse invertebrate assemblages that serve important ecological functions for the benthic community and the complex food web they support. A reduction of impacts within these sensitive benthic habitats would serve to benefit the benthic communities within the geographic analysis area. Impacts would range from short-term to permanent and negligible to moderate depending on their IPF with potentially moderate beneficial impacts.

Alternative E does not include the removal of structures or realignment of cables within Indian River Bay. As such the benthic impacts associated with the Inshore Export Cable Route within Indian River Bay would be the same as the Proposed Action (Alternative B).

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative E, would range from negligible to moderate with potentially moderate beneficial impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative E, would result in moderate benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative E would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures. Alternative E would have an appreciable impact when compared to all ongoing and planned activities.

3.5.2.8.2 Conclusions

Alternative E would decrease impacts of the benthic resources relative to the Proposed Action. Avoidance of these six AOCs including sand wave and complex habitat would potentially benefit benthic communities as they provide valuable refuge, feeding and spawning grounds for many fish and invertebrate species in the geographic analysis area. Overall, BOEM expects the impacts from Alternative E would be similar to the Proposed Action in a lesser degree and would range from short-term to permanent, with individual IPFs leading to impacts ranging from **negligible** to **moderate** with potentially **moderate beneficial** impacts, and overall impacts being **moderate**.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative E, would range from **negligible** to **moderate** with potentially **moderate beneficial** impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative E, would result in **moderate** benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative E would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures.

3.5.2.9 Comparison of Alternatives

As described in Section 3.5.2.5 the potential benthic impacts associated with the Proposed Action in combination with ongoing and planned activities would likely be **negligible** to **moderate** with potentially **moderate beneficial** as well as **moderate adverse** impacts when compared to the impacts expected under the No Action Alternative. The Proposed Action would impact benthic resources through increased anchoring, EMF exposure, new cable emplacement, underwater sound, seafloor profile disturbance, sediment deposition and presence of structures. Under the No Action Alternative, these impacts would not occur.

As discussed in Sections 3.5.2.4 through 3.5.2.9, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although the number of structures (WTGs, OSSs, and Met Tower), associated cabling and disturbance to sensitive benthic habitats varies slightly, the impacts to benthic resources would likely be **negligible** to **moderate** with potentially **moderate beneficial**, with an overall impact of **moderate** for all action alternatives. Alternative D would have least acres of impact in the offshore benthic community, as it would remove the largest number of offshore structures compared to the Proposed Action. Alternative E would avoid the six AOCs thereby reducing impacts to most sensitive benthic habitats which benefit fish and shellfish. However, for both Alternatives D and E, benthic impacts in Indian River Bay would remain the same as the Proposed Action. Alternative C would avoid impacts on benthic resources within the Indian River Bay, however, offshore benthic impacts would remain the same as the Proposed Action.

In the context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur under the same scenario (Appendix D). Therefore, impacts would only vary if the alternative's incremental contributions differ. BOEM expects individual impacts ranging from **negligible** to **moderate**, because while the impacts of accidental releases, anchoring, port utilization, EMF and cable heat, and discharges and intakes would be **negligible** the presence of structures for the life of the project would be **moderate adverse** to **moderate beneficial** and will remain so as long as the structures are in place. The overall impact of any action alternative on benthic resources when combined with past, present, and reasonably foreseeable activities would be **moderate**.

3.5.3 Birds

The reader is referred to Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts*, for a discussion of current conditions and potential impacts on birds from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.5.4 Coastal Habitat and Fauna

The reader is referred to Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts,* for a discussion of current conditions and potential impacts on coastal habitat and fauna from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.5.5 Finfish, Invertebrates, and Essential Fish Habitat

This section discusses potential impacts on finfish, invertebrates, and EFH from the Project, action alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area (Figure 3.5.5-1) includes the Northeast Continental Shelf Large Marine Ecosystem (LME)[17] and the Southeast Continental Shelf LME. The Northeast Continental Shelf LME extends from the southern edge of the Scotian Shelf (in the Gulf of Maine) to Cape Hatteras, North Carolina, and the Southeast Continental Shelf LME extends from Cape Hatteras to the Straits of Florida. These LMEs are likely to capture the majority of movement ranges for most invertebrates and finfish species. The geographic analysis area includes only U.S. waters. Due to the size of the geographic analysis area, the analysis in

[17] LMEs are delineated based on ecological criteria, including bathymetry, hydrography, productivity, and trophic relationships among populations of marine species, and the National Oceanic and Atmospheric Administration (NOAA) uses them as the basis for ecosystem-based management.

this EIS focuses on finfish and invertebrates that would be likely to occur in the Project area and be affected by Project activities.

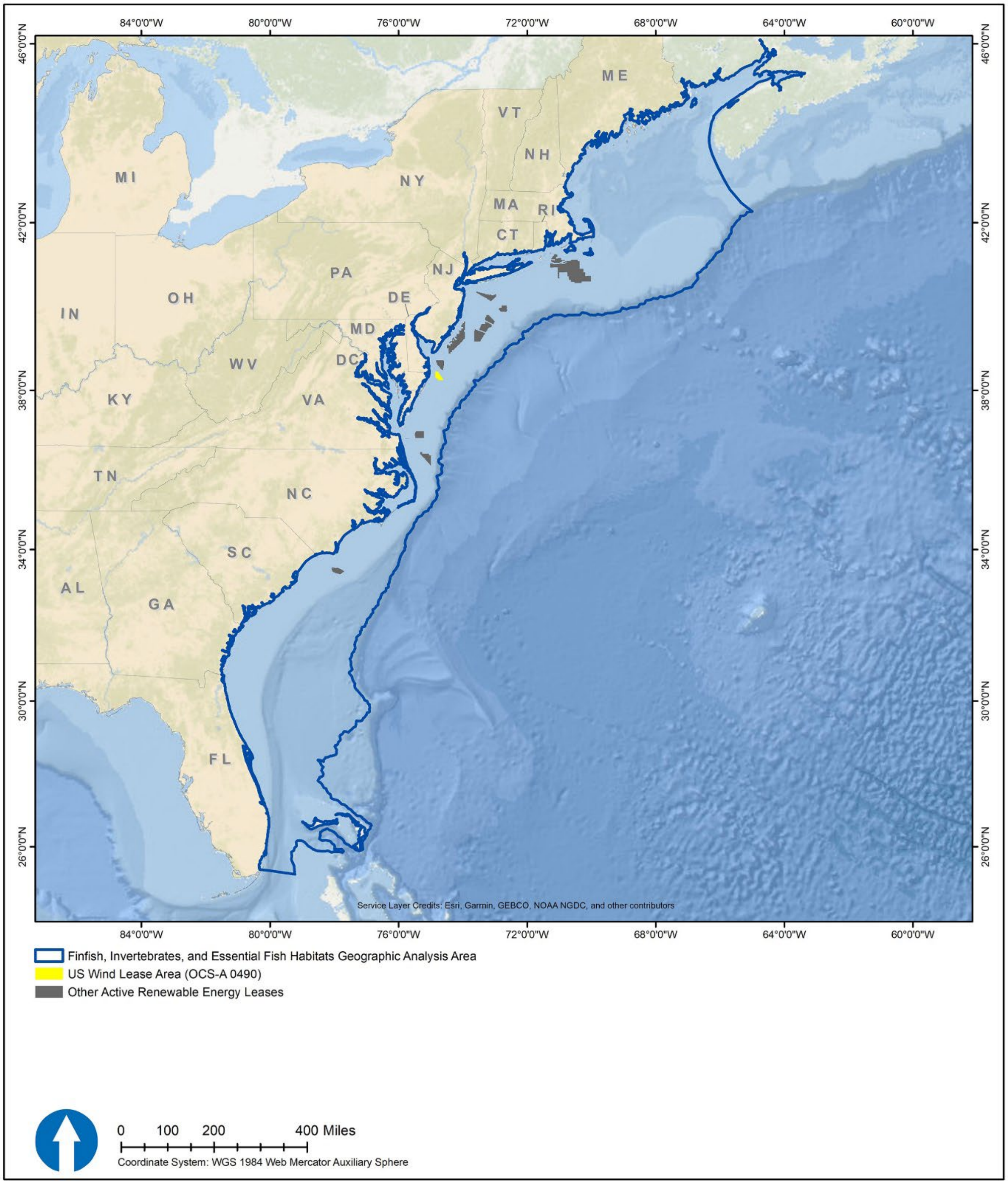


Figure 3.5.5-1. Finfish, invertebrates, and essential fish habitat geographic analysis area

EFH is defined as “those waters and substrate necessary for fish or invertebrates for spawning, breeding, feeding, or growth to maturity” (16 U.S.C. 1802(10)). This section provides a qualitative assessment of the impacts of each alternative on finfish, invertebrates, and EFH, which has been designated under the MSA as “essential” for the conservation and promotion of specific fish and invertebrate species. More detailed information regarding the impact on species listed under the ESA, as well as on EFH, can be found in the EFH Assessment (BOEM 2023a) and the BA (BOEM 2023b). A discussion of benthic resources and species is provided in Section 3.5.2, *Benthic Resources*, and a discussion of commercial fisheries and for-hire recreational fishing is provided in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*.

3.5.5.1 Description of the Affected Environment and Future Baseline Conditions

This section discusses existing finfish and invertebrate resources and designated EFH in the geographic analysis area for these aquatic organisms, as described in Appendix D, *Planned Activities Scenario*, Table D-1, and shown on Figure 3.5.5-1. Appendix F, Table F-7, identifies potential IPFs, issues, and indicators to assess impacts to coastal habitat and fauna.

The northern portion of the geographic analysis area includes only U.S. waters (Figure 3.5.5.5-1). Within this area, species discussed include deepwater marine species, estuarine, and diadromous species that use both fresh and marine habitats within one of their life stages.

The Project area falls within the southern extent of the MAB. This portion of the MAB supports a diverse finfish and invertebrate assemblage detailed in the COP (Volume II, Section 8.1.1; US Wind 2023). Additional descriptions of fish and invertebrate species in the Project area can be found in other regional BOEM EISs (BOEM 2014). The *Programmatic EIS for Alternative Energy Development* (MMS 2007), and Section 3.5.2 also describe the affected environment for this section of the Atlantic OCS.

The Maryland WEA is approximately 10.1 to 22 miles (16.2 to 35.4 kilometers) east of Ocean City, Maryland. The Project area includes finfish, invertebrates and the EFH of managed species in waters along the Offshore Export Cable Route and the Inshore Export Cable Route within Indian River Bay. The Lease Area covers approximately 80,000 acres (32,375 hectares) of seafloor with water depths up to 135 feet (41 meters). Salinities at any given point in the water column are consistent year-round in offshore waters but vary between 27 and 31 parts per thousand near shore. Water depths in the Offshore Export Cable Route range from 36 to 104 feet (11.1 to 31.8 meters) in federal waters, and 49 feet (15 meters) or less in state waters (COP, Volume II, Appendix K7; US Wind 2023).

Benthic habitat in the Lease Area is historically characterized by mobile sandy substrates on gentle slopes, with shell hash frequently accompanying mineral substrates (Guida et al. 2017). The primary geomorphological features are sand ripples, amalgamated sand ridges, and major sand ridges. Based on US Wind survey data major sand ridges (sand waves with wavelengths greater than 820 feet [250 meters], and 6.6 feet [2 meters] in height) are present within the southern portion of the Lease Area, while minor sand ridges and sand waves are present along the eastern side of the Lease Area and scattered along the Offshore Export Cable Route. Megaripples were the least widespread benthic feature in the Offshore Project area, confined to the far southeastern corner of the Lease Area. A total of 93 percent of the seafloor slope within the Lease Area and Offshore Export Cable Route is one degree or less. Within the Offshore Export Cable Route, the slope did not exceed 5 degrees, and is therefore still classified as a gentle slope. Steeper slopes exceeding 20 degrees were identified in the western portion of the Lease Area. These slopes classified as very steep, would complicate cable laying activities (COP, Volume II, Appendix K5; US Wind 2023).

In 2021, benthic survey collected sediment grab samples and underwater imagery within the Lease Area and the Offshore Export Cable Route (US Wind 2023). Using the NMFS-modified CMECS taxonomic framework categories, soft (60,626 acres [24,535 hectares]) and heterogeneous complex mixes (12,140 acres [4,913 hectares]) were the dominant substrate groups observed within the entire offshore Project area (COP, Volume II, Appendix E-1, Table 4; US Wind 2023). This softbottom habitat consisted of sand; no fine substrates such as muddy sands, sandy muds, or muds were observed. However, patches of heterogeneous complex habitat with gravel (including pebble/granule, and cobble) were documented as the second most dominant benthic habitat within the Offshore Project area. Complex and Large Grained Complex habitats were found to represent 316.3 acres (128 hectares) and 9.9 acres (4.0 hectares), respectively. Within some of the Offshore Export Cable Route 2 transects larger solitary boulders and mounds of smaller boulders and cobbles were observed embedded in soft bottom habitat (COP, Volume II, Appendix E-1; US Wind 2023). One transect in the southwestern portion of the Lease Area, identified a cobble pile of suspected anthropogenic origin, and the presence of a worm reef was identified along a sandy transect on the western side of the Lease Area (COP, Volume II, Appendix D4; US Wind 2023). Descriptions of the benthic resources and habitats are supported by project-specific surveys, including the COP appendices (Volume II, Appendices D4 and D5; US Wind 2023).

The benthic macrofaunal invertebrate community in the Lease Area and Offshore Export Cable Route are dominated by polychaetes, accounting for roughly 45 to 50 percent of the observed macroinvertebrates. Crustaceans and mollusks each accounted for approximately 25 percent of the taxa in the Lease Area samples. Typical species commonly found in the area also include oligochaete worms, common sand dollars (Clypeasteroida, *Echinarachnius parma*), sea stars (*Asterias* spp.), tube anemones (*Cerianthus* sp.), hermit crabs (*Pagurus* sp.), rock crabs (*Cancer* spp.), moon snails (Naticidae), and nassa snails (*Ilyanassa* [*Nassarius*] spp.). Surfclams (*Spisula solidissima*), sea scallops (*Placopecten magellanicus*), penaeid shrimp (Penaeidae), sand shrimp (*Crangon septemspinosa*), horseshoe crabs (*Limulus polyphemus*), and ocean quahogs (*Arctica islandica*) were also occasionally recorded in survey trawl data (Guida et al. 2017). Soft corals (sea whips) were found within the Maryland WEA; however, no habitat-enhancing hard corals were detected (Guida et al. 2017). Another notable, but uncommon and highly localized feature observed was the presence of a worm reef that may have been formed by spionid polychaetes, which were identified in a nearby benthic grab sample (COP, Volume II, Appendix D4; US Wind 2023). The worm reef habitat was identified within video transect site VT-LA-Z017 in the northcentral portion of the lease area (COP, Volume II, Appendix D4; US Wind 20232). The benthic habitat in the Project area is predominantly sandy sediment habitat and is almost homogenous in that the variations in sediment type observed only occur in small spatial scale. Benthic habitat is important for fish and invertebrate habitat and influences site fidelity in demersal fish and invertebrate species. A notable benthic community located north of the Project area is called the Old Grounds. The NJDEP 2023, Prime Fishing Grounds of New Jersey GIS portal describes the Old Grounds to be in 90 to 120 feet

(27.4 to 36.6 meters) water depth and approximately 10 nautical miles (18.5 kilometers) offshore encompassing an area of 45,786.4 acres ([18529.1 hectares] NJDEP 2023). The site is characterized as having lumps which are potentially areas of the drowned riverbed and banks consisting of sandy, pebble and gravel formed during the Pleistocene era (NJDEP 2023). Similar sediment types were observed at the Old Grounds as in the Project area.

Finfish

The geographic analysis area was selected based on the likelihood of capturing most of the movement range for the finfish species that would be expected to pass through the Project area. This area is large and has very diverse and abundant fish assemblages that can be generally categorized based on life history and preferred habitat associations (e.g., pelagic, demersal, resident, and highly migratory species).

The MAB fish fauna is a mix of demersal and pelagic species with boreal and warm temperate, cold temperate, and subtropical affinities. There are approximately 100 species of fish that could occur within the Project area. At the family level, demersal species of the region are represented by a very diverse suite of taxa, including skates (Rajiidae), dogfishes (Squalidae), requiem sharks (Carcharhinidae), searobins (Triglidae), hakes (Phycidae, Merlucciidae), anglerfishes (Lophiidae), seahorses and pipefishes (Syngnathidae), sculpins (Cottidae), seabasses (Serranidae), drums (Sciaenidae), scup (Sparidae), and flatfishes (Paralichthyidae, Pleuronectidae, Scophthalmidae) (Robins and Ray 1986).

The MAB demersal assemblage characteristically varies over space and time driven primarily by seasonal changes in water temperature such as those driven by the seasonal evolution of the MAB cold pool (Sims et al. 2001; Hopkins and Cech 2003; Fabrizio et al. 2014; Secor et al. 2019; Kohut and Brodie 2019). When water temperatures increase in the spring, warm temperate, and some subtropical, fishes move into the MAB from the south; at the same time, several cold-water species migrate back to areas north of the MAB. After shelf waters cool during fall and early winter, warm temperate species migrate back south and offshore while some of the cold temperate forms move into the area (BOEM 2014a; Guida et al. 2017). NEFSC bottom trawl surveys collected from 2003 to 2012 by Guida (2017) within the western half of the Lease Area exhibit the seasonal shift in demersal species (COP Volume II, Section 8.1.1; US Wind 2023). Fall Trawl surveys (September to October) primarily consisted of seasonally migratory species comprising Atlantic croaker (*Micropogonias undulates*), weakfish (*Cynoscion regalis*), spot (*Leiostomus xanthurus*), and northern sea robin (*Prionotus carolinus* [COP Volume II, Section 8.1.1; US Wind 2023; Guida et al. 2017]). Spring surveys (March) consisted predominantly of little skate (*Leucoraja erinacea*), smallmouth flounder (*Etropus microstomus*), and spotted hake (*Urophycis regia*) [COP Volume II, Section 8.1.1; US Wind 2023; Guida et al. 2017]). Most of the spring catch species were also present in the fall, representing a year-round resident fauna. The fall catches had higher rates of biomass and were more diverse (COP Volume II, Section 8.1.1; US Wind 2023; Guida et al. 2017).

Several fish species historically found south of the MAB have expanded their range northward and into offshore waters. This expansion in range for some species has been attributed to increased seawater temperatures and a gradual shift of the Gulf Stream current to the northeast, moving close to the

Mid-Atlantic coastline (Pinsky et al. 2013; Andres 2016). This is also a documented global trend observed as sea temperatures increase, northern shifts of fish distribution occur (Baudron et al. 2020).

The demersal fish assemblage is additionally structured by the geomorphology of the benthic habitat. For example, offshore shoal complexes (two or more shoals and the trough separating them) provide a habitat and micro-habitats for adults, settled juveniles, and larvae for multiple fish and invertebrate species that use these shoal complexes for spawning, larval recruitment, foraging, and migration (Rutecki et al. 2014). However, a 2-year study conducted on the inner continental shelf of the MAB showed greater species diversity, abundance, and richness in flat-bottom habitats than in shoal habitats (Slacum et al. 2011). Slacum et al. (2011) also noticed seasonal trends with lower values of all those indices during the winter than in the spring through fall. Cutter et al., 2000 found that fish, filter feeding epibenthos, and sand dollars were more prevalent on the shoals, while shoal troughs were more biologically active and productive areas than the shoal crests. This is potentially related to the clay-silt components of the sediment habitat found within the shoal troughs which are colonized by dense mats of mud-tube-building infaunal polychaetes. Shoal habitats occur in high-energy environments and migrate in a generally southwest direction within the MAB (Rutecki et al. 2014). Shaol habitats, sand ridges, sand ripples and waves were observed over a large portion of the Lease Area.

Pelagic species found in the MAB are also represented by a diverse suite of taxa, including sharks (Squalidae, Lamnidae, Carcharhinidae), herrings (Clupeidae), anchovies (Engraulidae), mackerels (Scombridae), cobia (Rachycentridae), striped bass (Moronidae), bluefish (Pomatomidae), and butterfishes (Stromateidae). All these taxa form schools of varying sizes which migrate seasonally. With the demersal fishes, most pelagic species found in the MAB are transitory, originating in waters either to the north (Gulf of Maine or Georges Bank) or to the south (south of Cape Hatteras) of the MAB (Guida et al. 2017). Their occurrence in the MAB is generally a response to seasonal changes in water temperature that trigger southerly or northerly movements by species of southern or northern origin, respectively. Many large-scale migrations of pelagic fishes in the MAB are related to spawning. Important prey species such as Atlantic silverside (*Menidia menidia*) bay anchovy (*Anchoa mitchilli*) and the Atlantic menhaden (*Brevoortia tyrannus*) dominate the pelagic community within the Delaware Inland Bays and nearshore habitats. Migratory cycles of the Atlantic menhaden can also be found within the Lease area (COP Volume II, Section 8.1.1; US Wind 2023; Able and Fahay 2010).

Invertebrates

Invertebrate resources assessed in this section include the planktonic zooplankton community and megafauna species that have benthic, demersal, or planktonic life stages. Macrofaunal and meiofaunal invertebrates associated with benthic resources are assessed in Section 3.5.2, *Benthic Resources*. Benthic sediments within the Project area are classified as primarily soft bottom (60,626 acres [24,535 hectares]), heterogeneous complex (12,140.0 acres [4,913 hectares]) as the second most prevalent, with small areas of complex (316.3 acres [128 hectares]), and large grained complex (9.8 acres [4.0 hectares]) benthic habitats (COP, Volume II, Appendix E1; US Wind 2023). Previously pockets of mud in the center and southern side of the Lease Area have been identified, though no fines were observed in recent surveys (Guida et al. 2017; COP, Volume II, Appendix D4; US Wind 2023). The macrofaunal invertebrate community in the Lease Area and Offshore Export Cable Route are dominated by polychaetes, accounting for roughly 45 to 50 percent of the observed macroinvertebrates. Oligochaete worms, mollusks, nemertean worms, and lancelets were also commonly present in the macrofaunal assemblage. Crustaceans and mollusks each accounted for approximately 25 percent of the taxa in the Lease Area samples. The epifauna is dominated by sand shrimp, New England dog whelk snails (*Nucella lapillus*), and sand dollars (Guida et al. 2017). Additional invertebrates within the geographic analysis area include crustaceans (e.g., amphipods, crabs, lobsters), mollusks (e.g., gastropods, bivalves), echinoderms (e.g., sand dollars, brittle stars, sea cucumbers), and various other groups (e.g., sea squirts, burrowing anemones) (Guida et al. 2017). Benthic invertebrates are commonly characterized by size (i.e., megafauna, macrofauna, or meiofauna). The most abundant taxa from samples collected within the Old Grounds were nematode roundworms, aorid amphipods (*Pseudunciola obliguua* and *Unciola* spp.), the tanaid (*Leptognathia caeca)*, the pea crab (*Dissodactylus melliate)*, and bean mussels *(Crenella* sp.) (COP, Volume II, Section 7.1.2.1; US Wind 2023). Macrofaunal and meiofaunal invertebrates associated with benthic resources are assessed in Section 3.5.2, *Benthic Resources*. In this section, the description of invertebrate resources focuses on the planktonic zooplankton community and megafauna species that have one or more of the following life stages: benthic, demersal, or planktonic.

Demersal, epibenthic, and infaunal invertebrates found within the Offshore Project area include sea scallops (*Placopecten magellanicus*), surfclams (*Spisula solidissimus*), ocean quahogs (*Arctica islandica*), and the calico scallop (*Argopecten gibbus*) (Guida et al. 2017). These species reside either on the seafloor (scallops) or buried within the seafloor sediments (ocean quahog and surfclams). The primary pelagic macroinvertebrates in the region are longfin inshore squid (*Doryteuthis pealeii*) and northern shortfin squid (*Illex illecebrosus*). Longfin squid adults move offshore in fall and remain there until April, at which time adults and young migrate back into shelf waters for the summer. Longfin inshore squid egg clusters (known as mops) were found within the lease footprint and accounted for 33 percent of the total biomass for trawl samples collected during the NOAA 2017 survey (Guida et al. 2017). General patterns include (1) cross-shelf movements to offshore spawning areas, (2) movements along the shelf to southerly spawning areas, and (3) movements between coastal rivers and the coastal ocean for spawning or the reverse (diadromy).

Zooplankton

Zooplankton are a type of heterotrophic plankton in the marine environment that range from small, microscopic organisms to large species, such as jellyfish. These invertebrates play an important role in marine food webs and include both organisms that spend their whole life cycles in the water column and those that spend only certain life stages (larvae) in the water column (meroplankton). In the marine environment, zooplankton dispersion patterns vary on a large spatial scale (from meters to thousands of kilometers) and over time (hours to years). Zooplankton exhibit diel vertical migrations up to hundreds of meters; however, horizontal large-scale distributions are dependent on ocean currents and the suitability of prevailing hydrographic regimes. Northward shifts of more than 10 degrees latitude have been attributed to the increase in atmospheric temperatures (Burkill and Reid 2010), which heat ocean surface temperatures and therefore increased zooplankton regionally (Kane 2011).

Megafaunal Invertebrates Associated with Soft and Hard Substrates

Some of the megafaunal invertebrates found in the geographic analysis area are migratory while others are sessile or have more limited mobility. Generally, mobile invertebrates with broad habitat requirements are more adaptable to disturbance and anthropogenic impacts compared to invertebrates that require specific habitats during one or more life stages or have limited mobility.

Taxa identified in grab samples collected were typical of soft sediment coastal shelf habitats of the MAB. Most of the benthic macrofaunal taxa observed in the benthic grab samples were small burrowing or tube-building taxa. Widespread or abundant organisms included polychaete worms, oligochaete worms, amphipods (e.g., *Unciola* sp., *Byblis serrata*), and nemertean ribbon worms. In substrates classified as gravel and gravel mixes, common Atlantic slipper shells (*Crepidula fornicata*), blue mussels (*Mytilus edulis*), Astarte clams (*Astarte* spp.), mollusks and crustaceans were abundant.

General Biological Trends in Primary Invertebrate Species

Though annual temperatures varied, seasonal fluctuations as large as 59°F (15°C) at the seafloor play a large role in migratory patterns and timing (Guida et al. 2017). Patterns of thermal stratification are also present, beginning in April and increasing through the summer. By September and October vertical turnover occurs and the temperature gradient is negligible. A steep decline of up to 53.6°F (12°C) is present by early winter (Guida et al. 2017). These patterns in temperature play a large role in signaling seasonal migrations and the settlement of demersal and benthic organisms.

The most recent trends in primary invertebrate species have been summarized in the State of the Ecosystem report for the Mid-Atlantic (NOAA 2022b). They indicated that long-lasting climactic events such as heatwaves can greatly impact invertebrate species, including those of commercial importance such as the lobster fishery. These industries have had to adapt as their target species shift north to cooler waters. In the same regard, changes in the cold pool were observed. The cold pool is a mass of colder water trapped on the ocean floor over the continental shelf. This distinctive feature of the MAB is becoming increasingly warmer, and the water column becomes homogenized earlier in the year. These physical changes to the ocean temperature contribute to ecosystem-level changes that are observed in many fishing industries.

3.5.5.1.1 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires fishery management councils to:

1. Describe and identify EFH for managed species (and their prey) in their respective regions;
2. Specify actions to conserve and enhance EFH; and
3. Minimize the adverse effects of fishing on EFH.

The MSA requires federal agencies to consult on activities that may negatively affect EFH identified in FMPs. In the MAB, fishery species and EFH are managed by MAFMC, SAFMC, and the NOAA Office of Highly Migratory Species (HMS). The Atlantic States Marine Fisheries Commission (ASMFC) manages some species and habitat at the state level.

Three basic marine habitat types occur in the region: pelagic (water column), soft-bottom demersal, and hard-bottom demersal. Within inshore waters, additional biogenic habitats such as emergent vegetation, submerged vegetation, and oyster reefs are important. Various managed species use these inshore habitats for shelter, feeding, growth, and reproduction. MAB pelagic habitats support northern shortfin and longfin inshore squids, coastal pelagic fishes (Atlantic mackerel [*Scomber scombrus*], Atlantic herring [*Clupea harengus*], Atlantic butterfish [*Peprilus triacanthus*], bluefish [*Pomatomus saltatrix*], spiny dogfish [*Squalus acanthias*]), and oceanic pelagic fishes (tunas [*Thunnus* spp.], swordfish [*Xiphias gladius*], and sharks [Carcharhinidae, Lamnidae, Squalidae]). Members of the oceanic pelagic group (HMS) can span the entire MAB through migratory, feeding, and reproductive activity (NMFS 2006, 2017). Within this group, NMFS has incorporated FMPs for 12 Atlantic species that can range from the South Atlantic Bight (SAB) up into the Northern MAB on a seasonal basis (NMFS 2017).

Managed soft-bottom demersal species include Atlantic surfclam, Atlantic sea scallop, and ocean quahog. Soft-bottom fishes with EFH in the Project area include summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), and spiny dogfish. Black seabass (*Centropristis striata*) is an example of a hard-bottom species with EFH in the Project area. Inshore habitats provide shelter for early life stages of summer flounder, striped bass (*Morone saxatilis*), bluefish, weakfish (*Cynoscion regalis*), black seabass, and scup. All major MAB habitats produce prey such as benthic invertebrates, anchovies (Engraulidae), silversides (Atherinidae), herrings (Clupeidae), and sand lances (Ammodytidae), which are important to many managed species (Kritzer et al. 2016). EFH has been designated for the following species for one or more life stages in the Project area. Table 3.5.5-1 provides a summary of the regional fishery management plan species.

Table 3.5.5-1. Fishery management plans and species, including life stage within the Geographic Analysis Area for the Maryland Offshore Wind Project

New England Fishery Management Plan Species	Mid-Atlantic Fishery Management Plan Species	Atlantic Highly Migratory Species Fishery Management Plan Species
Atlantic herring; A, J,	Atlantic butterfish; E, L, J, A	Albacore tuna; J, A
Atlantic sea scallop; E, L, J, A	Atlantic mackerel; E, L, J, A	Atlantic angel shark; J, A
Atlantic cod; E, L, J, A	Black sea bass; L, J, A	Atlantic bluefin tuna; J, A
Haddock; J	Bluefish; E, L, J, A	Atlantic sharpnose shark; J, A
Monkfish; E, L, J	Scup; A, J,	Atlantic skipjack tuna; J, A
Pollock; L	Summer flounder; E, L, J, A	Basking shark; J, A
Red hake; E, L, A	Spiny dogfish; Neonate, J, A,	Blue shark; J, A
Silver hake; E, L, J, A	Atlantic surfclam; A, J,	Common thresher shark; N, J, A
White hake; A	Ocean quahog; A, J	Dusky shark; N, J, A

New England Fishery Management Plan Species	Mid-Atlantic Fishery Management Plan Species	Atlantic Highly Migratory Species Fishery Management Plan Species
Windowpane flounder; E, L, J, A	Long-finned squid; A	Sand tiger shark; N, J, A
Witch flounder; E, L, A		Sandbar shark; N.J, A
Yellowtail flounder; E, L, J, A		Shortfin mako; N.J, A
Clearnose skate; J, A		Smooth dogfish; N.J, A
Little skate; J, A		Tiger shark; J, A
Winter skate; J, A		Yellowfin tuna; J, A

Note: Life stages within the geographic analysis area for the Maryland Offshore Wind project are as follows: A = adult; E = egg; J = juvenile; L = larvae; N = Neonate.

The fishery management councils also identify habitat areas of particular concern (HAPCs) within FMPs. HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. The Project area and the cable routes overlap with summer flounder HAPC within Indian River Bay and sand tiger shark HAPC ranges from Delaware Bay down to the northern side of the Indian River Inlet (Figure 3.5.5-2). Sandbar shark, summer flounder, and sand tiger shark HAPCs have been designated within potential vessel transit routes from ports to the Project area. Summer flounder HAPC has not been spatially defined by NOAA but does overlap with native species of macroalgae, seagrasses, and freshwater and tidal macrophytes within their defined EFH and the MAB.

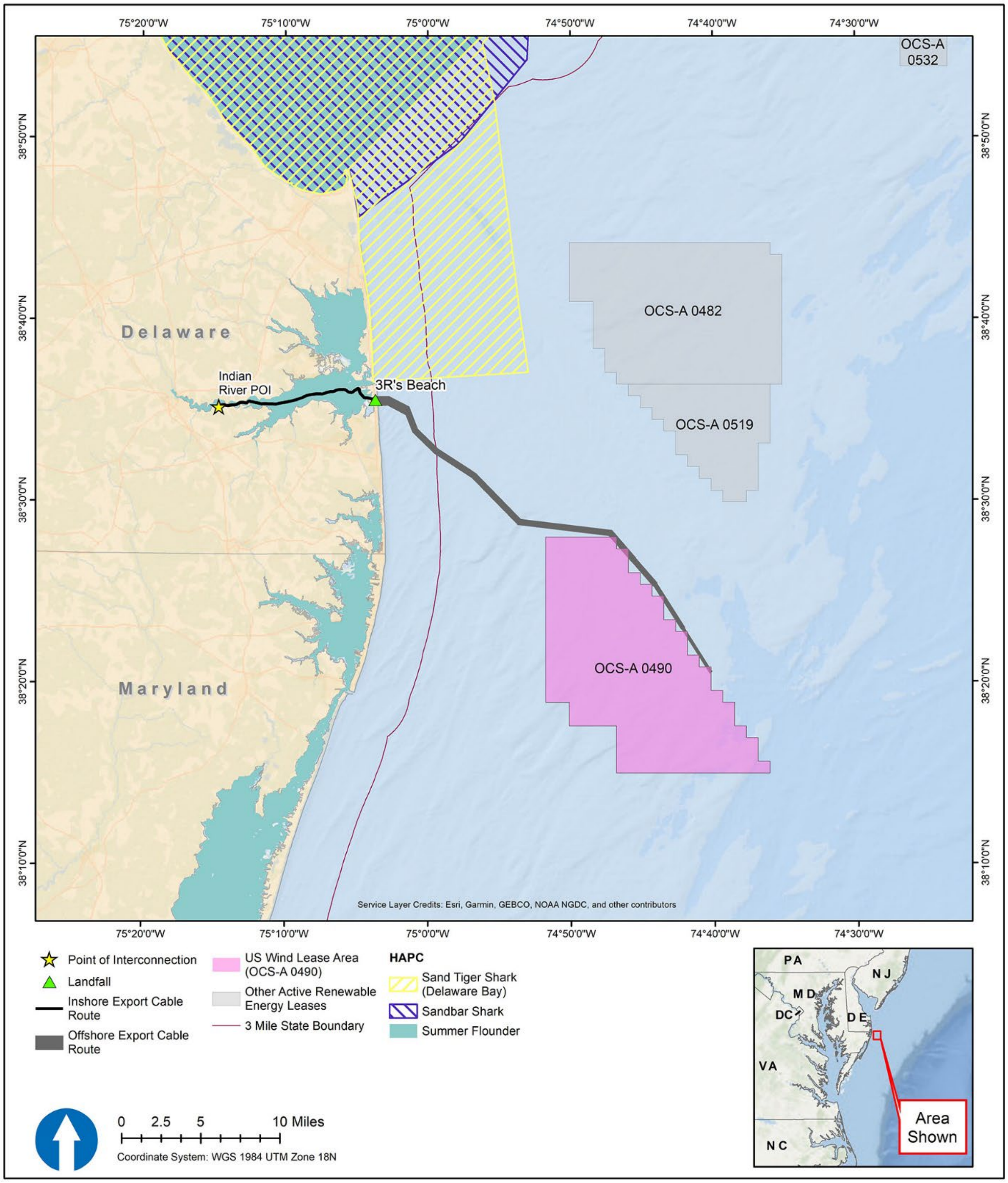


Figure 3.5.5-2. Sand tiger shark, sandbar shark, and summer flounder Habitat Areas of Particular Concern (HAPCs) in the Project area

3.5.5.1.2 Threatened or Endangered Species

Six fish species listed as endangered under the Endangered Species Act (ESA) may occur in the Project area: Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), oceanic whitetip shark (*Carcharhinus longimanus*), scalloped hammerhead (*Sphyrna lewini*), and Atlantic salmon (*Salmo salar*) (Table 3.5.5-2). The Atlantic salmon are generally found in latitudes north of Massachusetts into Canada and, therefore, would be very unlikely to be within the MAB, or Project area and are not discussed further. Both sturgeon species are anadromous, meaning they spawn in rivers and spend their adult life in the open ocean. The giant manta ray is listed as threatened under the ESA and may also occur in the Project area.

Table 3.5.5-2. Federally and state-listed fish species potentially occurring in the Project area

Common Name	Scientific Name	Federal Status	Delaware State Status	Maryland State Status
Atlantic salmon	*Salmo salar*	E	-	-
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	E	E	E
Giant manta ray	*Mobula birostris*	T	-	-
Oceanic whitetip shark	*Carcharhinus longimanus*	T	-	-
Scalloped hammerhead shark	*Sphyrna lewini*	T	-	-
Shortnose sturgeon	*Acipenser brevirostrum*	E	E	E

- = not listed; E = endangered; T = threatened

3.5.5.1.2.1 Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus)

The Atlantic sturgeon is an estuarine-dependent, anadromous species that is found along the eastern coast of North America from Canada to Florida. They spend most of their lives in the marine environment, but spawn in freshwater. They are present in 36 coastal rivers in the U.S., and spawning takes place in at least 20 of these rivers. Larvae and juveniles remain in riverine or estuarine areas where they were spawned and move to higher salinity waters as subadults. Subadults and adults migrate seasonally throughout marine waters. In the summer, they are found in shallow waters from 3.28 feet to 65.6 feet (1 to 20 meters), and in the winter they move to deeper waters of about 65.6 to 164.0 feet (20 to 50 meters). Current threats to Atlantic sturgeon include vessel strikes, bycatch, habitat degradation/loss, climate change and habitat impediments such as dams (BOEM 2013; NOAA Fisheries 2017a, 2022). Critical habitat for the New York Bight Distinct Population Segment (DPS) of Atlantic sturgeon includes approximately 340 miles (547 kilometers) of aquatic habitat in the Hudson, Connecticut, Housatonic, and Delaware Rivers (82 *Federal Register* 39160), and does not coincide with the Project area.

In 2011, telemetered Atlantic sturgeon were detected in nearshore waters off the coast of Maryland, along the southern end of the Delmarva Peninsula. Atlantic sturgeon were observed in shallow, well-mixed, relatively warm freshwater near the 82-foot (25-meter) isobath and appeared to be associated with a water mass tied to Delaware Bay (Oliver et al. 2013). Additionally, matching telemetry records with derived seascapes indicate that Atlantic sturgeon prefer a seascape that is associated with the coastline of Delaware Bay and the Atlantic Ocean, with a mean temperature of 68°F (19.8°C) and a mean reflectance of 0.0073 sr^{-1} at 17.4 inches (443 millimeters) (Breece et al. 2016). Based on these studies, Atlantic sturgeon would be more likely to occur near the coast rather than farther offshore in the Lease Area. The Delaware Division of Fish and Wildlife has not reported occurrences of Atlantic sturgeon within the Inland Bays (USACE 2015). Marine-phase Atlantic Sturgeon migrate through Delaware's coastal waters in mid-late March through mid-May and early September through mid-December (DNREC 2017).

From 2016 to 2018, tri-annular surveys of acoustically tagged sturgeon revealed an in-depth migratory pattern of movement of Atlantic sturgeon by Secor et al. (2020). Detections of Atlantic sturgeon occurred throughout the fall and the early winter months and briefly during the spring. Within these periods of occurrence, Atlantic sturgeon were at mid-range depths in the Lease Area during the fall but occurred in shallower regions within and outside the Lease Area in the spring. Detections for Atlantic sturgeon showed stronger association with cross-self depth and environmental gradients rather than specific seafloor characteristics. The results show that Atlantic sturgeon occurred extensively in the Lease Area as transients, and that the migration corridor does overlap within the Lease Area.

3.5.5.1.2.2 Shortnose Sturgeon (Acipenser brevirostrum)

The shortnose sturgeon is an anadromous species found in large rivers and estuaries of the North America eastern seaboard from the Indian River in Florida to the St. John River in Canada. The shortnose sturgeon is not found in any of the Delaware Inland Bays systems which include Rehoboth Bay, Indian River Bay, and Little Assawoman Bay, but is found in the Delaware River. Adults migrate downstream in the fall and upstream in the spring to spawn. Larvae and juveniles are found in deep channels of rivers with strong currents. Shortnose sturgeon are most commonly found in the estuary of their respective river. While they do occasionally enter the marine environment, they generally remain close to shore, and are not likely to be present in the Lease Area (Dadswell et al. 1984; Moser and Ross 1995; Collins and Smith 1997). Current threats to shortnose sturgeon include dams, pollution, and habitat alteration (NOAA Fisheries 2015). Shortnose sturgeon is not known to occur within the Delaware Inland Bays (USACE 2015).

3.5.5.1.2.3 Giant Manta Ray (Mobula birostris)

The giant manta ray is a large bodied, pelagic planktivore that is broadly spread in tropical and temperate waters of the Pacific, Atlantic and Indian oceans. This species is not regularly encountered in large numbers and overall encountered with far less frequency than any other manta species despite having a larger distribution across the globe (IUCN 2011). While manta rays feed typically in shallow waters, they can dive as deep as 3,300 feet (1,000 meters) (Miller and Klimovich 2016). Giant manta rays are observed to migrate by following prey abundance (Farmer et al. 2021). It is understood that the population of this species is in decline and it is ESA threatened throughout its range, which includes

New England/Mid-Atlantic, the Pacific Islands, and the Southeast. Giant mantas are slow growing and long-lived with low fecundity and reproductive output with a gestation period up to 1 year. These biological traits make them prone to overexploitation, with their most direct threats being bycatch and intentional hunting for gill rakers by the Asian market (White et al. 2006).

Recorded occurrences of giant manta rays within the Project are considered rare and only two recorded observations in 2016 and 2021 confirm giant manta ray range is off the coast of Delaware. Farmer et al. (2021) integrated decades of sightings and survey effort data from numerous sources in a comprehensive species distribution modeling (SDM) framework for the eastern U.S. and revealed that giant manta rays were most commonly detected at productive nearshore and shelf-edge upwelling zones at surface thermal frontal boundaries within a temperature range of approximately 59°F to 86°F (15°C to 30°C). The SDMs predicted high nearshore concentrations off Northeast Florida during April, with the distribution extending northward along the shelf-edge as temperatures warm, leading to higher occurrences north of Cape Hatteras, North Carolina from June to October, and then south of Savannah, Georgia from November to March as temperatures cool (White et al. 2006; IUCN 2011; Marshall et al. 2011; Miller and Klimovich 2016; Farmer et al. 2021).

3.5.5.1.2.4 Oceanic Whitetip shark (Carcharhinus longimanus)

The oceanic whitetip shark is a highly migratory, large bodied, pelagic shark found in deep offshore waters on the outer continental shelf or around islands. As suggested by their name, they have distinct mottling white on the tips of their pectorals, dorsal and tail fins. Despite its common occurrence in many commercial fisheries in tropical waters globally, there are information gaps regarding biology and population status (Young and Carlson 2020). As an opportunistic apex predator, they feed on tuna, marlin, other sharks, rays, seabirds and marine mammals. It is believed that oceanic whitetip sharks spend most of their time in the near surface waters but also avoid surface temperatures that negatively impact thermoregulation and low metabolic rates (Andrzejaczek et al. 2018). Although they have the ability to dive to depths up to 3,549 feet (1,082 meters), they usually remain above 656 feet (200 meters) and prefer waters warmer than 68°F (20°C) (NOAA 2022a).

Individual sharks have lived up to 36 years; however, the estimated age limit is 25 years. The females reach maturity by age 9 and biennially birth 1 to 14 pups after a 10- to 12-month gestation (NOAA 2022a). Ocean whitetip sharks were once considered one the most ubiquitous pelagic shark species but have faced steep declines due to the shark finning trade, and incidental bycatch in commercial fisheries (Young and Carlson 2020; NOAA 2022a). The population decline in the Atlantic is not well documented, though the substantial decline in the Pacific ranges from 80 to 95 percent since the mid-1990s, while the Gulf of Mexico observed an 88 percent decline (NOAA 2022a).

3.5.5.1.2.5 Scalloped Hammerhead Shark (Sphyrna lewini)

The scalloped hammerhead shark is a moderately large shark and is the most common of all hammerhead shark species. As suggested by their name, their head is shaped like a double-headed hammer with its eyes on each end and indentations along the front which create a scalloped appearance. They have been found as far north as New Jersey into the warm waters off Brazil (National Marine Sanctuary Foundation 2018). These sharks are highly mobile and stay close to the shore and move to deeper offshore waters at night to feed. They are rarely found in waters cooler than 72°F (22°C) and can reach depths of up to 1,600 feet (500 meters) (Miller et al. 2014). They are apex opportunistic predators who feed on mackerel, herring, sardines, cephalopods, rays, and smaller sharks (National Marine Sanctuary Foundation 2018).

3.5.5.2 Impact Level Definitions for Finfish, Invertebrates, and Essential Fish Habitat

Project construction would generate short-term and long-term direct and indirect effects on finfish, invertebrates, and EFH through accidental releases, anchoring, seabed preparation, and scour protection installation; noise, crushing, burial, and entrainment effects; and suspended sediments and turbidity from bed disturbance. These effects would occur intermittently and at varying locations in the Project area over the duration of Project construction. Thus, the suitability of EFH for managed species may be reduced depending on the nature, duration, and magnitude of each effect. Durations can be broken into three time periods: short term is less than two years; long term is the range between two years and the life of the Project; and permanent is the life of the project. Definitions of potential impact levels are provided in Table 3.5.5-3. Appendix F, Table F-7, identifies potential IPFs, issues, and indicators to assess impacts to finfish, invertebrates, and EFH.

Table 3.5.5-3. Impact level definitions for finfish, invertebrates, and essential fish habitat

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on species or habitat would be so small as to be unmeasurable.
Minor	Adverse	Most impacts on species would be avoided; if impacts occur, they may result in the loss of a few individuals, with no population-level effects. Impacts on sensitive habitats would be avoided; impacts that do occur would be temporary or short term in nature.
Moderate	Adverse	Impacts on species would be unavoidable but would not result in population-level effects. Impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
Major	Adverse	Impacts would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them.

3.5.5.3 Impacts of Alternative A – No Action on Finfish, Invertebrates, and Essential Fish Habitat

3.5.5.3.1 Non-offshore Wind Activities (without Proposed Action)

Under the No Action Alternative, baseline conditions for finfish, invertebrates, and EFH described in Section 3.5.5.1, *Affected Environment*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. Ongoing activities within the geographic analysis area that contribute to impacts on finfish, invertebrates, and EFH are generally associated with commercial harvesting and fishing activities, fisheries bycatch, water quality degradation and pollution, effects on benthic habitat dredging and bottom trawling, accidental fuel leaks or spills, and climate change.

Some mobile invertebrates can migrate long distances and encounter a wide range of stressors over broad geographical scales (e.g., longfin and shortfin squid). Their mobility and broad range of habitat requirements may also mean that limited disturbance may not have measurable effects on their stocks (populations). This would apply to finfish, where populations are composed largely of long-range migratory species; it would be expected that their mobility and broad ranges would preclude many temporary and short-term impacts associated with ongoing offshore impacts throughout the geographic analysis area. Invertebrates with more restricted geographical ranges or sessile invertebrates or life stages can be subject to the above stressors over time and can be more sensitive (Guida et al. 2017).

Seafloor habitat is routinely disturbed through anchoring, submarine cable installation, dredging (for navigation, marine minerals extraction, and military purposes), and commercial fishing use of bottom trawls and dredge fishing methods. Abandoned or lost fishing gear remains in the aquatic environment for extended time periods, often entangling or trapping mobile invertebrate and fish species. Based on data from NOAA, bycatch affects many species throughout the geographic analysis area—most notably, windowpane flounder, blueback herring, shark species, and hake species; most bycatch is a result of open area scallop trawls, large-mesh otter trawls, conch pots, and fish traps (NOAA 2019). Water-quality impacts from ongoing onshore and offshore activities affect nearshore habitats, and accidental spills can occur from pipeline or marine shipping. Invasive species can be accidentally released in the discharge of ballast water and bilge water from marine vessels. The resulting impacts on invertebrates and finfish depend on many factors but can be widespread and permanent, especially if the invasive species becomes established and outcompetes native species.

Global climate change could affect the distribution and abundance of invertebrates and their food sources, primarily through increased water temperatures but also through changes to ocean currents and increased acidity. Finfish and invertebrate migration patterns can be influenced by warmer waters, as can the frequency or magnitude of disease (Hare et al. 2016). Regional water temperatures that increasingly exceed the thermal stress threshold may affect the recovery of the American lobster fishery off the East Coast of the U.S. (Rheuban et al. 2017). Ocean acidification driven by climate change is contributing to reduced growth, and, in some cases, decline of invertebrate species with calcareous shells. Increased freshwater input into nearshore estuarine habitats can result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016).

Based on a recent study, marine, estuarine, and riverine habitat types were found to be moderately to highly vulnerable to stressors resulting from climate change (Farr et al. 2021). In general, rocky and mud bottom, intertidal, special areas of conservation, kelp, coral, and sponge habitats were considered the most vulnerable habitats to climate change in marine ecosystems (Farr et al. 2021). Similarly, estuarine habitats considered most vulnerable to climate change include intertidal mud and rocky bottom, shellfish, kelp, submerged aquatic vegetation, and native wetland habitats (Farr et al. 2021). Riverine habitats found to be most vulnerable to climate change include native wetland, sandy bottom, water column, and submerged aquatic vegetation habitats (Farr et al. 2021). As invertebrate habitat, finfish habitat, and EFH may overlap with these habitat types, the environmental study conducted by Farr et al.

(2021) suggests that marine life and habitats could experience dramatic changes and decline over time as impacts from climate change continue.

Vessel noise

Noise from large commercial ships, as well as smaller fishing and recreational vessels, is likely to be present and persistent in the geographical area. A description of the physical qualities of vessel noise can be found in Appendix B, *Supplemental Information*. Note that the specific effects of dynamic positioning noise on fishes and invertebrates have not been studied but are expected to be similar to that of transiting vessels as described below.

Avoidance of vessels and vessel noise has been observed in several pelagic, schooling fishes, including Atlantic herring (Vabo et al. 2002), Atlantic cod (Handegard 2003) and others (reviewed in De Robertis and Handegard [2013]). Fish may dive toward the seafloor, move horizontally out of the vessel's path, or disperse from their school (De Robertis and Handegard 2013). These types of changes in schooling behavior could render individual fish more vulnerable to predation, but are unlikely to have population-level effects. A body of recent work has documented other, more subtle behaviors in response to vessel noise, but has focused solely on tropical reef-dwelling fish. For example, damselfish antipredator responses (Ferrari et al. 2018; Simpson et al. 2016) and boldness (Holmes et al. 2017) seem to decrease in the presence of vessel noise, while nest-guarding behaviors seem to increase (Nedelec et al. 2017). There is some evidence of habituation, though: Nedelec et al. (2016) found that domino damselfish increased hiding and ventilation rates after two days of vessel sound playbacks, but responses diminished after one to two weeks, indicating habituation over longer durations.

It is possible that vessel noise could induce physiological stress or lead to acoustic masking in fishes. Several studies have shown an increase in cortisol, a stress hormone, after playbacks of vessel noise (Wysocki et al. 2006; Nichols et al. 2015; Celi et al. 2016), but other work has shown that the handling stress of the experiment itself may induce a greater stress response than an acoustic stimulus (Harding et al. 2020; Staaterman et al. 2020). The cavitation of vessel propellors produces low-frequency, nearly continuous sound that is audible by most fishes and invertebrates and could mask important auditory cues, including conspecific communication (Haver et al. 2021; Parsons et al. 2021). Stanley et al. (2017) demonstrated that the communication range of both haddock and cod (species with swim bladders but lacking connections to the ear) would be significantly reduced in the presence of vessel noise, which is frequent in their habitat in Cape Cod Bay. Generally, species that are sensitive to acoustic pressure would experience masking at greater distances than those that are only sensitive to particle motion (Section 3.5.5.1 includes an explanation of fish hearing). Stanley et al. (2017) and Rogers et al. (2021) theorize that fish may be able to use the directional nature of particle motion to extract meaning from short range cues (e.g., other fish vocalizations) even in the presence of distant noise from vessels.

The limited research on invertebrates' response to vessel noise has yielded inconsistent findings thus far. Some crustaceans seem to increase oxygen consumption (crabs: Wale et al. 2013) or show increases in some hemolymph (an invertebrate analog to blood) biomarkers like glucose and heat-shock proteins, which are indicators of stress (spiny lobsters: Filiciotto et al. 2014). Other species (American lobsters and blue crabs) showed no difference in hemolymph parameters but spent less time handling food, defending food, and initiating fights with competitors (Hudson et al. 2022). While there does seem to be some evidence that certain behaviors and stress biomarkers in invertebrates could be negatively affected by vessel noise, it is difficult to draw conclusions from this work because it has been limited to the laboratory, and in most cases, did not measure particle motion as the relevant cue.

The planktonic larvae of fishes and invertebrates may experience acoustic masking from continuous sound sources like vessels. Several studies have shown that larvae are sensitive to acoustic cues, and may use these signals to navigate towards suitable settlement habitat (Simpson et al. 2005; Montgomery 2006), metamorphosize into their juvenile forms (Stanley et al. 2012), or even to maintain group cohesion during their pelagic journey (Staaterman et al. 2014). However, given the short range of such biologically relevant signals for particle motion-sensitive animals (Kaplan and Mooney 2016), the spatial scale at which these cues are relevant is rather small. If vessel transit areas overlap with settlement habitat, it is possible that vessel noise could mask some biologically relevant sounds (e.g., Holles et al. 2013), but these effects are expected to be short-term and would occur over a small spatial area.

Overall, vessel noise may lead to changes in natural behaviors, could induce a stress response, or may cause acoustic masking in fishes, invertebrates, and larvae, but these effects will be species- and context-specific. Impacts are expected to occur over a relatively small area, especially species without swim bladders that are only sensitive to particle motion. Some species may become habituated to persistent vessel noise. Vessel noise is expected to be short term and would, therefore, have a minor impact on fishes and invertebrates.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on finfish, invertebrates, and EFH include:

- Continued O&M of the Block Island project (5 WTGs) installed in state waters;
- Continued O&M of the CVOW project (2 WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.
- Ongoing O&M of Block Island and CVOW projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect finfish, invertebrates, and EFH through the primary IPFs of noise, presence of structures, and disturbance.

Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, and seafloor disturbance that are described in detail in Section 3.13.3.2 for planned offshore wind activities, but the impacts would be of lower intensity.

3.5.5.3.2 Future Offshore Wind Activities (without Proposed Action)

All offshore wind leasing activities that BOEM considers reasonably foreseeable by lease areas and projects are presented in Appendix D, Table D-3. Appendix D, Section D.2, provides a description of ongoing and planned activities. The geographic analysis area for the Project includes the Northeast Continental Shelf LME and the Southeast Continental Shelf LME. There are currently two offshore wind lease areas to the north of the Project area, Skipjack Offshore Energy, LLC (OCS-A 0519), and GSOE I, LLC (OCS-A 0482). Skipjack Offshore Energy is approximately 10 miles (16.1 kilometers) from the Maryland

Offshore Wind Lease Area and is therefore the closest to the planned project, though all the planned offshore wind projects on the U.S. Atlantic coast are within the geographic analysis area (Figure 3.5-2). Offshore wind development along the Atlantic coast is expected to result in approximately 3,081 offshore structures over the next seven years. BOEM expects future offshore wind activities to affect benthic resources through the following primary IPFs.

Accidental releases: Using the assumptions in Appendix D, *Planned Activities Scenario*, there would be a low risk of a release of hydrocarbon products from any of approximately 3,081 offshore structures, from approximately 30 offshore wind projects. From 2000 to 2009, the average spill size for vessels other than tanker ships and tanker barges was 88 gallons (333 liters) (USCG 2011), should a spill from a vessel associated with the offshore wind activities occur, BOEM anticipates the volume would be similar. According to BOEM modeling (Bejarano et al. 2013), a release of 128,000 gallons (484,533 liters) is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons (7,571 liters) or less is likely to occur every 5 to 20 years. The probability of an accidental discharge or spill occurring simultaneously from multiple WTGs is extremely low. An oil weathering model, used by NOAA predicted that a spill of 105,000 gallons (397,468 liters) would dissipate rapidly, and depending on the ambient conditions would reach a concentration of 0.05 percent between 0.5 and 2.5 days (Tetra Tech Inc. 2015). The volume tested was 1,931 times the average volume recorded by the USCG, suggesting that 88 gallons (333 liters) would dissipate much faster. Therefore, along with the low likelihood of a large release, and the rapid dissipation impacts on finfish, invertebrates, and EFH are extremely unlikely.

Marine invasive species have been accidentally introduced into habitats along the U.S. Atlantic seaboard in multiple instances. Pederson et al. (2005) list the numerous vectors that transport invasive organisms and inoculate new areas. Ballast water exchange/discharge and biofouling are the two main vectors for invasive species introduction (Carlton et al. 1995; Drake 2015). Some of the dominant vectors are shipping and hull fouling, aquaculture, marine recreational activities, commercial and recreational fishing, and ornamental trades. Still, canals, offshore drilling, hull cleaning activities, habitat restoration, research, and floating marine debris (particularly plastics) may also facilitate the transfer of invasive organisms (Pederson et al. 2005). The offshore wind industry would increase the risk of accidental releases of invasive species due to increased maritime traffic. Vessels required for the importation of components of the WTGs, OSSs, and submarine power cables and the specialized construction vessels from international ports could represent transport vectors. The impacts related to the release and establishment of invasive species on finfish, invertebrates, and EFH are multifaceted. Invasive species such as the Asian shore crab (*Hemigrapsus sanguineus*) have spread throughout most of the MAB and northern areas of the SAB. The Asian shore crab was first collected in the Delaware Bay area in 1988 and extended north to Maine and south to North Carolina (Epifanio 2013). The impacts of invasive species on finfish, invertebrates, and EFH could be strongly adverse, widespread, and permanent. The introduction and impact of the Asian shore crab in the geographical analysis areas is a prime example of a species that became established and has out-competed native fauna and adversely modified the coastal habitat. The increase in this risk related to the offshore wind industry would be slight compared to the risk from ongoing activities. The potential for introducing an invasive species through ballast water releases or biofouling from installation activities is estimated to be short term and localized and to result in limited changes to finfish, invertebrates, and EFH. As such, accidental releases from offshore wind development would not be expected to contribute appreciably to overall impacts on finfish, invertebrates, and EFH; impacts on these resources would be considered negligible.

Anchoring: Vessel anchoring related to ongoing, commercial, and recreational activities continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. Spud barges, jack-up vessels, or DP vessels may be required for other offshore wind projects; only spud barges and jack-up vessels will affect the seafloor during emplacement and removal. Impacts on finfish, invertebrates, and EFH are greatest for sensitive EFH (e.g., eelgrass, hard bottom) and sessile or slow-moving species (e.g., corals, sponges, sedentary shellfish). Impacts from anchoring would occur during construction and installation activities related to the placement of WTGs and their scour protection, placement of OSSs, and installation of the submarine power cable arrays, depending on the vessels used. Impacts resulting from anchoring or bottom contact would include increased turbidity levels and potential for contact causing mortality of demersal species and, possibly, degradation of sensitive habitats. All impacts would be localized; turbidity would be temporary; impacts from anchor contact (or spud can or leg emplacement) would recover in the short term. Degradation of sensitive habitats such as certain types of hard bottom or eelgrass, if it occurs, could cause long-term to permanent impacts. Construction operations within the Project footprint would not occur simultaneously and the footprint of each anchoring would be relatively small and of short duration and would represent a minor impact on the finfish and invertebrate community.

EMFs and cable heat: EMFs emanate continuously from installed electrical power transmission cables. Biologically notable impacts on finfish, invertebrates, and EFH have not been documented for alternating current (AC) cables (Thomsen et al. 2015; CSA Ocean Sciences Inc. and Exponent 2019), but behavioral impacts have been documented for benthic species (skates and lobster) present near operating direct current (DC) cables (Hutchison et al. 2018). These impacts are localized and affect the animals only while they are within the EMF. Transmission cables using HVAC emit ten times less magnetic field than HVDC (Taormina et al. 2018); therefore, HVAC cables are likely to have less EMF impacts on benthic species. There is no evidence to indicate that EMFs from undersea AC power cables negatively affect commercially and recreationally important fish species (CSA Ocean Sciences Inc. and Exponent 2019). The combined impacts of EMFs over the geographical extent of all the wind energy lease areas on finfish, invertebrates, and EFH from ongoing and planned actions would likely range from negligible to minor.

Light: Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles (e.g., spawning), possibly leading to short-term impacts. Marine vessels have an array of lights, including navigational lights and deck lights. There is little downward-focused lighting and, therefore, only a small fraction of the emitted light enters the water. Light impacts from vessels can be mitigated through application of BOEM lighting guidelines (BOEM 2021). Light sources from the estimated (PDE up to 121 WTGs and 4 OSSs) would occur during their operational phase, and these would be incrementally added over time. Lighting of turbines and other structures would be minimal (navigation and aviation hazard lights) and in accordance with BOEM guidance. This would increase the amount of light over time within the geographic analysis area. The impacts from lighting related to the planned offshore wind activities are highly localized and spatially restricted in comparison to future non-offshore wind activities. In the context of reasonably foreseeable environmental trends, the combined impacts of this sub-IPF on finfish, invertebrates, and EFH from offshore wind activities would likely be short term, limited to highly localized attraction, and includes some potential disruption of spawning cycles. Light impacts on finfish and invertebrates would be considered negligible.

Cable emplacement and maintenance: The proposed offshore wind activities would require cable installation and maintenance activities that would disturb the seafloor and cause temporary increases in suspended sediment; these disturbances are local and limited to the cable route. Cable installation and maintenance would use ground disturbance (grapnel runs), jetting, jet plowing, or dredging equipment to install and support cable burial maintenance operations. The total area of direct seafloor disturbance related to new cable emplacement would not be simultaneous. Cable installation and burial maintenance activities could disturb, displace, and injure finfish and invertebrates and result in temporary to long-term habitat alterations, depending on the benthic habitat type. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur (see also the IPF of *Sediment deposition and burial*). Overall, the combined impacts from the ongoing and planned offshore wind activities along the Atlantic OCS would likely be moderate but temporally short and constructed in a phased spatial approach.

Noise: Anthropogenic noises on the OCS associated with offshore wind development include noise from aircraft, pile-driving activities, G&G surveys, cable-laying activities, WTG operations, and vessel traffic. These noises could cause temporary effects on some finfish and invertebrate species and their EFH resources by displacing them and, potentially, changing their temporal feeding and migratory behavior. BOEM anticipates these impacts would be localized and temporary. Potential impacts could be greater if avoidance and displacement of finfish and invertebrates occurs during seasonal spawning or migration periods.

The type of effect will depend on the type of noise, the noise level to which an animal is exposed, and the duration of the exposure. Sources of anthropogenic noise can generally be categorized in two ways; impulsive noise which is characterized by a rapid increase in sound pressure over a short period of time, and non-impulsive noise, which does not have the characteristic rapid rise in sound pressure seen in impulsive sources. Noise can also be characterized as intermittent or continuous depending on how often noise is generated over time. Both types of noise may be produced by activities related to offshore wind projects. Acoustic thresholds, which represent the minimal sound level at which the onset of a particular effect may occur, are available for fish grouped either by size (less than 2 grams and greater than or equal to 2 grams) as recommended by the Fisheries Hydroacoustic Working Group (FHWG 2008) and adopted by the Greater Atlantic Region Fisheries Office (GARFO 2021) or by physiology as recommended by Popper et al. (2014), and are provided in Table 3.5.5-4.

Table 3.5.5-4. Acoustic thresholds for fish for each type of impact associated with impulsive and non-impulsive noise sources

Fish Category	Impulsive Sounds				Non-impulsive Sounds		
	Mortality and Potential Mortal Injury	Recoverable Injury	TTS	Behavior	Recoverable Injury	TTS	Behavior
Fish <2 grams	--	L_{pk} 206 dB re 1 µPa	--	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Fish <2 grams		SEL_{24h} 183 dB re 1 µPa^2 s	--	SPL 150 dB re 1 µPa			SPL 150 dB re 1 µPa
Fish ≥2 grams	--	L_{pk} 206 dB re 1 µPa	--	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Fish ≥2 grams	--	SEL_{24h} 187 dB re 1 µPa^2 s	--	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Fishes without swim bladders	L_{pk} 213 dB re 1 µPa	L_{pk} 213 dB re 1 µPa	SEL_{24h} 186 dB re 1 µPa^2 s	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Fishes without swim bladders	SEL_{24h} 219 dB re 1 µPa^2 s	SEL_{24h} 216 dB re 1 µPa^2 s	SEL_{24h} 186 dB re 1 µPa^2 s	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Fishes with swim bladder not involved in hearing	L_{pk} 207 dB re 1 µPa	L_{pk} 207 dB re 1 µPa	SEL_{24h} 186 dB re 1 µPa^2 s	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Fishes with swim bladder not involved in hearing	SEL_{24h} 210 dB re 1 µPa^2 s	SEL_{24h} 203 dB re 1 µPa^2 s	SEL_{24h} 186 dB re 1 µPa^2 s	SPL 150 dB re 1 µPa			SPL 150 dB re 1 µPa
Fishes with swim bladder involved in hearing	L_{pk} 207 dB re 1 µPa	L_{pk} k 207 dB re 1 µPa	SEL_{24h} 186 dB re 1 µPa^2 s	SPL 150 dB re 1 µPa	SPL 150 dB re 1 µPa	SPL 150 dB re 1 µPa	SPL 150 dB re 1 µPa
Fishes with swim bladder involved in hearing	SEL_{24h} 207 dB re 1 µPa^2 s	SEL_{24h} 203 dB re 1 µPa^2 s	SEL_{24h} 186 dB re 1 µPa2 s	SPL 150 dB re 1 µPa			SPL 150 dB re 1 µPa
Eggs and larvae	L_{pk} 207 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa
Eggs and larvae	SEL_{24h} 210 dB re 1 µPa^2 s	--	--	SPL 150 dB re 1 µPa	--	--	SPL 150 dB re 1 µPa

Sources: FHWG 2008; GARFO 2021; Popper et al. 2014.

- = not available for the fish category or impact type; µPa = micropascal; dB re 1 µPa = decibel referenced to 1 micropascal; dB re 1 µPa^2 s = decibel referenced to 1 micropascal squared second; L_{pk} = peak sound pressure; SEL_{24h} = sound exposure level over 24 hours; SPL = root-mean-square sound pressure level; TTS = temporary threshold shift

Noise from construction and installation of approximately 3,081 WTGs and associated OSSs would result in local and temporary impacts on finfish and invertebrates (see also the sub-IPF for *Noise: Pile-driving*). The main source of noise via construction would be through impact pile-driving. Other sources of noise would be related to vessel operations supporting the construction and maintenance of offshore wind projects; high-resolution geophysical (HRG) survey activities in support of site characterization surveys before and during construction; vibratory pile-driving used during the installation of export cables; cable trenching activities; and operational noise produced by the WTGs.

In comparison to future non-offshore activities, vessel activities during the projected offshore wind activities would likely not lead to noticeable impacts on finfish, invertebrates, and their EFH resources.

Ongoing and future HRG surveys conducted for offshore wind development produce noise around sites of investigation. Equipment used during these surveys include both impulsive (e.g., sparker systems) and non-impulsive sources (e.g., compressed high-intensity radiated pulse sonar) (Crocker and Fratantonio 2016; Crocker et al. 2019). Fish and invertebrates are known to be sensitive to frequencies below approximately 2 kilohertz (Hawkins and Johnstone 1978; Lovell et al. 2005; Casper et al. 2013; Popper et al. 2014) which may overlap with noise produced by these equipment (Crocker and Fratantonio 2016; Crocker et al. 2019) and may, therefore, result in exposures for fish to above-threshold noise during these surveys. These activities can disturb finfish and invertebrates in the immediate vicinity of the survey and can cause temporary behavioral changes. Site characterization surveys are anticipated to occur infrequently in relation to the offshore wind development over the next 2 to 10 years. The intensity and extent of the resulting impacts are difficult to generalize but are likely local and temporary, and the *Biological Assessment for Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf* (Baker and Howson 2021) concluded that no ESA-listed fish species are likely to be adversely affected or experience long-term impacts from this activity. In the context of reasonably foreseeable environmental trends, the impacts from noise generated by surveys for proposed offshore wind development would likely be approximately equal to the sum of all these impacts and would likely qualify as negligible.

During the operational phase of the offshore wind development, some finfish and invertebrates may be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Farm, this low-frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (2015), sound pressure levels would be expected to be at or below ambient levels at relatively short distances (approximately 164 feet [50 meters]) from WTG foundations. These low levels of elevated noise likely have little to no impact on finfish and invertebrates in close proximity to the source. As documented by English et al. (2017), there are very few field studies that have correlated pile-driving with behavioral aspects of finfish or motile invertebrates (squid) that can demonstrate noise would adversely affect finfish, invertebrates, and EFH. Additionally, as discussed in the presence of structures IPF, the WTGs are likely to provide a new artificial reef habitat for many fish species, which will attract them to the sites, providing further evidence of the non-measurable, negligible impact of noise produced during operations.

Noise from impact pile-driving is transmitted through the water column and through the seafloor. The intensity and magnitude of this energy could result in injury to finfish and invertebrates in a localized area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. Eggs, embryos, and larvae of finfish and invertebrates could also be affected and could result in developmental delays and malformations, and reduced rates of settlement for sessile species which could have broader implications for these populations (Hawkins and Popper 2017; Weilgart 2018). Potentially injurious noise could also be considered as rendering EFH temporarily unavailable or unsuitable during pile-driving activities. The extent of pile-driving acoustic impacts depends on pile size, hammer energy, and local acoustic conditions. Noise from pile-driving from offshore wind farm construction would occur during installation of foundations for offshore structures for 2 to 3 hours per foundation or 4 to 6 hours per day over a 6- to 12-year period, increasing the risk of injury to finfish and invertebrates in a limited radius around each pile and short-term stress and behavioral changes to individuals over a broader area and would predominantly effect fishes that have swim bladders connected to the ear (otoliths) and some invertebrates such as squid that have lateral lines and statocysts that detect particle motion (water movement [Mooney et al. 2010; Solé et al. 2013]). However, ranges to the potential onset for injury assume, in part, that a fish will be present in the ensonified area for up to 24 hours which, with fish movement and behavior, is unlikely to occur as these species are highly motile.

Additionally, behavioral impacts are based on a root-mean-square sound pressure level (SPL) threshold of 150 decibels referenced to 1 micropascal (dB re 1 µPa) (Table 3.5-4), which has not been tested for biologically notable behavioral reactions in fish, and behavioral responses in fish may range from a heightened awareness of the noise to changes in movement, behavior (including abandonment of spawning activities) or feeding activity (Popper and Hastings 2009; Mahanty et al. 2017); therefore, it should be considered a conservative estimate for the onset of behavioral responses. Impact pile-driving could mask biologically important noises during construction activities, which could indirectly affect reproduction, foraging, and predator avoidance (Alves et al. 2017; Weilgart 2018), but this would only be expected to result in population-level effects if there was long-term exposure. Noise produced by impact pile-driving would be intermittent and temporary, and finfish and invertebrate populations would recover completely after construction. Additionally, all future proposed wind energy development projects would implement mitigation measures such as noise attenuation systems (e.g., bubble curtains) and protected species monitoring, so impacts from impact pile-driving would be negligible to moderate depending on the species. Finfish, particularly those with swim bladder, are likely to face a higher risk of exposure to above-threshold noise as they are known to have a higher sensitivity to underwater sound pressure (Popper et al. 2014). Other finfish species without swim bladders, squid species, elasmobranchs, and invertebrates are likely to face a lower risk of exposure to noise sufficient to elicit acoustic injury as they are less sensitive to underwater sound pressure (Popper et al. 2014). However, studies show they are receptive to the particle motion component of underwater sound (Appendix B, *Supplemental Information* contains details on particle motion). While there are currently no accepted thresholds for potential impacts on fish from particle motion, behavioral responses to the particle motion produced by impact pile-driving activities may occur (Mooney et al. 2020; Aimon et al. 2021; Jézéquel et al. 2021). Regardless of the species or effect, impacts from pile-driving are expected to be short-term and localized, and would not result in long-term effects to populations.

Vibratory pile-driving used during export cable installation and port facility construction is the source of intermittent non-impulsive noise expected to result in the highest risk of exposure to fish during offshore wind projects. Typical noise levels generated by vibratory pile-driving are not expected to exceed injury threshold for fish (Table 3.5-4) but may exceed the behavioral disturbance threshold a few kilometers from the source. However, as discussed for impact pile-driving, the behavioral onset threshold should be viewed as highly conservative and does not necessarily correspond to biologically notable impacts for fish populations. Additionally, vibratory pile-driving activities would occur over a very short time period, only a few days at a time for individual projects, limiting the risks from long-term exposure to finfish and invertebrates. Given this low exposure probability and improbability of injury occurring, impacts on finfish, invertebrates, and EFH from vibratory pile-driving activities would be negligible.

Trenching activities and burial methods conducted in support of cable installation are known to emit noise, comparable to those produced by use of vessels with DP thrusters. These disturbances are temporary, local, and extend only a short distance beyond the cable lay corridor. Impacts of this noise source are typically less prominent than the impacts arising from physical disturbance and subsequent sediment suspension. Cable burial maintenance operations would be infrequent over the life of the proposed offshore wind sites; related noise impacts would be temporary, local, and extend only a short distance beyond the cable route, resulting in negligible impacts that are temporary, short, and spatially localized to the trenching/burial operations.

In the context of reasonably foreseeable environmental trends, the combined impact of pile-driving noise on finfish, invertebrates, and EFH from future proposed wind energy development, would likely qualify as moderate. Above-threshold noise may extend several kilometers from the source, and over a longer time scale, noise from impact pile-driving could affect the same populations or individuals multiple times in 1 year or in sequential years, but it is currently unknown whether a reduction in impact would be possible if piles were driven either sequentially or concurrently (BOEM 2021). However, it is expected that fish would move to avoid more severe impacts, and with mitigation such as noise attenuation systems, no long-lasting population-level impacts are expected.

Port utilization: The major ports in the U.S. are seeing increased numbers of vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 37 years. Multiple ports along the Atlantic seaboard are investing in expanding and modifying port facilities to accommodate supporting offshore wind energy projects. These development expansion activities are in part directly associated with the offshore wind developments within the geographic analysis area. Progressive increases in port utilization due to offshore wind energy development would lead to increased vessel traffic through 2030. Although the degree of impacts on EFH would likely be undetectable outside the immediate vicinity of the ports, adverse impacts on EFH for certain species, life stages, or both may lead to impacts on finfish and invertebrates beyond the vicinity of the port. Based on the expected level of port utilization and related activities (e.g., dredging), impacts on finfish, invertebrates, and EFH from offshore wind activities would be expected to be negligible.

Presence of structures: The addition of structure to an open sand bottom seascape can produce the potential for multiple IPFs on species of finfish and invertebrates and their associated EFHs within the geographic analysis area. The impacts can include direct displacement and possible mortality of some slow moving and infaunal invertebrate species. Other sub-IPFs will include attraction to these artificial substrates by both finfish and invertebrates and the loss of commercial and recreational fishing gear that is fouled with these structures. The risks of impact from the listed sub-IPFs are proportional to the amount of structure present. Offshore wind projects are estimated to add up to 3,081 offshore structures, each potentially requiring scour protection to be emplaced around its foundation. At this stage, it is unknown how many acres of habitat within the geographic analysis area would be impacted; however, some impacts on benthic and demersal finfish, invertebrates, and their respective EFHs would be permanent.

Impacts related to commercial and recreational gear loss are localized but can affect finfish and motile invertebrate assemblages and other marine vertebrates (e.g., marine mammals, sea turtles) through entanglement issues. This risk of entanglement and harm to individuals from fouled commercial and recreational gear on any offshore structure would increase with the addition of hard substrate. Fouled gear would result in highly localized, periodic, short-term impacts on finfish, invertebrates, and EFH. The occurrence of gear losses specifically related to WTGs is generally rare, and the impacts related finfish and invertebrates through this sub-IPF from proposed offshore wind project would likely be negligible.

Human-made structures, especially tall vertical structures that extend from the seafloor to the surface such as foundations for towers, continuously alter local water flow at a fine scale. Although water flow typically returns to background levels within a relatively short distance from a structure and impacts on finfish, invertebrates, and EFH are typically undetectable (BOEM 2021), the cumulative effects of the presence of multiple structures on local or regional-scale hydrodynamic processes are not currently well understood. A recent study completed by BOEM assessed the mesoscale effects of offshore wind energy facilities on coastal and oceanic environmental conditions and habitat by examining how oceanic responses will change after turbines are installed, particularly with regards to turbulent mixing, bed shear stress, and larval transport (Johnson et al. 2021). This study focused on the Massachusetts-Rhode Island marine areas where proposed wind energy lease areas are in the licensing review process. The modeling study assessed four post-installation scenarios. Two species of finfish (silver hake and summer flounder) and one invertebrate (Atlantic sea scallop) were selected as focal species. The results of this modeling effort indicate that, at a regional fisheries management level, these shifts are not considered overly relevant with regards to larval settlement. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are also not well understood. Overall, BOEM anticipates offshore wind activities (exclusive of the Proposed Action) would cause a negligible impact on finish, invertebrates, and EFH through this sub-IPF based on currently available information.

New structures will be installed within the geographic area of analysis through 2030. These added structures may attract finfish and invertebrates that approach the structures during routine movement or during migration. Such attraction could alter or slow migratory movements. However, temperature is expected to be a bigger driver for habitat occupation and species movement (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2019). Migratory fish and invertebrates have exhibited an ability to move away from structures unimpeded. In the context of reasonably foreseeable environmental trends, the presence of many distinct structures from ongoing and planned actions, exclusive of the Proposed Action, could increase the time required for migrations, resulting in a moderate impact.

The geographic analysis area is primarily a homogenous sandy seascape exhibiting both flat bottom Relief and benthic features such as ripples, sand waves, and ridges (MARCO n.d.; Stevenson et al. 2004; USGS 2014). Benthic features such as ripples and ridges are important contributors to diversity and abundance of benthic macrofauna (Stevenson et al. 2004). Areas of heterogenous, hard-bottom, and other complex habitats also exist within the geographic analysis area (MARCO n.d.; Stevenson et al. 2004; USGS 2014). Habitat complexity is an important contributor to diversity and abundance of a large number of commercially and ecologically important fish and invertebrate species (e.g., through facilitating refuge from prey during early life stages, providing areas of post-larval settlement) (Malatesta and Auster 1999; Lowery et al. 2007). Wind energy structures, including WTG foundations and the scour protection around the foundations, create uncommon relief in areas that are predominantly flat sandy seascapes. Structure-oriented fishes are attracted to these hard substrate installations. Impacts on the soft sediment habitats from structure presence are local and can be short-term to permanent for the life of each wind energy project, potentially for as long as each structure remains in place. Fish aggregations found in association with seafloor structures can provide localized, short-term to permanent, beneficial impacts on some demersal hard bottom associated fish species due to increased prey species availability. Increased fish presence around offshore structures may provide more prey opportunities for predators as documented on other artificial reef systems (Hixon and Beets. 1989, Connell. 1997, Leitao et al. 2008). Initial recruitment to these hard substrates may result in the increased abundance of certain fish and epifaunal invertebrate species (Claisse et al. 2014; Smith et al. 2016; BOEM 2021a); such recruitment may result in the development of diverse demersal fish and invertebrate assemblages. However, such high initial diversity levels may decline over time as early colonizers are replaced by successional communities (Degraer et al. 2018). Furthermore, colonization by non-indigenous biota (e.g., invasive or nuisance species) may alter localized benthic or epipelagic communities (Glasby et al. 2007). Considering the above information, BOEM anticipates the impacts of the presence of structures on finfish, invertebrates, and EFH would be moderate adverse and include moderate beneficial impacts. All impacts would be permanent as long as the structures remain.

Regulated fishing effort: While primarily an ongoing activity, regulated fishing effort impacts finfish, invertebrates, and EFH by modifying the nature, distribution, and intensity of fishing-related impacts (displacement, mortality, and habitat disturbance). Regulated fishing effort results in the removal of a substantial amount of the annually produced biomass of commercially regulated finfish and invertebrates and can also influence bycatch of non-regulated species, leading to moderate impacts. Offshore wind development other than the Project could influence finfish, invertebrates, and EFH through this IPF by influencing the management measures chosen to support fisheries management goals, which may alter the nature, distribution, and intensity of fishing-related impacts on finfish, invertebrates, and EFH. Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, provides additional details.

Seabed profile alterations: The process of cable installation can cause localized short-term impacts (habitat alteration, change in complexity) through seabed profile alterations, as well as through sediment mobilization and redeposition. Assuming the extent of such impacts is proportional to the length of cable installed (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2), such impacts from offshore wind activities could be extensive within the proposed inter-array and offshore export cable routes. Dredging would most likely occur in sand wave areas where typical jet plowing is insufficient to meet cable burial target depths. Sand waves that are dredged would likely be redeposited in areas containing similar like-sediment areas. Any particular sand wave may not recover to the same height and width as pre-disturbance. However, the habitat function would largely recover post-disturbance, although full recovery of faunal assemblage may require several years (Boyd et al. 2005). Therefore, seabed profile alterations, while locally intense, are expected to have minor impacts on finfish, invertebrates, and EFH on a regional scale.

Sediment deposition and burial: Cable installation and burial activities supporting the proposed offshore wind development projects will be the primary cause for sediment deposition and burial impacts within the geographic analysis area. Cable installation activities in certain regions of the geographic analysis area would use jet plowing and dredging installation methodologies to install and bury the inter-array and offshore export cables associated for each project. Generally, permit requirements for these operations will mandate mitigation activities to reduce the temporal and spatial impacts related to both dredging and jet plow activities. Even with stringent adherence to mitigation procedures, sediment dispersion and redisposition could have negative impacts on eggs and larvae of finfish and invertebrates. This is particularly critical for demersal eggs such as longfin squid, which are known to have high rates of egg mortality if egg masses are exposed to abrasion or burial (BOEM 2021a). Impacts related to sediment deposition and burial may vary based on season, or time of year and regional conditions within each proposed future project area. In the context of reasonably foreseeable environmental trends, the impacts of sediment deposition and burial on finfish, invertebrates, and their EFH from offshore wind development projects would likely be minor.

Climate change: Several sub-IPFs related to climate change, including ocean acidification, warming/sea level rise, altered habitat or ecology, altered migration patterns, and increased disease frequency, could result in long-term, potentially high-consequence risks to finfish, invertebrates, and EFH. Ocean acidification has been shown to have negative impacts on the settlement and survival of shellfish (PMEL 2020). These impacts could lead to changes in prey abundance and distribution, changes in migratory patterns, and timing. Appendix D, *Planned Activities Scenario* provides more details on the expected contribution of offshore wind to climate change. The intensity of impacts resulting from climate change are uncertain but are anticipated to qualify as minor to moderate.

3.5.5.3.3 Impacts of Alternative A on ESA-Listed Species

Fish species from the geographic analysis area, and specifically within the Offshore Project area, listed under the ESA include the Atlantic salmon (*Salmo salar*), Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), giant manta ray (*Mobula birostris*), oceanic whitetip shark (*Carcharhinus longimanus*), and scalloped hammerhead shark (*Sphyrna lewini*). The Atlantic salmon are found in northern New England into Maine and are not likely within the Maryland Lease Area. The

Giant manta and oceanic whitetip sharks are found within New England and MAB from late summer through early fall (NOAA Fisheries 2022b). The scalloped hammerhead would most likely transit through the project site following prey species migrations (herring, mackerel, sardines, and squid). The Atlantic sturgeon and the shortnose sturgeon are the most likely to be found within the Project area, inshore for the shortnose and Atlantic sturgeon, and offshore for the Atlantic sturgeon. A recent NMFS Biological Opinion (2022) reviewed the development and utilization of the New Jersey Wind Port, (Alloway Creek, NJ). The Biological Opinion assessed the take of Atlantic and shortnose sturgeon over 27 years of port operations. The main source of impact was vessel strikes through increased port utilization. The potential for impacts related to port utilization and vessel strike on shortnose and Atlantic Sturgeon could result in a moderate impact. The Biological Opinion concluded that utilization of the New Jersey Wind Port would result in an adverse effect but not result in a population level affect for the New York Bight DPS (NMFS 2022). A secondary impact related to wind energy projects on Atlantic sturgeon is noise impacts from pile-driving. The combination of vessel strike and sound impacts would result in a potential moderate impact on Atlantic sturgeon.

3.5.5.3.4 Conclusions

Under the No Action Alternative finfish, invertebrates, and EFH would continue to be affected by existing environmental trends and ongoing activities. Ongoing activities are expected to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on finfish, invertebrates, and EFH. These effects are primarily driven by offshore construction impacts and presence of structures.

Ongoing activities and offshore wind would continue to have temporary and permanent impacts (disturbance, displacement, injury, mortality, habitat degradation, habitat conversion) on finfish, invertebrates, and associated EFH primarily through resource exploitation/regulated fishing effort, dredging, bottom trawling, bycatch, anthropogenic noise, new cable emplacement, the presence of structures, and climate change. Ongoing activities, especially interactions with commercial fisheries, bottom disturbance, presence of structures, and climate change, would be **moderate**. In addition to ongoing activities, the impacts of planned actions other than offshore wind development, including new submarine cables and pipelines, marine minerals extraction, port expansions, and the installation of new structures on the OCS would be **minor**. The combination of ongoing activities and reasonably foreseeable activities other than offshore wind would result in **moderate** impacts on finfish, invertebrates, and EFH within the geographic analysis area.

3.5.5.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the following sections. The following PDE parameters (Appendix C*, Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on finfish, invertebrates, and EFH.

- The number, size, and location of WTGs and placement of the OSSs.
- The time of year during which construction occurs.

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

- **WTG number and location**: the level of impact related to the installation of WTGs and the concomitant scour protection is proportional to the number of WTGs installed; fewer WTGs would present less hazard to soft-bottom, demersal finfish and invertebrates and their associated EFHs.
- **Season of construction:** The diversity and abundance of the offshore assemblage of finfish and invertebrates is typically highest in late spring through early fall (Eklund and Targett 1991). Construction/installation activities occurring outside of these time frames would have a reduced impact on finfish and invertebrates, particularly as compared to construction occurring during the active spring spawning and summer migratory seasons.

3.5.5.5 Impacts of Alternative B – Proposed Action on Finfish, Invertebrates, and Essential Fish Habitat

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

3.5.5.5.1 Construction and Installation

3.5.5.5.1.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

The Inshore Export Cable Route passes through both the Indian River and Indian River Bay, and environmental disturbances would occur. Due to high volumes of silting, the Indian River and Indian River Bay have been, and will continue to be, dredged. Therefore, EFH have been, and will continue to be, disturbed. During the 2017 field survey, the water turbidity was so high that collected imagery was of little use, though it did confirm scattered sea lettuce (*Ulva lactuca*) growth and did not discern any SAV present. The IPFs that would have the greatest impact on finfish, invertebrates, and EFH within Indian River Bay are anchoring, cable emplacement, noise and port utilization. Impacts from accidental releases, climate change, discharges/intakes, EMF and cable heat, and gear utilization would remain similar to those described in the Offshore impact IPF sections. The presence of structures would only have impacts during the construction phase. Light is not expected to impact the nearshore areas or Indian River Bay, as construction activities will only be conducted during daylight hours. Once the cabling is in place any materials associated with the gravity cells or HDD operations would be removed.

Anchoring: Under the Proposed Action, anchoring would occur within Indian River Bay. It is expected that the barges used for cable installation will be moved along the Inshore Export Cable Route using a six-point anchor system, assisted by an anchor handling tug, in combination with spud piles. The cable barge will lay and bury the cable between the two end points maneuvering along the cable route using its anchoring system and positioned using spuds as required. These activities would disturb the benthic resources, suspend sedimentation, and increase short-term turbidity. Anchor drag would increase impacts, potentially resulting in scarring or additional damage to finfish habitats. Impacts on the benthos would be limited to the diameter of the spud cans (through deck pilings) or jack-up legs if spud barges or jack-up vessels are used. If anchors are employed for installation, US Wind will use mid-line anchor buoys. Impacts from contact with the anchor would be localized and although some organisms would be killed by the contact, motile species may be able to avoid this direct mortality, and the benthic community is likely to recover relatively quickly in this soft sediment habitat (Dernie et al. 2003).

Cable emplacement and maintenance: Prior to cable installation in Indian River Bay, route clearance activities would include a pre-installation survey and grapnel run. Grapnel runs would be conducted to remove marine debris such as lost fishing nets, pots, or other objects from the construction path that could impact cable lay and burial. Typically, three passes of pre-lay grapnel runs occur, one along the centerline and parallel lines to the centerline on either side, to ensure routes are clear. Seabed preparation such as leveling, pre-trenching, or boulder removal is not expected. Temporary benthic disturbance due to the cable installation in Indian River Bay would be 168.27 acres (68.10 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2).

While not anticipated, if a UXO is detected, UXO clearance has the potential to cause disturbances to the seafloor (sediment suspension and deposition) as well as punctuated extreme levels of noise if detonation is utilized as a removal methodology. The most common approach utilized to deal with UXOs within a cable route or footprint of a WTG or OSS, is avoidance. Avoidance entails micrositing of cable routes and WTG/OSS foundations to avoid UXO hazards. UXO clearance involves relocation, removal, or detonation/incineration in place (Middleton et al. 2021). Clearance methodologies are not a common mitigation approach because of the high risk and cost (Middleton et al. 2021). The micrositing or relocation adjustments are usually limited to 50 to 100 feet (15 to 30 meters) from the UXO hazard (Middleton et al. 2021). The micrositing efforts result in the same type of short-term construction-related and permanent operational impacts as those described in the construction methods for cable installation and WTG and OSS foundation installation.

As part of the operation, a thorough clearance plan would be required and submitted to BOEM and cooperating agencies. This plan would include protective measures for marine life, cultural resources, and human health and safety (Geneva International Centre for Humanitarian Demining 2016; Middleton et al. 2021). If all other removal or relocation methods are deemed ineffective for the UXO, detonation may be required and the resultant explosion creates both a shock wave and a rapid oscillation in pressure, which can adversely affect fishes and invertebrates through risk of barotrauma, hearing effects, or potential mortality.

Cable installation includes HDD entrance and exit locations in Indian River Bay. HDD operations would be employed to install cable ducts at transition points between water and land. The cables would be fed to the HDD ducts by small boats where possible. Temporary installation of gravity cells would be used at the end of the HDD ducts to retain cuttings, drilling fluids, and other debris. Prefabricated sections of duct about 24 inches (60 centimeters) in diameter are planned, but final sizing would be determined by cable sizing and the thermal properties of the surrounding sediment. For the in-water operations gravity cells are expected to be up to 197 feet (60 meters) long and 33 feet (10 meters) wide. Gravity cell excavation pits would reach approximately 9.8 feet (3 meters) depth and material excavated from the gravity cell would be backfilled, or repurposed. Gravity cells would be needed for each of the four inshore export cables as they enter Indian River Bay and an additional four as they exit the Indian River for the onshore substation connection. This would disturb 1.19 acres (0.48 hectares). An additional four gravity cells may be needed on the Atlantic Ocean side of the barrier beach landfall and is considered part of the Offshore Export Cable Route. Bottom disturbance for these four would be an additional 0.59 acres (0.24 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). The cable duct would run approximately 8 to 60 feet (2 to 18 meters) below grade from the ocean to the landfall, and 8 to 49.2 feet (2 to 15 meters) below the Indian River for the Old Basin Cove, and Deep Hole HDD exits, respectively. Specifics about the three HDD exit pits, and cable distances between them are provided in Table 2-3. Final HDD lengths depend on factors such as sediment conductivity, cable design, and available installation methods to minimize disturbance in the shallow waters. A detailed design will be presented in the FDR/FIR. The maximum length of inshore export cables, four total, would be 42.3 miles (68.1 kilometers).

To achieve the target burial depth US Wind and its contractors have determined dredging would necessarily precede cable installation in locations along the Inshore Export Cable Routes for barge access. Maximum dredging disturbance is assumed to be within 295 feet (90 meters) wide along the route which is within a maximum 633 feet (193 meters) area of temporary construction disturbance. Dredging would be conducted using mechanical, or most likely, hydraulic means. The maximum volume of dredging, assuming all 4 cables installed in a single season, and across the entirety of the 295-foot width of the cable route, would be 916,000 cubic yards. Temporary benthic disturbance due to dredging for barge access in Indian River Bay would be 288.8 acres (116.87 10 hectares) (COP, Vol 1, Section 1.3, US Wind 2023).

The results of the Indian River Bay Sediment Transport assessment indicated that most of the fluidized sediments lost to the water column are predicted to quickly settle back to the bay floor and deposition thicknesses greater than 0.2 inches (5 millimeters) will typically occur within 95 feet (30 meters) of the cables regardless of route (COP, Volume II, Appendix B3; US Wind 2023). Suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 4,600 feet (1,400 meters) from the cables (COP, Volume II, Appendix B3; US Wind 2023). Model results indicate that the suspended sediment plume resulting from jet plowing will have a limited duration. All suspended sediment concentrations greater than 50 mg/L above ambient conditions are predicted to dissipate in less than 12 hours after the passage of the jet plow. Suspended sediment plumes greater than 10 mg/L are predicted to disappear within 24 hours after the completion of jetting operations.

The timing of the jet plowing with respect to the tidal cycle will play a large role in determining the direction of the sediment plume. Flushing rates within Indian River Bay are long (approximately 3 days) relative to the anticipated sediment suspension duration (less than 12 hours), making it unlikely the suspended sediment would flush out through the inlet. The sediment transport modeling results concluded that the proposed jet plowing for cable installation would result in short-term and localized effects (COP, Volume II, Appendix B3; US Wind 2023). Due to silting in Indian River Bay, it would continue to be dredged, so burying cables in the area would not cause greater impacts than dredging.

Cable protection in the form of concrete mattresses or the equivalent would permanently impact up to 10.10 acres (4.09 hectares) of benthic habitat within Indian River Bay (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Cable protection structures would provide novel surfaces for colonization and recruitment. This disturbance would lead to habitat conversion of soft- to hard-bottom benthic communities. This habitat conversion in predominantly soft-bottom environments can enhance local biodiversity (Coolen et al. 2022; Degrear et al. 2020; Inger et al. 2009), although it can also provide habitat for non-native species (Forrest et al. 2013).

Sessile and slow-moving organisms would be the most likely organisms to be negatively impacted. Should they come into contact with gear in the construction pathway total mortality would occur. The increased turbidity and sediment deposition may kill filter feeding organisms, or sensitive larval life stages of finfish. Many organisms that inhabit these soft sediment habitats are regularly exposed to natural disturbances that create spatial heterogeneity and resource patchiness. These communities are composed of opportunistic species which have high reproductive rates to recolonize disturbed areas. Impacts would be localized and temporary, and communities are expected to recover relatively quickly (Dernie et al. 2003; Boyd et al. 2005). BOEM does not expect population-level impacts on benthic species from cable emplacement activities within Indian River Bay. Impacts from new cable emplacement are expected to be notable but resources would recover completely and would therefore be minor.

Noise: Noise from the installation of the inshore export cables through Indian River Bay as a result of the Proposed Action would be inevitable. Increased vessel traffic within Indian River Bay could induce physiological stress in invertebrates and lead to acoustic masking in fishes. Several studies have shown an increase in the stress hormone cortisol following simulated vessel noise (Wysocki et al. 2006; Nichols et al. 2015; Celi et al. 2016); however, other studies have shown that the experimental setting may be inducing this increased stress (Harding et al. 2020; Staaterman et al. 2020). Species that are sensitive to acoustic pressure would experience masking at greater distances than those that are only sensitive to particle motion. Stanley et al. (2017) and Rogers et al. (2021) theorize that fish may be able to use the directional nature of particle motion to extract meaning from short range cues (e.g., other fish vocalizations) even in the presence of distant noise from vessels. Section 3.5.5.3 provides further information on impacts from vessel noise.

The use of cofferdams was previously considered but would not be pursued due to the increased underwater sound. US Wind would compile a preliminary Construction Noise Management Plan to comply with DNREC and local noise regulations prior to construction. The most significant source of noise associated with the Proposed Action is the HDD and gravity cell installation. These sounds are not expected to vary greatly from those associated with construction activities in coastal waters. Impacts from construction noise in Indian River Bay would therefore be localized, short term, and minor.

Port Utilization: The port utilization IPF would impact finfish, invertebrates, and EFH in nearshore environments, including the Indian River and Indian River Bay. Expansions and improvements are expected to port facilities as a result of the Proposed Action, with increased vessel traffic, and the necessary dredge projects to maintain navigable waterways on a regular basis, throughout the life cycle of the project. The Proposed Action anticipates utilizing facilities in the Greater Baltimore area, including Sparrows Point. Other port facilities elsewhere on the east coast could be utilized to support the Project and will be considered by US Wind on an as needed basis (Table 2-4). US Wind continues to evaluate and refine the Project design and works with suppliers to select the Project components, equipment fabrication and assembly locations, as well as the transport and installation strategies for the Project. These port enhancement activities would cause mortality of any organisms which come into direct contact with machinery, increase turbidity for a short duration, and increase deposition which may smother some fish in larval or juvenile stages, as well as invertebrates at varying life stages.

Should turbidity levels dramatically increase within the Project area, then finfish, invertebrates, and EFH have a slight risk of being negatively impacted, though overall impacts would be negligible. In the context of reasonably foreseeable environmental trends, combined port utilization impacts on finfish, invertebrates, and EFH from ongoing and planned actions, including the Proposed Action, would be expected to be negligible.

Nearshore and onshore activities and facilities will be covered under Section 3.5.4, *Coastal Habitat and Fauna.* Section 3.4.2, *Water Quality*, discusses turbidity and total suspended solids in. Should turbidity levels dramatically increase within the Project area, then finfish, invertebrates, and EFH have a slight risk of being negatively impacted, though overall impacts would be negligible.

Offshore Activities and Facilities

Accidental releases: Vessels associated with the Proposed Action may potentially generate waste, including bilge and ballast water, sanitary and domestic wastes, and trash and debris and potential small fuel spills. According to a BOEM Modeling study (Bejarano et al. 2013) it was predicted that the impacts related to a 2,000 gallon (7,571 liters) or less is likely to occur every 5 to 20 years. Thus, the risk of smaller spills are low and the resultant impacts on finfish, invertebrates and EFH would be minimal. Accidental releases from the project activities would be localized and most likely occur within the construction, decommissioning operations. All vessels associated with the Proposed Action would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects on finfish, invertebrates, and their respective EFHs resulting from the release of debris, fuel, hazardous materials, or waste (BOEM 2012). Additionally, training and awareness of BMPs proposed for waste management and mitigation of marine debris would be required of Project personnel, reducing the likelihood of occurrence to a very low risk. US Wind will prepare a project specific SPCC Plan and OSRP prior to construction. However, US Wind will still monitor for and report any environmental releases or fish kills to the appropriate authorities (e.g., in Delaware state waters, reports will be made via DNREC 24-hour hotline).

Another potential impact related to vessels and vessel traffic is the accidental release of invasive species, especially during ballast water and bilge water discharges from marine vessels. Vessels are required to adhere to existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and USEPA National Pollutant Discharge Elimination System (NPDES) Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. The risk of accidental releases would be increased by the additional vessel traffic associated with the Proposed action. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, BOEM expects localized and temporary negligible impacts on finfish, invertebrates, and EFH resulting from these accidental releases. Accidental releases of trash and debris may occur from vessels during any phase of the Project. Vessel operators, employees and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 (Marine Trash and Debris Awareness and Elimination), per BSEE guidelines for marine trash and debris prevention. BOEM assumes all vessels would comply with these laws and regulations to minimize releases.

In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be expected to be localized and temporary due to the likely limited extent and duration of a release of debris, minor fuel spills, bilge or ballast water contaminated with invasive species, and result in negligible impacts.

Anchoring: Impacts on finfish, invertebrates, and EFH are greatest for sensitive EFH (e.g., eelgrass, hard bottom) and sessile or slow-moving species (e.g., corals, sponges, sedentary shellfish). Impacts from anchoring relative to the Proposed Action occur during construction and installation but would be limited, as construction is staggered from 2025 through 2028. The use of DP vessels would preclude the use of anchors, while utilization of jack-up vessels or spud barges would directly affect the benthos.

The maximum benthic disturbance from vessel anchoring in relation to the installation of offshore structures is 14.95 acres (6.05 hectares). The placement of up to 121 WTGs (PDE), 4 OSSs, 1 Met Tower with corresponding scour protection, and the emplacement of offshore export cables and inter-array cables would affect the benthos, with potential for impacts on demersal finfish and invertebrate species. These impacts would include increased turbidity levels and contact would cause mortality of benthic species and, possibly, degradation of sensitive habitats. Impacts related to sensitive resources would be avoided by following mitigation measures and BMPs when operating near or within any areas with sensitive resources. All impacts would be localized; turbidity would be temporary; impacts from anchor, spud can, or leg contact would recover in the short-term. Construction operations under the Proposed Action would not occur simultaneously, but rather in a phased approach from 2025 through 2028. The footprint of each anchor, spud can, or leg placement would be relatively small in area and likely to fully recover. Minor impacts on the demersal portions of the finfish and invertebrate community would be expected.

The expected minor incremental impact of the Proposed Action combined with the planned actions would result in seafloor disturbance and associated turbidity from anchoring. In the context of reasonably foreseeable environmental trends, the combined anchoring impacts from ongoing and planned actions, could occur if impacts are in close temporal and spatial proximity. However, these impacts from anchoring would be expected to be minor and would expect to recover completely.

EMFs and cable heat: Under the Proposed Action, and the process of transmitting power to onshore infrastructure, a network of cables will need to be installed. Once these cables begin to transmit power, the effects from EMFs and cable heat would initiate. Impacts of EMF and cable heat will be minimized by proper electrical shielding and cable burial depth, when practicable. EMFs and cable heat will be present throughout most of the project and, therefore, is discussed in Section 3.5.5.5.2, *Operations and Maintenance*.

Light: Additional lights will be needed for the offshore infrastructure associated with the Proposed Action. As the impact from light will be greatest during the operational phase, impacts are discussed in Section 3.5.5.5.2, *Operations and Maintenance*.

Cable emplacement and maintenance: New cables would be required as a result of the Proposed Action and would have impacts on finfish, invertebrates, and EFH. Prior to cable installation, route clearance activities would include a pre-installation survey and grapnel run. Grapnel runs would be conducted to remove marine debris such as lost fishing nets, pots, or other objects from the construction path that could impact cable lay and burial. Seabed preparation such as leveling, pre-trenching, or boulder removal is not expected.

The Proposed Action could result in temporary seafloor disturbance from installation of the offshore export (34 acres [13.76 hectares]) and inter-array cables (29.98 acres [12.13 hectares]), in a phased approach from 2025 through 2028 (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). The resultant impacts include turbidity effects that could displace finfish and motile invertebrates and cause mortality of infaunal invertebrates within the cable route during emplacement (COP, Volume II, Section 7.2; US Wind 2023). These impacts would be temporary and localized. Sediment transport modeling (COP, Volume II, Appendix B2; US Wind 2023) predicts that most sediments suspended by the jet plowing will remain in a narrow corridor along the Offshore Export and Inter-array Cable Routes. The overwhelming majority of the deposition thicker than 0.008 inches (0.2 millimeters) will occur within 300 feet (91 meters) of the proposed cable route. Most of the fluidized sediments lost to the water column are predicted to quickly settle back to the seafloor. Suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 450 feet (137 meters) from the offshore export and inter-array cables. Model results indicate that the suspended sediment plume resulting from jet plowing will have a short duration. The model results show increases in suspended sediment concentrations greater than 10 mg/L over ambient are only of short duration (hours). All suspended sediment plumes are predicted to disappear within 24 hours after the completion of jetting operations. In conclusion, the sediment transport modeling results indicate that the proposed jet plow embedment process for cable installation will result in short-term and localized effects.

Some infaunal invertebrate species such as Atlantic surfclam, ocean quahogs, Atlantic sea scallops, and calico scallops could be displaced, or mortality may result from cable emplacement due to potential direct burial impacts. More broadly, impacts on infaunal invertebrate populations and communities are expected to be temporary and localized to the emplacement corridor. However, recovery of these infaunal invertebrate assemblages would be expected to occur within months after cable emplacement resulting in minor impacts, if any, on the infaunal assemblages or populations and would be expected given the localized and temporary nature of the impacts (Hobbs 2002, 2006; Dernie et al. 2003; Boyd et al. 2005). Suspended sediment concentrations during activities other than cable emplacement would be within the range of natural variability for this area of the MAB.

Disturbance of sand waves and ridges would be temporary, given that sand waves and ridges are changing, mobile features. These sand-dominated substrates are resilient by nature and are capable of tolerating disturbances because the sediment is regularly disturbed by wave action, nor'easters, offshore storms, and hurricanes (Rutecki et al. 2014). Organisms inhabiting these environments are regularly exposed to natural disturbance due to the motile nature of the sand sediments (Guida et al. 2017). The sediment composition from the crest to the trough varies and each microhabitat supports different benthic invertebrates (Rutecki et al. 2014). Impacted sand ridges are likely to recover faster than the trough microhabitats (Rutecki et al. 2014). Past studies following sand mining operations showed that the time scales for recolonization also vary by taxonomic group, with polychaetes and crustaceans recovering in the first several months and deep burrowing mollusks with a long-term recovery within several years (Brooks et al. 2006, Wilber and Clarke 2007).

The majority of the Project area is characterized as soft bottom. Benthic sediments within the Project area are classified as soft bottom (60,626 acres [24,535 hectares]), heterogenous complex habitat accounts for 12,140 acres (4,913 hectares), with complex as 316.3 acres (128 hectares), and large grained complex as the least common at 9.9 acres (4.0 hectares) [COP, Volume II, Appendix E1; US Wind 2023]). Based on US Wind survey data major sand ridges (sand waves with wavelengths greater than 820 feet [250 meters], and 6.6 feet [2 meters] in height) are present within the southern portion of the Lease Area, while minor sand ridges and sand waves are present along the eastern side of the Lease Area and scattered along the Offshore Export Cable Route. Megaripples were the least widespread benthic feature in the Offshore Project area, confined to the far southeastern corner of the Lease Area. In areas as identified in the southeastern corner where megaripple conditions might not allow for sufficient burial depth and at cable crossings, cable protection would be installed. Cable protection methods include concrete mattresses and rock placement of cable protection systems (CPS). CPS will be used for inter-array cable ends close to WTG and OSS foundations, where cable burial is not possible. An estimated 10 percent of the inter-array cable route will also require cable protection. Therefore, a maximum of 29.98 acres (12.13 hectares) of the inter-array cables, and 34 acres (13.76 hectares) of the Offshore Export Cable Route would require cable protection (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). The total for offshore cable protection would be 63.98 acres (25.9 hectares) of permanent benthic impacts, conservatively. This acreage would be converted from soft-bottom to hard-bottom species.

The expected minor impact of the Proposed Action combined with the planned actions would result in seafloor disturbance from the offshore export and inter-array cables. In the context of reasonably foreseeable environmental trends, the combined cable emplacement impacts from ongoing and planned actions, including the Proposed Action could occur if impacts are in close temporal and spatial proximity. Impacts from cable emplacement under the Proposed Action would be expected to be moderate but temporally short and would recover completely.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on finfish, invertebrates, and EFH in are impact pile-driving (installation of WTG and OSS foundations), geophysical surveys (HRG surveys), vessel traffic, aircraft, cable laying or trenching and dredging, and potential drilling during construction. UXO detonations are not included under the Proposed Action and will not be analyzed (US Wind 2023). Project construction activities could generate underwater noise and result in auditory injury and behavioral disturbances on finfish and invertebrates. Assessment of the potential for underwater noise impacts from the Proposed Action was assessed using the modeling conducted for the COP (Volume II, Appendix H1; US Wind 2023) and the acoustic threshold criteria provided in Table 3.5.5-4.

Impact Pile-driving Noise

Noise from pile-driving for the installation of WTGs, OSSs, and Met Tower foundations would occur intermittently during the installation of offshore structures. Impact pile-driving would be used for various pile types: 36.1-foot (11-meter) monopiles, 9.8-foot (3-meter) skirt piles, and 5.9-foot (1.8-meter) pin piles. The estimated duration is 120 minutes for impact pile-driving of the monopile assuming one pile is installed per day; and 480 minutes per day for the 9.8-foot (3-meter) skirt piles pin piles assuming up to four could be installed per day; and up to 360 minutes per day for the 5.9-foot (1.8-meter) pin piles assuming up to three are installed per day. US Wind also proposes to implement sound attenuation technologies such as double bubble curtains and nearfield attenuation devices to reduce the underwater noise impacts from impact pile-driving. These technologies are expected to achieve at least 10 dB noise reduction from modeled impact pile-driving activities, but US Wind will target 20 dB noise reduction (Appendix G, *Mitigation and Monitoring*, Table G-1). The modeling report provides ranges with 0, 10, and 20 dB noise mitigation applied, but because 10 dB is considered the most reasonable level of mitigation achievable for this activity (Bellmann et al. 2020) and was carried forward in the exposure assessment in the Projects LOA application (TRC 2023a). Results of the acoustic modeling with 10 dB noise mitigation for impact pile-driving scenarios are summarized in Tables 3.5.5-5 through 3.5.5-7 for the WTG, OSS, and Met Tower foundations, respectively. Ranges for the eggs and larvae category from Popper et al. (2014) were not included in the modeling but because the thresholds for this group are the same as those for fish with swim bladders not involved for hearing, the results for this group can be used for discussion.

Table 3.5.5-5. Ranges (in meters) to acoustic thresholds in meters during impact pile-driving activities for the WTG foundations under the Proposed Action

Foundation Type	Potential Mortal Injury		Recoverable Injury		TTS		Behavioral
	L_{pk}	SEL_{24h}	L_{pk}	SEL_{24h}	L_{pk}	SEL_{24h}	SPL
Fish with no swim bladder	50	0	50	0	-	4,500	13,650
Fish with swim bladder not involved in hearing	100	150	100	450	-	4,500	13,650
Fish with swim bladder involved in hearing	100	200	100	450	-	4,500	13,650
Fish <2 g	-	-	150	6,150	-	-	13,650
Fish ≥2 g	-	-	150	4,000	-	-	13,650

Source: LOA Appendix A, TRC 2023a

- = not applicable for this category; L_{pk} = zero-to-peak sound pressure level in units of decibels referenced to 1 micropascal; SEL_{24h} = sound exposure level over 24 hours in units of decibels referenced to 1 micropascal squared second; SPL = root-mean-square sound pressure level in units of decibels referenced to 1 micropascal; WTG = wind turbine generator

Table 3.5.5-6. Ranges (in meters) to acoustic thresholds in meters during impact pile-driving activities for the OSS foundations under the Proposed Action

Foundation Type	Potential Mortal Injury		Recoverable Injury		TTS		Behavioral
	L_{pk}	SEL_{24h}	L_{pk}	SEL_{24h}	L_{pk}	SEL_{24h}	SPL
Fish with no swim bladder	<50	0	<50	0	-	1,750	2,650
Fish with swim bladder not involved in hearing	<50	0	<50	50	-	1,750	2,650
Fish with swim bladder involved in hearing	<50	50	<50	50	-	1,750	2,650
Fish <2 g	-	-	<50	2,600	-	-	2,650
Fish ≥2 g	-	-	<50	1,500	-	-	2,650

Source: LOA Appendix A, TRC 2023a
- = not applicable for this category; L_{pk} = zero-to-peak sound pressure level in units of decibels referenced to 1 micropascal;
SEL_{24h} = sound exposure level over 24 hours in units of decibels referenced to 1 micropascal squared second;
SPL = root-mean-square sound pressure level in units of decibels referenced to 1 micropascal; OSS = offshore substation

Table 3.5.5-7. Ranges (in meters) to acoustic thresholds in meters during impact pile-driving activities for the Met Tower foundations under the Proposed Action

Foundation Type	Potential Mortal Injury		Recoverable Injury		TTS		Behavioral
	L_{pk}	SEL_{24h}	L_{pk}	SEL_{24h}	L_{pk}	SEL_{24h}	SPL
Fish with no swim bladder	<50	0	<50	0	-	50	750
Fish with swim bladder not involved in hearing	<50	0	<50	0	-	50	750
Fish with swim bladder involved in hearing	<50	0	<50	0	-	50	750
Fish <2 g	-	-	<50	150	-	-	750
Fish ≥2 g	-	-	<50	50	-	-	750

Source: LOA Appendix A, TRC 2023a
- = not applicable for this category; L_{pk} = zero-to-peak sound pressure level in units of decibels referenced to 1 micropascal;
SEL_{24h} = sound exposure level over 24 hours in units of decibels referenced to 1 micropascal squared second;
SPL = root-mean-square sound pressure level in units of decibels referenced to 1 micropascal

Results of the modeling indicate there is potential for recoverable injury (Popper et al. 2014) to occur in some species of fish during impact pile-driving of the WTG and OSS foundations. The predominant impact expected during impact pile-driving on finfish and invertebrates is behavioral responses such as startle responses or avoidance of the ensonified area during construction. However, the recommended threshold for the onset of behavioral disturbances from FHWG (2008) is based on observations of fish in captivity and may not accurately capture behavioral responses of free-swimming fish, and also does not capture differences in hearing sensitivity among fish species due to the presence of a swim bladder or other gas-filled organ that could detect underwater sound (Popper et al. 2014). Further information on underwater acoustics and fish hearing is provided in Appendix B, *Supplemental Information*.

Prior to construction, US Wind will prepare a pile-driving noise monitoring plan, which will align with conditions set by NOAA Fisheries. Noise mitigation is planned for both near-field (e.g., an AdBm Technologies Noise Mitigation System and using a damper between the hammer and sleeve to prolong the impact pulse) and far-field (e.g., a large double bubble curtain) to achieve a 10 dB attenuation, with a target of 20 dB at the source. A double bubble curtain is a compressed air system (air bubble barrier) for sound absorption in water. Air is pumped from a separate vessel with compressors into nozzle hoses lying on the seafloor and it escapes through holes that are provided for this purpose. Thus, bubble curtains are generated within the water column due to buoyancy. Noise emitted by pile-driving must pass through those ascending air bubbles and is thus attenuated. To further minimize impacts, pile-driving will begin by hammering at a low energy level for no less than 30 minutes. This soft-start allows motile organisms a chance to withdraw from the noise, before it reaches full intensity.

Overall, the duration of pile-driving activities would be relatively short term (up to 2 hours per day for the WTG foundations; 8 hours per day for the OSS foundations; and 6 hours per day for the Met Tower Foundations) and only occurring as a singular installation operation and once construction is complete and pile-driving has ceased impacts from this sub-IPF would dissipate. Due to the temporary, localized nature of noise produced by impact pile-driving under the Proposed Action and the implementation of mitigation measures (Appendix G), which would minimize the risk of exposure to above-threshold noise levels, minor impacts on finfish, invertebrates, and EFH would be expected.

All other noise-producing activities under the Proposed Action or Alternative A-1 (i.e., G&G survey activity, vessel activity, cable trenching and dredging) would not be expected to exceed the impacts expected under the No Action Alternative described in Section 3.5.5.3. The additional vessels and G&G survey equipment would result in a nominal increase in potential sources within the context of reasonably foreseeable environmental trends and impacts would similarly be negligible.

In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action would be expected to be moderate for finfish, invertebrates, and EFH. The main activity that would result in adverse effects on these resources is impact pile-driving during installation of WTG, OSS, and Met Tower foundations. The expected minor incremental impact from pile-driving under the Proposed Action combined with offshore wind activities would result in increased underwater noise levels during construction starting in 2022 and continuing through 2030. Alternatively, these sound impacts from this activity would be removed once piling had stopped. All other noise-producing activities under the Proposed Action are expected to result in negligible impacts on these resources, and combined impacts with ongoing and planned actions would similarly be negligible. Impacts from other noise-producing activities are lower in intensity relative to impact pile-driving, and impacts would be localized, temporary, and not biologically notable for finfish or invertebrates and would not result in any notable effects on EFH.

Port utilization: Impact on finfish, invertebrates, and EFH from port utilization would take place in the nearshore environments and are therefore discussed in *Onshore Activities and Facilities*.

Presence of structures: A primary impact on finfish, invertebrates, and EFH from the Proposed Action would be the construction and placement of the up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower in the Project area. These hard structures would displace and cause mortality among the non-motile, infauna, and demersal soft-bottom fauna that use this habitat. Each WTG would require approximately 9,203 to 18,417 square feet (855 to 1,711 square meters) per foundation (COP, Volume II, Section 1.3; US Wind 2023), most of which is related to the scour protection apron.

The permanent area displaced by WTGs (PDE of up to 121) under the Proposed Action is expected to be 2.84 acres, with an additional 22.7 acres for scour protection, totaling 25.5 acres (10.3 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Four OSSs would be installed, and though the foundation has not yet been decided the total area of seafloor disturbance is up to 1.7 acres (0.7 hectares), assuming they are also monopile foundations, creating the maximum footprint. The Met Tower would displace an additional 0.1 acre 435 square feet (40.41 square meters). In total, about 27.21 acres (10.61 hectares) (Appendix C, Table C-2) of seafloor habitat would be permanently affected by the construction and installation of the WTGs, OSSs, and Met Tower foundations for the Proposed Action.

An additional 63.98 acres (25.9 hectares) of seafloor could be permanently affected by the placement of cable protection structures along the offshore export and inter-array cables utilizing cement mattresses, rock placement or other hard structure systems (Appendix C; Table C-2). Species such as the summer flounder, Atlantic surfclam, Atlantic sea scallops, calico scallops, and the longfin squid would have their available habitat reduced, resulting in a moderate impact and permanent as long as structures remained for the full Project life cycle.

Once in place, impacts of these structures include entanglement and gear loss or damage, hydrodynamic disturbance, fish aggregation resulting in increased predation on benthic invertebrates, and habitat conversion. Section 3.5.5.3 provides more details on general impacts. Many of the impacts from these structures are covered in Section 3.5.5.5.2, *Operations and Maintenance*; these impacts remain as long as the structures are in place.

Regulated fishing effort: A notice to mariners would notify commercial fishermen that vessels would need to avoid the areas around construction activities. For foundation construction activities, smaller portions of the Lease Area would need to be avoided by vessels actively fishing or towing. For cable-laying activities, commercial fishing vessels (specifically trawlers and bivalve dredging vessels) would be needed to prevent interferences with construction vessels. Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, contains more information.

Seabed profile alterations: Much of the Offshore Project area is characterized as soft bottom habitat (60,626 acres [24,535 hectares]), heterogenous complex habitat accounts for 12,140 acres (4,913 hectares), with complex as 316.3 acres (128 hectares), and large grained complex as the least common at 9.9 acres (4.0 hectares) [COP, Volume II, Appendix E1; US Wind 2023]). Offshore shoal complexes support diverse invertebrate assemblages with faunal differences found between the ridge crest and trough habitats (Rutecki et al. 2014). These habitats serve important ecological functions for the benthic community and the complex food web they support. Sand shoals would temporarily be disturbed by pre-construction grapnel runs, anchoring, seabed preparation, and clearing, should be required. Permanent impacts include foundation placement, scour protection installation, trenching for cable installation, if needed, and cable protection. Sand ripples and waves disturbed by offshore export and inter-array cable installation would naturally reform within days to weeks under the influence of the same tidal and wind-forced bottom currents that formed them initially (Kraus and Carter 2018).

Under the Proposed Action, the primary machinery that may impact the seabed profile would be a jet plow. The impacts related to jet plowing would be very localized and temporary and would recover completely without mitigation (Boyd et al. 2005). Therefore, overall, impacts on finfish, invertebrates, and EFH from seabed profile alterations under the Proposed Action would be minor.

The impacts of the Proposed Action alone would not increase the impacts beyond those of the No Action Alternative because dredging is not anticipated. Although the amount of seabed profile alteration in the No Action Alternative is not known, it would occur. In the context of reasonably foreseeable environmental trends, the combined impacts of this IPF on finfish, invertebrates, and EFH from ongoing and planned actions, including the Proposed Action would likely be minor.

Sediment deposition and burial: The Proposed Action would cause sediment deposition from the construction activities. The overwhelming majority of the deposition thicker than 0.008 inches (0.2 millimeters) will occur within 300 feet (91 meters) of the proposed cable route, as presented. However, as presented in the cable emplacement IPF discussed previously, sediment deposition impacts on finfish, invertebrates, and EFH would be expected to range between negligible and minor. Sediment deposition and burial under the Proposed Action could cause impacts on sensitive life stages, such as demersal eggs.

In the context of reasonably foreseeable environmental trends, the impacts of sediment deposition and burial on finfish, invertebrates, and EFH from ongoing and planned actions, the Proposed Action, would be temporally short and recover fully and would be likely be minor.

Climate change: Because this IPF is a global phenomenon, the impacts of this IPF from the Proposed Action, would be very similar to those in Section 3.5.2.3, including ocean acidification and warming, sea level rise, altered habitat and function, storm frequency and intensity, and nutrient availability. None of these are directly affected by the construction of the Proposed Action and are discussed in further detail in Section 3.5.5.5.2, *Operations and Maintenance*.

3.5.5.5.2 Operations and Maintenance

3.5.5.5.2.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

US Wind will be responsible for daily operations, which includes planned and unplanned maintenance. The majority of onshore activities and facilities will not impact finfish, invertebrates, and EFH within Indian River Bay during O&M. As the onshore cable route passes through Indian River Bay, which will continue to be dredged (non-Project related), the benthic habitat would continue to be disturbed. The IPFs that would have an impact on finfish, invertebrates, and EFH within Indian River Bay as a result of the Proposed Action are anchoring, cable maintenance, and EMF and cable heat. Impacts from accidental releases and discharges/intakes would remain similar to those described in the Offshore impact IPF sections. Noise, presence of structure, gear utilization, light, and port utilization would not be impacted above present conditions in Indian River Bay by the O&M phase of the Proposed Action. Nearshore and onshore activities and facilities will be covered under Section 3.5.4, *Coastal Habitat and Fauna.*

Anchoring: Vessel anchoring would be at its maximum during construction, but Project-related anchoring would still occur during the O&M phase. Anchoring gear which contact benthic organisms would experience mortality, and nearby organisms could be injured or killed due to high turbidity, and deposition. Indian River Bay possesses typical soft-sediment estuarine habitats that are adapted to periodic disturbance events. These communities are dominated by infaunal invertebrates, such as polychaete worms, which were found within recent benthic samples from Indian River Bay. By following mitigation measures and BMPs when operating near or within any areas with sensitive resources impacts to sensitive resources would be avoided. Given the small scale of disturbance from anchoring in a community that has already adapted to periodic disturbance events, and short-term turbidity, impacts from the O&M phase of the Proposed Action would recover without mitigation and would be negligible.

Cable maintenance: The O&M of the installed cables would include inspections and maintenance when needed. Vessel anchoring to conduct cable inspections would impact finfish, and EFH the same as previously described. Temporary increases in suspended sediment and resulting depositions would impact finfish, invertebrates, and EFH should cable repairs be necessary. These disturbances would be expected to be on a small scale, localized and temporally short (several weeks to months). Impacts would be similar and generally less than installations, therefore O&M activities of onshore cables is expected to be negligible.

EMFs and cable heat: With cables running under Indian River Bay for the life of the Project, finfish and invertebrate species would be exposed to some level of EMFs. EMF emanates continuously from installed electrical power transmission cables. Biologically notable impacts on finfish, invertebrates, and EFH have not been documented for AC cables (Thomsen et al. 2015; CSA Ocean Sciences Inc. and Exponent 2019), but behavioral impacts have been documented for benthic species (skates and lobster) near operating DC cables (Hutchison et al. 2018). The impacts from EMF are localized and affect the animals only while they are within relatively close proximity to the EMF source. There is no evidence to indicate that EMFs from undersea AC power cables negatively affect commercially and recreationally important fish species (Section 3.9; CSA Ocean Sciences Inc. and Exponent 2019). Recent studies on the impact of EMFs on benthic invertebrates have found conflicting results. Albert et al. (2022) found no differences in valve activity or filtration rates (suggesting no hinderance of feeding behaviors) in adult blue mussels exposed to 300 microtesla (μT) DC compared to controls. Yet Jakubowska-Lehrmann et al. (2022) found significantly lower filtration rates in cockles (*Cerastoderma glaucum*) that were exposed to 6.4 mT for 8 days. No changes in the respiration were noted but ammonia excretion rates were significantly lower after exposure to EMFs. Further studies are needed to understand the implications of this conflicting information as it applies in natural marine environments.

Because of the presence of snortnose sturgeon, Atlantic sturgeon and horseshoe crabs within the Project area, US Wind has conducted a site-specific study of potential EMF impacts and found that electric field produced to be below the reported detection thresholds for electrosensitive marine organisms (Exponent 2023). When operating at peak loading, the maximum level of the magnetic field produced from the Offshore Export Cable Route cables both offshore and through Indian River Bay was calculated as 148 mG (14.8 µT) at the seabed, and quickly decreased to 12 mG (1.2 µT) just 3 feet (1 meter) above the seafloor (Exponent 2023). These values are 3.4 and 42 times lower respectively than EMF levels which have shown no impact (Exponent 2023). In the case of sturgeon species the maximum EMF levels calculated of the induced electric field sensed by sturgeon is approximately 1.8 mV/m at the seabed over the buried Offshore Export Cable during periods of peak loading. Studies utilizing Russian sturgeon as a test subject found that the threshold for behavioral changes in is approximately 11 times lower than the 20 mV/m electric field reported (Exponent 2023). The maximum EMF levels produced by the inter-array cables at the target burial depth of 3.3 feet (1 meter) was calculated as 49 mG (4.9 µT). At a distance of 10 feet (3 meters) horizontally from all cable types, the EMF decreased to less than 1 mG (0.1 µT) (Exponent 2023).

As stated previously ambient water temperature, sediment permeability, burial depth, and spacing between cables all affect heat emitted from the cables. To minimize this impact, cables would be buried or trenched, where possible, and installed with appropriate shielding to reduce potential electric and magnetic fields to low levels. EMFs would be minimized by shielding and by burying inshore export cables to the target depth of 3.3 to 6.6 feet (1 to 2 meters). Based on the available information BOEM expects the impacts on finfish, invertebrates, and EFH from EMF and cable heat to be negligible.

Offshore Activities and Facilities

Accidental releases: The risk of any type of accidental release (i.e., fuels, invasive species, debris) would be increased primarily during construction or conceptual decommissioning but may also occur during O&M. US Wind will have proper plans and procedures in place to avoid accidental releases into the environment (see Section 5.5.5.5.11).

Anchoring: Vessel anchoring would increase as a result of the Proposed Action and can occur at all phases of the Proposed Action. As stated earlier in *Construction and Installation*, anchors would cause short-term impacts in the immediate area where anchors and chains meet the seafloor. During the operational phase of the project, anchors can also pose a threat to the buried cables, and partially damage or completely sever the cables.

EMFs and cable heat: EMF emanates continuously from installed electrical power transmission cables. Biologically notable impacts on finfish, invertebrates, and EFH have not been documented for AC cables (Thomsen et al. 2015; CSA Ocean Sciences Inc. and Exponent 2019), but behavioral impacts have been documented for benthic species (skates and lobster) near operating DC cables (Hutchison et al. 2018). The impacts from EMF are localized and affect the animals only while they are within relatively close proximity to the EMF source (Bochert and Zettler 2004). There is no evidence to indicate that EMFs from undersea AC power cables negatively affect commercially and recreationally important fish species (Section 3.6.1; CSA Ocean Sciences Inc. and Exponent 2019). Under the Proposed Action the shielding and burial depths would minimize EMF intensity and extent (Normandeau et al. 2011). Although the EMFs would exist as long as a cable was in operation, previous studies indicate that the EMFs from AC cables within the Project area are not expected to affect commercial and recreational fisheries (Thomsen et al. 2015; CSA Ocean Sciences Inc. and Exponent 2019). Therefore, impacts on pelagic finfish species would be expected to be negligible, and impacts on bottom-dwelling finfish and motile invertebrate species would be expected to be minor.

In the context of reasonably foreseeable environmental trends, the combined impacts from EMF and cable heat from ongoing and planned actions would be expected to be localized, long term, and result in negligible to minor impacts.

Light: Under the Proposed Action, up to 121 WTGs (PDE) and 4 OSSs would be lit with navigational and FAA hazard lighting. Per BOEM guidance (BOEM 2021) and outlined in the COP (Volume II, Section 16.4; US Wind 2023), each WTG would be lit in accordance with USCG, FAA, and BOEM requirements, with two FAA model L-864 aviation red flashing obstruction lights on the highest point and up to four FAA model L-810 red flashing lights at mid-mast level, adding up to 588 new red flashing lights to the offshore environment where none currently exist. Only a small fraction of the emitted light would enter the water. Therefore, light resulting from the Proposed Action would be minimal and would be expected to lead to a negligible impact, if any, on finfish, invertebrates, and EFH.

The expected negligible impact of the Proposed Action alone would not noticeably increase the impacts of light beyond the impacts described under the No Action Alternative (Section 3.5.5-1, *Description of the Affected Environment for Finfish, Invertebrates, and Essential Fish Habitat*). Under the planned action scenario, up to 3,081 structures would have lights, and these would be incrementally added over time beginning in 2023 and continuing through 2030. Lighting of turbines and other structures would be minimal (navigation and aviation hazard lights) and in accordance with BOEM (2021b) guidance.

In the context of reasonably foreseeable environmental trends, combined lighting impacts on finfish, invertebrates, and EFH from ongoing and planned actions, including the Proposed Action, would be expected to have negligible, non-measurable impacts on finfish, invertebrates, and EFH. Ongoing and future non-offshore wind activities would be expected to cause permanent impacts, primarily driven by light from offshore structures and short-term and localized impacts from vessel lights.

Cable maintenance: Offshore O&M of the offshore export and inter-array cables with the Proposed Action include regular inspections. Cable surveys are anticipated in year 1, year 3, and then every 5 years after. Underwater ROV surveys will be used to inspect cable protection and cable entry, and cathodic protection, therefore finfish, invertebrates, and EFH will not be physically disturbed. Only cable repairs, if required, would temporarily impact benthic communities, and only in a localized area immediately adjacent to the repair. Assuming repairs would be infrequent and affecting only small sections of the cables, impacts are expected to have no detectable effects and would be negligible.

Noise: Noise-producing activities during O&M of the Proposed Action include HRG survey activity, vessel activity, WTG operations, vessel traffic, and routine inspections (by ROV). These activities would not be expected to exceed the impacts expected under the No Action Alternative described in Section 3.5.5.3. Field measurements taken during operations at the Block Island Wind Farm in 2019 were compared to published audiograms for a few fish species (Elliot et al. 2019). Study results showed that at a distance of 165 feet (50 meters) from an operating turbine, particle acceleration levels were below the hearing thresholds of several fish species, therefore they would not be audible at this distance. Pressure-sensitive species may be able to detect operational noise at greater distances, though this will depend on other characteristics of the acoustic environment. The additional vessels and HRG survey equipment present within the Project area, as well as the additional noise produced by the operating WTGs would result in a nominal increase in potential sources within the context of reasonably foreseeable environmental trends and impacts on finfish, invertebrates, and EFH would similarly be negligible.

Port utilization: Although project-related vessel traffic would decrease once construction is complete, regular maintenance activities would still require vessel support, dredging, and port improvements to allow these activities. Impacts on finfish, invertebrates, and EFH are expected be unmeasurable and negligible.

Presence of structures: Anthropogenic structures, especially tall vertical structures that extend from the seafloor to the surface such as the WTG and OSS foundations, once in place continuously alter local water flow (hydrodynamics) at a fine scale, and increase seafloor scour, which may alter sediment grain sizes and benthic community structure (Lefaible et al. 2019). Although water flow typically returns to background levels within a relatively short distance from a structure and impacts on managed species of finfish and invertebrates are typically undetectable (BOEM 2021), the cumulative effects of the presence of multiple structures on local or regional-scale hydrodynamic processes are not currently well understood. A recent study completed by BOEM assessed the “mesoscale” effects of offshore wind energy facilities on coastal and oceanic environmental conditions and habitat by examining how oceanic responses would change after turbines are installed, particularly with regards to turbulent mixing, bed shear stress, and larval transport (Johnson et al. 2021). This study focused on the Massachusetts-Rhode Island marine areas where proposed wind energy lease areas are in the licensing review process. This modeling study assessed four post-installation scenarios. Two of the managed species that occur within the Lease Area, summer flounder and Atlantic sea scallop, were selected as focal species in this study (silver hake [*Merluccius bilinearis*] was the third focal species assessed in the model but does not have a defined EFH within the Lease Area). The results of this modeling effort indicate that, at a regional fisheries management level, these shifts are not considered overly relevant with regards to larval settlement. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are also not well understood. The placement of each WTG for the Proposed Action would additionally attract structure-oriented demersal and pelagic finfish and invertebrate species that would benefit from the creation of hard substrate (Claisse et al. 2014; Smith et al. 2016, Mavraki et al. 2021); however, the diversity of these structure-associated assemblages may decline over time as early colonizers are replaced by successional communities (Degraer et al. 2018). These hard structures, (e.g., tower foundations, scour protection, cable protection) create uncommon vertical relief in a predominantly flat homogeneous soft-bottom seascape. Marine structures particularly WTGs create turbulence that transports nutrients into the water column, increasing primary productivity at localized scales (Danheim et al. 2020). These changes have been reported to increase food availability for filter-feeders on and near the structures creating a beneficial impact (Degrear et al. 2020). The impacts of invasive species that might settle the introduced hard structure on finfish, invertebrates, and EFH depend on many factors but could be widespread and permanent. Releases of invasive species may or may not lead to the establishment and persistence of invasive species. Invasive species becoming established as a result of the additional habitat provided by the structures is possible. As documented in observations of colonial sea squirt (*Didemnum vexillum*) at the Block Island Wind Farm (HDR 2020), the impacts of invasive species on finfish, invertebrates, and EFH could be strongly adverse, widespread, and permanent if the species were to become established and out compete native fauna or modify habitat. The increase in this risk related to the Proposed Action would be small in comparison to the risk from ongoing activities. For example, colonial sea squirt is already an established species in New England with documented occurrence in subtidal areas, including on Georges Bank, where numerous sites within a 56,834-acre (23,000-hectare) area are 50 to 90 percent covered by colonial sea squirt (Bullard et al. 2007). This would result in short-term to permanent impacts on soft-bottom habitat within the proposed Lease Area and would impart minor impacts on finfish, invertebrates, and EFH, though localized impacts would likely be greater.

The Planned Activities Scenario (Appendix D) indicates that there could be 3,081 foundations within the geographic analysis area. The Proposed Action would add up to 119 offshore structures, and the consequential impacts would remain at least until conceptual decommissioning is complete (33-year project lifetime). In the context of reasonably foreseeable environmental trends, the combined impacts arising from the presence of structures from ongoing and planned actions, including the Proposed Action, would be expected to range from negligible to moderate based on the sub-IPFs and may result in minor beneficial impacts for hard bottom associated finfish and invertebrate species due to the large number of structures and "reefing" effect. Approximately 96 percent of these impacts would occur as a result of structures associated with other offshore wind development and not the Proposed Action, as the Proposed Action would account for approximately four percent of the new offshore structures on the OCS.

Regulated fishing effort: Regulated fishing effort can affect finfish, invertebrates, and EFH by modifying the nature, distribution, and intensity of fishing-related impacts (e.g., mortality, bottom disturbance). The State of Delaware allows recreational and commercial clamming for hard clams throughout the Indian River Bay that is not classified as Prohibited or Seasonally Prohibited. Presently there are no natural oyster resources within the bay; however the Delaware's Department of Natural Resources and Environmental Control (DNREC), Division of Fish & Wildlife (FW) in 2017 issued its first aquaculture lease (DNREC 2021). Section 3.6.1 describes the contribution of the Proposed Action and other future wind projects on regulated fishing effort. The intensity of impacts on finfish, invertebrates, and EFH under future fishing regulations is uncertain, but would likely be similar to or less than under the status quo and would be moderate.

Seabed profile alterations: The presence of structures including foundations for WTGs, OSSs, and the Met Tower along with cable protection in areas where seabed conditions will not allow for jet plowing would alter the seabed profile through the life of the Project (33 years). Various cable protection methods include rocks, geotextile sand containers, or concrete mattresses which would permanently alter the seabed profile.

Sediment deposition and burial: Sediment deposition may occur in nearshore environments where sediment is deposited by wind, or rain from the land. This along with natural marine deposition would continue in the operational phase of the Proposed Action and would not likely exceed impacts described in the No Action Alternative.

Climate change: Several sub-IPFs related to climate change, including ocean acidification, warming/sea level rise, altered habitat or ecology, altered migration patterns, and increased disease frequency, could result in long-term, potentially high-consequence risks to finfish, invertebrates, and EFH. Ocean acidification has been shown to have negative impacts on the settlement and survival of shellfish (PMEL 2020). These impacts could lead to changes in prey abundance and distribution, changes in migratory patterns, and timing. These sub-IPFs would contribute to potential alterations in finfish migration patterns or reductions in growth or decline of invertebrates that have calcareous shells. Because these sub-IPFs are a global phenomenon, the impacts through this IPF from the Proposed Action would be practically the same as those under the No Action Alternative (Section 3.5.5-1). The intensity of impacts resulting from climate change are uncertain but would be anticipated to qualify as minor to moderate.

3.5.5.5.3 Conceptual Decommissioning

3.5.5.5.3.1 Offshore and Inshore Activities and Facilities

All foundations and Project components would be removed to 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)), unless other methods are deemed suitable through consultation with the regulatory authorities, including BOEM. The conceptual decommissioning process for the WTGs and OSSs is anticipated to be generally the reverse of construction and installation, with Project components transported to an appropriate disposal or recycling facility. WTGs, OSSs, and the Met Tower would all be removed, with their foundations removed potentially to 15 feet (5 meters) below the seafloor. Based on the approval of the appropriate regulatory agencies, scour protection systems may be left in place to provide seafloor habitat. The inter-array and offshore export cables will be disconnected and either retired in place or removed from the seafloor based on the preferred approach to minimize environmental impacts, based on agency approval.

Accidental releases, anchoring, discharges, noise, and port utilization would all have similar risks or impacts as the construction phase mentioned previously. Short-term, localized sediment suspension, water turbidity, and sediment deposition would occur from the removal of Project structures, and vessel anchoring. Vessel traffic would be higher than the O&M phase as the deconstruction and or removal of structures occurs. The increase in vessel traffic increases the risk of accidental releases, and discharges. These activities would temporarily impact finfish, invertebrates, and EFH locally and full recovery post decommission is expected (Dernie et al. 2003; Boyd et al. 2005).

3.5.5.5.4 Impacts of Alternative B on ESA-Listed Species

Fish species from the geographic analysis area, and specifically within the Offshore Project area, listed under the ESA by NOAA as endangered are the shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) (NOAA Fisheries 2022; BOEM 2023b). Three additional MAB fish species listed as threatened that occur within the Project area are the giant manta ray (*Mobula birostris*), oceanic whitetip shark (*Carcharhinus longimanus*), scalloped hammerhead shark (*Sphyrna lewini*) (NOAA Fisheries 2022a). The giant manta and oceanic whitetip shark are listed as threatened throughout their range, while the scalloped hammerhead is listed as threatened within the central and southeast Atlantic DPS. The scalloped hammerhead would most likely transit through the project site following prey species migrations (herring, mackerel, sardines, and squid). The giant manta ray and oceanic whitetip sharks are found within New England and Mid Atlantic Bight mainly from July through September when waters reach 66.2°F to 71.6°F (19°C to 22°C) (NOAA Fisheries 2022b). More information on these ESA-listed species may be found in the Biological Assessment (BOEM 2023b). The Biological Assessment prepared to support the Maryland Offshore Wind Draft EIS presents the analysis of the impacts related to the potential five species of ESA-listed finfish. Of the five species, the Atlantic sturgeon was the only species that is demersal and may be resident within the proposed export cable route and Lease Area during construction and conceptual decommissioning operations. The two main IPFs that could impact the Atlantic sturgeon are noise impacts from pile-driving and a potential for vessel strike mainly within the shallower portions of the export cable route and within the Indian River Bay. As outlined in the NMFS BA (BOEM 2023b), the primitive morphological hearing sensory structures of the Atlantic sturgeon makes it less sensitive to impact pile-driving noise. The range to the physiological injury threshold is relatively large (up to 13,123 feet [4,000 meters]) and the limited mitigation and monitoring methods that are effective for this species, therefore these is a potential for auditory injury and behavior threshold impacts. Mitigation measures such as the implementation of soft-starts should greatly reduce the potential for serious injury. Soft-starts could be effective in deterring Atlantic sturgeon from areas of impact pile-driving activities prior to exposure resulting in a serious injury. Utilizing these soft-start protocols before pile-driving operations and other mitigation measures such as bubble currents could reduce and delimit the risk of injury from pile-driving activities for the Atlantic Sturgeon.

Atlantic sturgeon and shortnose sturgeon are vulnerable to vessel collisions within restricted riverine habitats, resulting in potential mortality (Balazik et al. 2012), but is very rare within open ocean habitats. Vessel strike within the shallower areas of the Offshore Export Cable Route could be an area with potential higher risk for the Atlantic sturgeon based on the amount of activity and vessel traffic. The Atlantic sturgeon and the shortnose sturgeon are the most likely to be found within the Project area both inshore within the Indian River, Indian River Bay and Delaware Bay for the shortnose and within the offshore Project are for the Atlantic sturgeon. A recent NMFS Biological Opinion (2022) reviewed the development and utilization of the New Jersey Wind Port, (Alloway Creek, NJ). The Biological Opinion assessed the take of Atlantic and shortnose sturgeon over 27 years of port operations. The main source of impact was vessel strikes through increased port utilization. The potential for impacts related to port utilization and vessel strike on shortnose and Atlantic Sturgeon could result in a mortality of individual resulting in adverse effects and resulting in a moderate affect. The Biological Opinion concluded that utilization of the New Jersey Wind Port would result in an adverse effect but not result in a population level affect for the New York Bight DPS (NMFS 2022). US Wind will be implementing several monitoring and mitigation measures to utilizing Protected Species Observers and reporting procedures in response to sturgeon sightings and observed vessel strike events.

Atlantic sturgeon are susceptible to capture in trawl nets, which may result in injury or death. Non-lethal effects could include reduced fecundity and delayed or aborted spawning migrations (Moser and Ross 1995; Collins et al. 2000; Moser et al. 2000). Northeast Fisheries Observer Program data from Miller and Shepherd (2011) indicate mortality rates of Atlantic sturgeon caught in otter trawl gear is approximately 5 percent. US Wind will be implementing several monitoring and mitigation measures to standardize

Atlantic sturgeon handling and reporting procedures in response to an entanglement. These measures will reduce impact to Atlantic sturgeon through potential monitoring effort by ensuring the handling of any sturgeon caught in fisheries sampling gear will not cause or exacerbate any direct injury to the animal. Sufficient training and proper technique will also reduce impacts to captured sturgeon by minimizing the time of handling and, therefore, the individual's stress (Bartholomew and Bohnsack 2005; Beardsall et al. 2013) reducing the impacts to Atlantic sturgeon to a negligible level.

3.5.5.5.5 Conclusions

Project construction and installation and conceptual decommissioning would introduce noise, lighting, EMF, and new structures to the geographic analysis area, as well as result in habitat conversion impacting finfish, invertebrates, and EFH to varying degrees depending on the location, timing, and species affected by an activity. Impacts associated with the Proposed Action would be specific to the life stage and habitat requirements of a species as well. Impacts from Project O&M would occur, although at lower levels than those produced during construction and conceptual decommissioning. Offshore structures would also result in long-term effects on pelagic habitat. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate**, including the presence of structure, which may result in **minor beneficial** impacts to hard bottom associated demersal finfish and invertebrate species. Therefore, BOEM expects the overall impact on finfish, invertebrates, and EFH from the Proposed Action alone would be **moderate** because the impacts would be localized; however, because the structures would remain for the full life of the Project, impacts would be long-term. Proposed mitigation measures outlined by US Wind (Appendix G, Table G-1) and any future additional mitigation measures set forth by BOEM or other federal agencies could further reduce impacts (but would most likely not change the impact determinations).

In the context of reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including the Proposed Action, would range from **negligible** to **moderate** and **minor beneficial**. Considering all the IPFs together, BOEM anticipates the impacts from ongoing and planned actions, including the Proposed Action, would result in **moderate** impacts on finfish, invertebrates, and EFH in the geographic analysis area. The main drivers for this impact rating are fish mortality, climate change, recurring seafloor disturbance from bottom-tending fishing gear, and mortality resulting from offshore construction. The Proposed Action would contribute to the overall impact rating primarily through the temporary disturbance due to new cable emplacement and permanent impacts from the presence of structures (cable protection measures and foundations). Therefore, the overall impacts on finfish, invertebrates, and EFH would likely qualify as **moderate** because a notable and measurable impact is anticipated, but the resource would likely recover completely when the WTGs are removed or when remedial or mitigating actions are taken.

3.5.5.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes on Finfish, Invertebrates, and Essential Fish Habitat

Under Alternative C there would be an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route) that would minimize impacts on Indian River Bay including finfish, invertebrates, and EFH. There are four potential

Onshore Export Cable Routes based on which landfall location is selected (one associated with Alternative C-1 and three associated with Alternative C-2). There are no changes to the offshore activities, so therefore those impacts would be the same as the Proposed Action. The only differences to the finfish, invertebrates, and EFH is based on the impact within Indian River Bay, which are described in more detail below.

3.5.5.6.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

Alternative C was developed through the scoping process for the Draft EIS in response to comments requesting an alternative to minimize impacts in Indian River Bay. This alternative would result in terrestrial onshore export cable routing that avoids crossing through Indian River Bay or the Indian River and has two proposed sub-alternatives which vary by landfall location and Onshore Export Cable Route to the Onshore substation. Offshore Project components within the Lease Area (WTGs, OSSs, inter-array, and Met Tower) would be like the Proposed Action (Alternative B).

Alternative C-1 assumes the northern Offshore Export Cable Route would be selected with the landfall at Towers Beach and could have one potential route (Onshore Export Cable Route 2) before reaching the POI, which avoids crossing through Indian River Bay (Figure 2-6). The route would use Delaware DOT ROWs to run the cabling underground, to the extent feasible. Onshore Export Cable Route 2 does cross a small Indian River Bay tributary, the Indian River, just east of Millsboro, Delaware, and would require HDD to reach the Onshore substation.

Onshore Export Cable Route 2 would cross a navigable section of the Indian River (NOAA 2022c) that is routinely dredged by the USACE (2021). The dredging begins at the Indian River Inlet and narrows as it continues to Millsboro. The crossing of this waterway for route 2 would occur just east of an area called Old Landing, which would be dredged to about 9 feet (2.7 meters) deep and 80 feet (24.4 meters) wide (USACE 2021). This project was first authorized in 1937 and has occurred when needed to maintain safe navigation for commercial and recreational fishing as well as U.S. Coast Guard passage. There are jetties at the mouth of the Indian River Inlet that were deemed to be in poor condition when last evaluated in 2020, with more than 350 linear feet (106.7 linear meters) of loss from the north jetty since 1960 (USACE 2021). Although this area provides habitat for finfish and invertebrates, there appears to be routine disturbance to the benthic habitat from ongoing actions. Although the impacts from Alternative C-1, Route 2 would not likely exceed those of ongoing dredge projects, the cabling infrastructure does pose a risk of getting caught in dredge gear.

Alternative C-2 assumes the southern Offshore Export Cable Route is selected with the landfall at 3R’s Beach, similar to the Proposed Action; however, only terrestrial-based Onshore Export Cable Routes will be considered in the three optional routes (1a, 1b, and 1c) which all run south of Indian River Bay to their POI (Figure 2-7). These routes range from 16 or 17 miles (26 or 27 kilometers) long. Because none of these southern proposed onshore routes traverse Indian River Bay, there would be no impacts on finfish, invertebrates, or EFH from Alternative C-2 compared to the Proposed Action.

Offshore Activities and Facilities

Offshore Project components within the Lease Area (WTGs, OSSs, inter-array cables, and Met Tower) for Alternatives C-1 and C-2 would be the same as the Proposed Action (Alternative B) and are discussed in Section 3.5.5.5.

3.5.5.6.2 Impacts of Alternative C on ESA-Listed Species

Indian River Bay and the Indian River proper are too shallow for the ESA-listed species. These ESA-listed species prefer water depths greater than approximate 5 feet (1.5 meters) near the Indian River crossing as part of Alternative C-1 Onshore Export Cable Route 2. As supported by the COP (Volume II, Table 8-1; US Wind 2023), these species are not likely to occur within the Project area and are therefore not likely to be impacted by either Alternative C-1 or C-2.

3.5.5.6.3 Conclusions

Alternative C would mostly avoid Indian River Bay and remove the Inshore Export Cable Route replacing it with an Onshore Export Cable Route, though one alternative would cross a small section of the Indian River. The decrease in impact from avoiding crossing through the Indian River Inlet, into the bay, and through the Indian River would be beneficial for juvenile fish, invertebrates, and EFH. BOEM expects the impacts resulting from Alternative C would be similar to the Proposed Action in a lesser degree and would range from temporary to long term with individual IPFs leading to impacts ranging from **negligible** to **moderate** with potentially **minor beneficial** impacts, and overall impacts being **moderate,** though functionally less than in the Proposed Action.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative C, would range from **negligible** to **moderate** with potentially **minor beneficial** impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative C, would result in **moderate** impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom benthic habitat, fishing using bottom-tending gear, and effects from climate change. Alternative C would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures.

3.5.5.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts on Finfish, Invertebrates, and Essential Fish Habitat

Under Alternative D the WTGs within a 14-mile (22.5-kilometer) buffer from the Maryland coastline would be excluded, eliminating 32 WTGs and 1 OSS. The associated cabling would also be excluded, which will result in less benthic disturbance and therefore less impact on finfish, invertebrates, and EFH than the Proposed Action.

3.5.5.7.1.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

Inshore impacts within Indian River Bay would be the same as the Proposed Action (Alternative B). Nearshore and onshore activities and facilities will be covered under Section 3.5.4, Coastal Habitat and Fauna.

Offshore Activities and Facilities

Alternative D was developed to address public comments concerning the visual impacts of the Proposed Action. Alternative D would exclude 32 WTGs and 1 OSS associated with the future development phase. The public requested a 15-mile (24.1-kilometer) exclusion zone from the shore (in the northeast portion of the Lease Area); however, these structures are within 14 miles (22.5 kilometers) from the Maryland coastline, though the 1-mile (1.6-kilometer) difference is not likely to be significant. This exclusion would not impact the development of MarWin or Momentum wind (phases 1 and 2, respectively) but would only impact future development (Figure 2-8).

The exclusion of 32 WTGs and 1 OSS closest to the Maryland shoreline would result in a reduction in the amount of seafloor disturbance compared to the Proposed Action. However, the overall impact level would remain moderate, as impacts to finfish, invertebrates, and EFH would be unavoidable, and permanent as long as the structures remain.

3.5.5.7.2 Impacts of Alternative D on ESA-Listed Species

Atlantic sturgeon is the only ESA-listed species that may be resident within the Project area and is most impacted by noise from pile-driving and a potential for vessel strike. As previously stated, the scalloped hammerhead would most likely transit through the project site following prey species migrations (herring, mackerel, sardines, and squid). The giant manta ray and oceanic whitetip sharks are found within New England and Mid Atlantic Bight mainly from July through September. The reduction of 32 WTGs, 1 OSS, and associated inter-array cables would result in lowering the potential impact of sound through pile-driving, the risk of vessel strikes, and benthic resource disturbance by the associated construction activities related to WTG, OSS, and inter-array cable installation for all of the listed species that utilize the offshore resources within the US Wind Lease Area.

3.5.5.7.3 Conclusions

Alternative D would decrease the number of WTGs, OSSs, and associated inter-array cables which would have a decrease in potential impacts on benthic disturbance and therefore finfish, invertebrates, and EFH. BOEM expects the impacts resulting from Alternative D would be similar to the Proposed Action in a lesser degree and would range from temporary to long term with individual IPFs leading to impacts ranging from **negligible** to **moderate** with potentially **minor beneficial** impacts, and overall impacts being **moderate**, though functionally a lesser impact than the Proposed Action.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative D, would range from **negligible** to **moderate** with potentially **minor beneficial** impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative D, would result in **moderate** benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative D would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures.

3.5.5.8 Impacts of Alternative E – Habitat Impact Minimization on Finfish, Invertebrates, and Essential Fish Habitat

Alternative E would avoid impacts on AOCs which includes sensitive benthic habitats (Figure 2-9). This alternative would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or repositioning the Offshore Export Cable Route. Micrositing of WTGs and cables may be necessary to avoid AOC (i.e., sensitive benthic habitat). There are up to five areas which may be excluded along the perimeter of the Lease Area.

3.5.5.8.1.1 Offshore and Inshore Activities and Facilities

Inshore Activities and Facilities

Inshore activities and facilities from Alternative E would not impact finfish, invertebrates, or EFH differently than the Proposed Action.

Offshore Activities and Facilities

Alternative E, the Habitat Impact Minimization Alternative was developed through the scoping process in response to comments about minimizing impacts on offshore habitats for finfish. Alternative E would result in the removal of 11 WTGs, associated inter-array cables, and repositioning the offshore export cable to avoid sensitive benthic habitats (Figure 2-9). NMFS identified six habitat AOCs using data provided by US Wind and previously collected data and reports (e.g., Guida et al. 2017). These areas are characterized by large, landscape scale features such as high-relief sand ridge and trough complexes and deep holes/drop-offs, where development and conversion of the bottom may result in significant impacts. These areas produce habitat value for finfish, invertebrates and the EFH for managed species that utilize these seafloor features. Characteristics of these habitats include vertical relief, high rugosity, stratification of sediments, presence of other benthic features, and other characteristics that result in high habitat heterogeneity and complexity on various spatial scales (from sub-meter to many kilometers). BOEM expects the impacts resulting from Alternative E would be similar to the Proposed Action, but avoiding these spatially complex sand wave areas would reduce the impacts through preserving these significant benthic habitats. A roughly 10 percent reduction in WTGs would decrease the duration of construction activities along with noise exposure from pile-driving or jet-plowing operations, turbidity levels, and sediment deposition. This alternative would have 11 fewer WTG foundations, scour protection and associated reduction in inter-array cables. This would reduce the amount of displacement of soft-bottom invertebrates and finfish within the footprint associated with each WTG and cable installation impacts within the sensitive benthic habitats such as sand ridges. Offshore sand ridge and trough features support diverse finfish, invertebrate, and EFH assemblages that serve important ecological functions for the offshore MAB community and complex food web. A reduction of impacts within these high value habitats would serve to benefit the finfish and invertebrate communities within the geographic analysis area. BOEM expects the impacts resulting from Alternative E would be similar to the Proposed Action to a lesser physical and ecological degree. The focus for implementing Alternative E is on preserving complex benthic habitat and would range from temporary to long-term impacts with individual IPFs leading to impacts ranging from negligible to moderate with potentially minor beneficial impacts for hard-bottom associated finfish and invertebrates, and overall impacts being minor to moderate, depending on the amount of complex habitat avoided, and the reduction in benthic disturbance.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative E, would range from negligible to moderate with potentially minor beneficial impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative E, would result in moderate benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative E would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures.

3.5.5.8.2 Impacts of Alternative E on ESA-Listed Species

The Atlantic sturgeon is the only ESA-listed species that may be resident within the Project area and is most impacted by noise from pile-driving and a potential for vessel strike. As previously stated, the scalloped hammerhead would most likely transit through the project site following prey species migrations (herring, mackerel, sardines, and squid). The giant manta ray and oceanic whitetip sharks are found within New England and Mid Atlantic Bight mainly from July through September when waters reach 66.2°F to 71.6°F (19°C to 22°C) (NOAA Fisheries 2022b). The giant manta and oceanic whitetip shark are listed as threatened throughout their range, while the scalloped hammerhead is listed as threatened within the central and southeast Atlantic DPS. With the reduction of 11 WTGs, associated inter-array cables, and repositioning the offshore export cables adopting Alternative E could potentially reduce the negative impacts to the ESA-Listed species that may be resident or seasonally migrating through the Project area.

3.5.5.8.3 Conclusions

Alternative E would decrease seafloor disturbance and impacts of the finfish, invertebrates, and EFH relative to the Proposed Action. BOEM expects the impacts resulting from Alternative E would be similar to the Proposed Action in a lesser degree and would range from temporary to long term with individual IPFs leading to impacts ranging from **negligible** to **moderate** with potentially **minor beneficial** impacts, and overall impacts being **moderate**.

In the context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including Alternative E, would range from **negligible** to **moderate** with potentially **minor beneficial** impacts. Considering all the IPFs collectively, BOEM anticipates the impacts from ongoing and planned actions, including Alternative E, would result in **moderate** benthic impacts. The main drivers for this impact rating are direct physical impacts (e.g., displacement, smothering) during WTG and cable installations, habitat conversion from soft- to hard-bottom habitat, fishing using bottom-tending gear, and effects from climate change. Alternative E would contribute to the overall impact rating primarily through the permanent impacts due to the presence of structures.

3.5.5.9 Comparison of Alternatives

As described in Section 3.5.5.5, the potential impacts associated with the Proposed Action in combination with ongoing and planned activities would likely be **negligible** to **moderate** with potentially **minor beneficial** as well as **moderate adverse** impacts when compared to the impacts expected under the No Action Alternative. The Proposed Action would impact finfish, invertebrates, and EFH through increased anchoring, EMF exposure, new cable emplacement, underwater sound, seabed profile disturbance, sediment deposition and presence of structures. Under the No Action Alternative, these impacts would not occur.

As discussed in Sections 3.5.5.5 through 3.5.5.8, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although the number of structures (WTGs, OSSs, and Met Tower), associated cabling and disturbance to sensitive benthic habitats varies slightly, the impacts to finfish, invertebrates, and EFH would likely be **negligible** to **moderate** with potentially **minor beneficial**, with an overall impact of **moderate** for all action alternatives, though functional differences would occur between action alternatives, with Alternative E resulting in the least impact.

In the context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur under the same scenario (Appendix D, *Planned Activities Scenario*). Therefore, impacts would only vary if the incremental contributions of each alternative differ. BOEM expects individual impacts ranging from **negligible** to **moderate**, because while the impacts of accidental releases, anchoring, EMF and cable heat, port utilization, and discharges and intakes would be **negligible**, the presence of structures for the life of the project would be **moderate adverse** to **minor beneficial** and will remain so long as the structures are in place.

3.5.6 Marine Mammals

This section discusses potential impacts on marine mammal resources from the Project, action alternatives, and ongoing and planned activities in the marine mammal geographic analysis area. The marine mammal geographic analysis area (Figure 3.5.6-1) includes the Canadian Scotian Shelf, Northeast U.S. Continental Shelf, and Southeast U.S. Continental Shelf LMEs. This geographic analysis area is likely to capture the general movement range for most marine mammal species but does not include all areas that would be transited by Project vessels (e.g., Europe if local supply chains cannot be established). Due to the size of the geographic analysis area, the analysis of IPFs focuses on marine mammals that would likely occur near the Offshore Project area and could be affected by the Proposed Action. The Offshore Project area includes the Lease Area and the Offshore Export Cable Route shown in Figure 2-1 (Section 2.1.2).

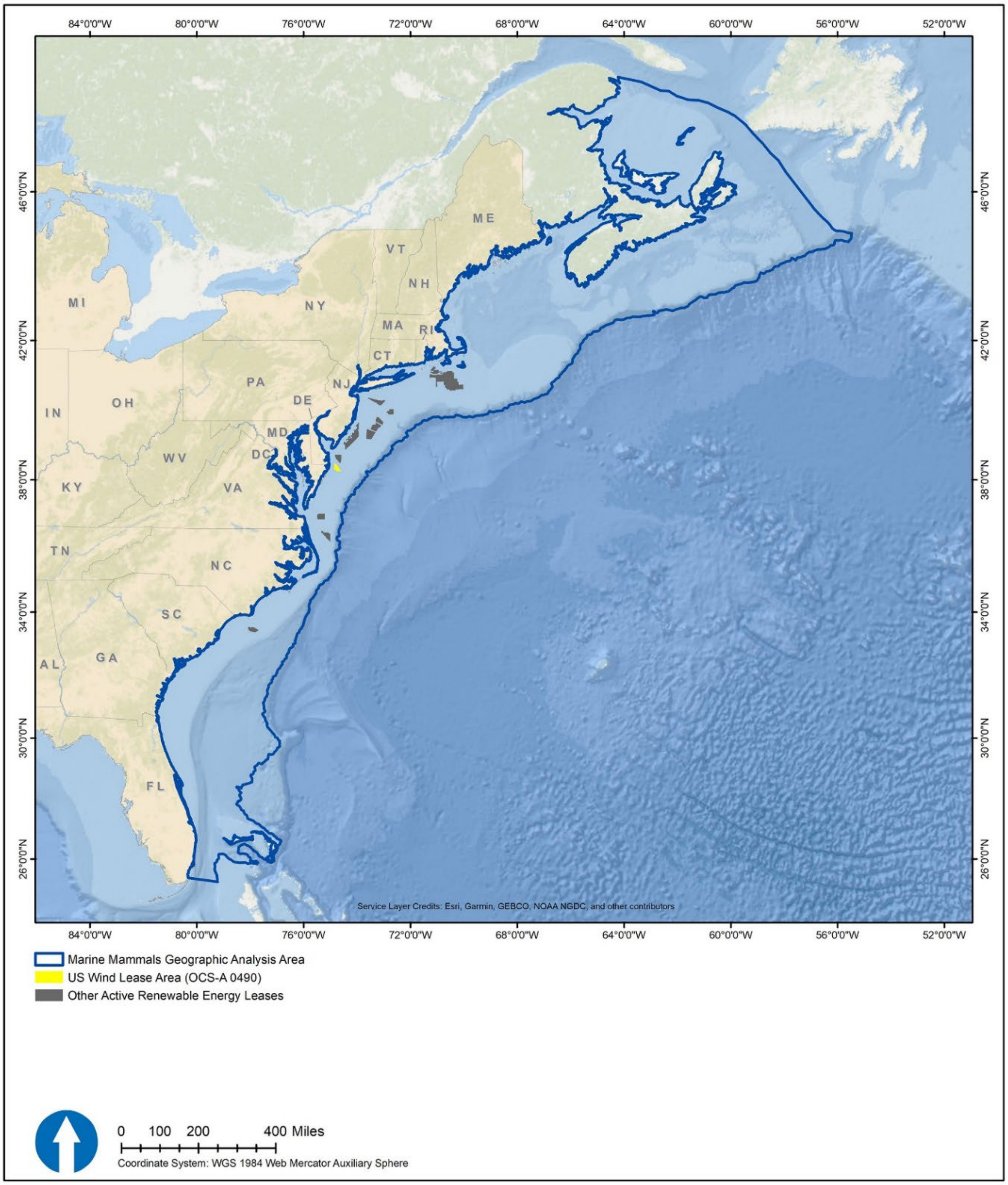


Figure 3.5.6-1. Marine mammals geographic analysis area

Section 3.5.6.1 presents an overview of the affected environment and future baseline conditions for marine mammals within the geographic analysis area. Impact level terminology is defined in Section 3.5.6.2. Impacts of the No Action Alternative in consideration of ongoing non-offshore wind and planned offshore wind activities without the Proposed Action are discussed in Section 3.5.6.3. Relevant project details and potential variances of the action alternatives are outlined in Section 3.5.6.4 prior to the analysis of impacts of the Proposed Action (Alternative B; Section 3.5.6.5) and Alternatives C and D (Sections 3.5.6.6 and 3.5.6.7).

3.5.6.1 Description of the Affected Environment and Future Baseline Conditions

Thirty-eight species of marine mammals are known to occur or could occur in waters of and in the vicinity of the Offshore Project area, which is within the Northeast Shelf LME and is where almost all Project activities would occur (Table 3.5.6-1). The Offshore Project area is defined as the region inclusive of the Project's Lease Area and the Offshore Export Cable Route to landfall. This includes 6 mysticetes (i.e., baleen whales), 27 odontocetes (i.e., toothed whales, dolphins, and porpoises), 4 pinnipeds (i.e., seals), and 1 sirenian (i.e., manatee) species. Fifteen of those could interact with the Project as they are likely to have regular, common, or uncommon occurrences in the Project area.

Table 3.5.6-1. Marine mammal species with geographic ranges that include the Project area

Common Name	Scientific Name	ESA/MMPA Status[1]	Relative Occurrence in the Offshore Project Area[2]	Seasonal Occurrence in the Offshore Project Area[3]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Population Estimate[4]	Population Trend[5]	Total Annual Human-Caused Mortality/ Serious Injury[6]	Reference
Mysticetes										
Blue whale	*Balaenoptera musculus*	E/D	Rare	Fall, winter	N/A	Western North Atlantic	402[7]	Unknown	Unknown	Hayes et al. (2020)
Fin whale	*Balaenoptera physalus*	E/D	Common	Year-round (peak in spring)	N/A	Western North Atlantic	6,802	Unknown	1.85	Hayes et al. (2022)
Humpback whale	*Megaptera novaeangliae*	None/N	Common	Year-round (peak in winter)	N/A	Gulf of Maine	1,396	+2.8% per year (2000 through 2016)	12.15	Hayes et al. (2020)
Minke whale	*Balaenoptera acutorostrata*	None/N	Common	Year-round (peak in spring)	N/A	Canadian East Coast	21,968	Unknown	10.55	Hayes et al. (2022)
North Atlantic right whale	*Eubalaena glacialis*	E/D	Common	Year-round (peak in winter, spring)	No[8]	Western North Atlantic	338	–29.7% overall (2011 through 2020)	8.1	NMFS (2023a)
Sei whale	*Balaenoptera borealis*	E/D	Rare	Spring	N/A	Nova Scotia	6,292	Unknown	0.80	Hayes et al. (2022)
Odontocetes										
Atlantic spotted dolphin	*Stenella frontalis*	None/N	Uncommon	Year-round	N/A	Western North Atlantic	39,921	Decreasing	Presumed 0	Hayes et al. (2022)
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	None/N	Uncommon	Year-round (peak in winter, spring)	N/A	Western North Atlantic	93,233	Unknown	27.2	Hayes et al. (2022)
Common bottlenose dolphin (coastal)	*Tursiops truncatus*	None/D	Common	Year-round (peak in summer)	N/A	Western North Atlantic, Northern Migratory Coastal	6,639	Decreasing[9]	12.2 to 21.5	Hayes et al. (2021)
Common bottlenose dolphin (offshore)	*Tursiops truncatus*	None/N	Common	Year-round (peak in summer)	N/A	Western North Atlantic, Offshore	62,851	Unknown	28	Hayes et al. (2020)
Clymene dolphin	*Stenella clymene*	None/N	Rare	Rare	N/A	Western North Atlantic	4,237	Unknown	Presumed 0	Hayes et al. (2020)
Cuvier's beaked whale	*Ziphius cavirostris*	None/N	Rare	Rare	N/A	Western North Atlantic	5,744	Unknown	0.2	Hayes et al. (2020)
Dwarf sperm whale	*Kogia sima*	None/N	Rare	Rare	N/A	Western North Atlantic	7,750[10]	Unknown	Presumed 0	Hayes et al. (2020)
False killer whale	*Pseudorca crassidens*	None/N	Rare	Rare	N/A	Western North Atlantic	1,791	Unknown	Presumed 0	Hayes et al. (2020)
Fraser's dolphin	*Lagenodelphis hosei*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Presumed 0	Hayes et al. (2020)
Harbor porpoise	*Phocoena phocoena*	None/N	Uncommon	Year-round (peak in winter, spring)	N/A	Gulf of Maine, Bay of Fundy	95,543	Unknown	163	Hayes et al. (2022)

Common Name	Scientific Name	ESA/MMPA Status[1]	Relative Occurrence in the Offshore Project Area[2]	Seasonal Occurrence in the Offshore Project Area[3]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Population Estimate[4]	Population Trend[5]	Total Annual Human-Caused Mortality/ Serious Injury[6]	Reference
Killer whale	*Orcinus orca*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Unknown	Waring et al. (2015)
Long-finned pilot whale	*Globicephala melas*	None/M	Uncommon	Year-round	N/A	Western North Atlantic	39,215	Unknown	9	Hayes et al. (2022)
Melon headed whale	*Peponocephala electra*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Presumed 0	Hayes et al. (2020)
Blainville's beaked whale	*Mesoplodon densirostris*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[11]	Unknown	0.2	Hayes et al. (2020)
Gervais' beaked whale	*Mesoplodon europaeus*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[11]	Unknown	0	Hayes et al. (2020)
Sowerby's beaked whale	*Mesoplodon bidens*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[11]	Unknown	0	Hayes et al. (2020)
True's beaked whale	*Mesoplodon mirus*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[11]	Unknown	0.2	Hayes et al. (2020)
Northern bottlenose whale	*Hyperodon ampullatus*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Presumed 0	Waring et al. (2015)
Pantropical spotted dolphin	*Stenella attenuata*	None/N	Uncommon	Year-round (peak in summer)	N/A	Western North Atlantic	6,593	Unknown	Presumed 0	Hayes et al. (2022)
Pygmy killer whale	*Feresa attenuata*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Presumed 0	Hayes et al. (2020)
Pygmy sperm whale	*Kogia breviceps*	None/N	Rare	Rare	N/A	Western North Atlantic	7,750[10]	Unknown	Presumed 0	Hayes et al. (2020)
Rough-toothed dolphin	*Steno bredanensis*	None/N	Rare	Rare	N/A	Western North Atlantic	136	Unknown	0	Hayes et al. (2019)
Risso's dolphin	*Grampus griseus*	None/N	Regular	Year-round	N/A	Western North Atlantic	35,215	Unknown	34	Hayes et al. (2022)
Common dolphin	*Delphinus delphis*	None/N	Common	Year-round (peak fall, winter, spring)	N/A	Western North Atlantic	172,974	Unknown	390.4	Hayes et al. (2022)
Short-finned pilot whale	*Globicephala macrorhynchus*	None/N	Uncommon	Year-round	N/A	Western North Atlantic	28,924	Unknown	136	Hayes et al. (2022)
Sperm whale	*Physeter macrocephalus*	E/D	Rare	Summer, fall	N/A	North Atlantic	4,349	Unknown	0	Hayes et al. (2020)
Spinner dolphin	*Stenella langirostris*	None/N	Rare	Rare	N/A	Western North Atlantic	4,102	Unknown	Presumed 0	Hayes et al. (2020)
Striped dolphin	*Stenella coeruleoalba*	None/N	Rare	Rare	N/A	Western North Atlantic	67,036	Unknown	0	Hayes et al. (2020)
Pinnipeds										
Harbor seal	*Phoca vitulina*	None/N	Regular	Fall, winter, spring	N/A	Western North Atlantic	61,336	Unknown	339	Hayes et al. (2022)
Gray seal	*Halichoerus grypus*	None/N	Uncommon	Fall, winter, spring	N/A	Western North Atlantic	27,300	Increasing	4,452	Hayes et al. (2022)

Common Name	Scientific Name	ESA/MMPA Status[1]	Relative Occurrence in the Offshore Project Area[2]	Seasonal Occurrence in the Offshore Project Area[3]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Population Estimate[4]	Population Trend[5]	Total Annual Human-Caused Mortality/ Serious Injury[6]	Reference
Harp seal	*Pagophilus groenlandicus*	None/N	Rare	Winter, spring	N/A	Western North Atlantic	Unknown[12]	Increasing	178,573	Hayes et al. (2022)
Hooded seal	*Cystophora cristata*	None/N	Rare	Summer, fall	N/A	Western North Atlantic	593,500	Increasing	1,680	Hayes et al. (2019)
Sirenians										
West Indian manatee	*Trichechus manatus*	T/D	Rare	Rare	No[13]	Florida	8,810[14]	Increasing or stable	98.6[15]	USFWS (2014, 2023)

D = depleted; E = endangered; ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act; N = non-strategic; N/A = not applicable; NMFS = National Marine Fisheries Service; T = threatened; USFWS = United States Fish and Wildlife Service

Notes:

[1] This denotes the highest federal regulatory classification. A strategic stock is defined as any marine mammal stock:

a. for which the level of direct human-caused mortality exceeds the PBR level;

b. that is declining and likely to be listed as threatened under the Endangered Species Act (ESA); or

c. that is listed as threatened or endangered under the ESA or as depleted under the Marine Mammal Protection Act (MMPA).

[2] Relative occurrence is defined as:

Common: occurring consistently in moderate to large numbers

Regular: occurring in low to moderate numbers on a regular basis or seasonally

Uncommon: occurring in low numbers or on an irregular basis

Rare: limited records exist for some years

[3] Seasonal occurrence, when available, was derived from abundance estimates using density models (Roberts et al. 2016) and NMFS Stock Assessment Reports. Seasons are depicted as follows: spring (March through May); summer (June through August); fall (September through November); winter (December through February).

[4] Unless otherwise noted, best available abundance estimates are from NMFS stock assessment reports (Waring et al. 2015; Hayes et al. 2019, 2020, 2021; 2022; NMFS 2023a).

[5] Increasing = beneficial trend, not quantified; Decreasing = adverse trend, not quantified; Unknown = there are insufficient data to determine a statistically significant population trend.

[6] The total annual estimated average human-caused mortality and serious injury, if known, is the sum of detected mortalities/serious injuries resulting from incidental fisheries interactions and vessel collisions. The value (number of individuals per year) represents a minimum estimate of human-caused mortality/serious injury only.

[7] No best population estimate exists for the blue whale; the minimum population estimate is presented in this table (Hayes et al. 2020).

[8] Critical habitat for the North Atlantic right whale is established for their foraging area in the Gulf of Maine, located approximately 330 mi (531 km) northeast of the Offshore Project area, and calving area off the Southeast U.S., located approximately 352 mi (566 km) southwest of the Offshore Project area.

[9] Based on an analysis of coast-wide (New Jersey to Florida) trends in abundance for common bottlenose dolphin.

[10] Estimated abundance is for *Kogia* spp. (dwarf and pygmy sperm whales).

[11] Estimated abundance is for *Mesoplodon* spp. (Blainville's [*M. densirostris*], Gervais' [*M. europaeus*], Sowerby's [*M. bidens*], and True's [*M. mirus*] beaked whales).

[12] Hayes et al. (2022) reported insufficient data to estimate the population size of harp seals in U.S. waters; the best estimate for the whole population (range-wide) is 7.6 million.

[13] Critical habitat for the West Indian manatee, Florida subspecies (*Trichechus manatus latirostris*) is located approximately 644 mi (1,036 km) southwest of the Offshore Project area.

[14] A best population estimate is provided for the West Indian manatee, Florida subspecies (USFWS 2023). The current range-wide population estimate for the West Indian manatee (all subspecies) is 13,000 (USFWS 2019).

[15] Total annual average of human-caused morality only, from 2008 through 2012 (USFWS 2014). The effect of the ongoing Florida manatee unusual mortality event (UME) on population size and trend is unknown at this time (USFWS 2023).

Marine mammals use the North Atlantic OCS to rest, forage, mate, and migrate. Some marine mammal species are highly migratory, traveling long distances between foraging and nursery areas, whereas other species migrate on a regional scale. Species occurrence in the Project area is not uniform as some species are pelagic and occur farther offshore, some are coastal and found nearshore, and others occur in both near and offshore areas. Seasonal migrations between foraging and nursery areas are generally determined by prey abundance and availability, which can be highly dependent on oceanographic properties and processes. Therefore, impacts on prey items must also be considered when assessing impacts on marine mammals. Section 3.5.5 summarizes the effects on fish, invertebrates, and EFH.

The analysis of the Proposed Action includes 15 species of marine mammals that are considered likely to occur (e.g., common, regular, or uncommon occurrence; Table 3.5.6-1) in the Offshore Project area and that would likely overlap with the Proposed Action including construction, operation, and decommissioning activities as described in Section 3.1.2. Species occurrence, seasonality, habitat use, and density were determined based on the most current available aerial and vessel survey data, which are routinely collected near the Offshore Project area. Current species abundance estimates can be found in NMFS marine mammal stock assessment reports (Waring et al. 2015; Hayes et al. 2019, 2020, 2021, 2022). For these reports, data collection, analysis, and interpretation are conducted through marine mammal research programs at NOAA Fisheries Science Centers and by other researchers. Additional population information for the North Atlantic right whale (NARW; *Eubalaena glacialis*) is accessed using the North Atlantic Right Whale Consortium's Annual Report Card (Pettis et al. 2022) and the recent Pace (2021) population modeling report. Descriptions of marine mammals found in the geographic analysis area are summarized in the COP (Volume II, Section 9.0; US Wind 2023), which incorporates existing published literature, gray literature, and public reports.

Several studies of marine mammal occurrence and distribution have been conducted in or near the Offshore Project area. The MABS were conducted for the Department of Energy (DOE) and the Maryland Energy Administration (MEA) to provide wildlife information specific to the mid-Atlantic WEAs off the coasts of Delaware, Maryland, and Virginia, using HD digital aerial surveys and boat-based surveys (Williams et al. 2015a, b). The Virginia Aquarium & Marine Science Center Foundation (VAQF) study was conducted for the Maryland Department of Natural Resources (MDNR) from 2013 through 2015 to provide fine-scale data on the presence of protected species for Maryland's offshore wind development efforts (Barco et al. 2015). US Wind conducted preliminary geotechnical and geophysical (G&G) surveys within the boundaries of the Lease Area in 2015 and along potential export cable routes in 2015, 2016, and 2017, with protected species observers (PSOs) using visual and passive acoustic monitoring to detect the presence of marine mammals (COP, Volume II, Appendix A1-A6; US Wind 2023).

In addition, the Atlantic Marine Assessment Program for Protected Species (AMAPPS) coordinates data collection and analysis to assess the abundance, distribution, ecology, and behavior of marine mammals in the U.S. Atlantic. These include both ship and aerial surveys conducted from 2010 and are currently ongoing. Although most of AMAPPS survey effort has been focused on offshore areas outside the Offshore Project area, the broad area surveyed encompasses and, therefore, is relevant to the assessment of the Proposed Action (Palka et al. 2017, 2021).

A habitat-based cetacean density model for the U.S. Exclusive Economic Zone of the East Coast (eastern U.S.) and Gulf of Mexico was also developed by the Duke University Marine Geospatial Ecology Lab in 2016 (Roberts et al. 2016). These models were subsequently updated to include more recently available data between 2017 and 2022 (Roberts et al. 2017, 2018, 2020; Curtice et al. 2019; Roberts 2022). Collectively, these estimates are considered the best information currently available for marine mammal densities in the U.S. Atlantic. Abundance and density data maps are accessible from Duke University's Marine Geospatial Ecology Lab online mapper (https://seamap.env.duke.edu/models/Duke/EC/).

Threatened and Endangered Marine Mammals

The ESA (16 U.S.C. 1531 et seq.) classifies certain species as threatened or endangered based on their overall population status and health. Five marine mammals that are known to occur in the Offshore Project area are classified as endangered: the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), NARW, sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*) (Hayes et al. 2020, 2022). Of the marine mammal species listed under the ESA, critical habitat has only been designated for the NARW. Critical habitat for the NARW within the marine mammal geographic analysis area comprises the feeding areas in Cape Cod Bay, Stellwagen Bank, and the Great South Channel, as well as the calving grounds that stretch from off Cape Canaveral, Florida to Cape Fear, North Carolina (Hayes et al. 2022). These critical habitat areas do not overlap with the Offshore Project area; however, the general region is an important migratory corridor for several ESA-listed large whales, including the NARW (Hayes et al. 2020, 2022). The closest designated NARW critical habitat area is approximately 355 miles (571 kilometers) northeast of the Offshore Project area (Figure 3.5.6-2).

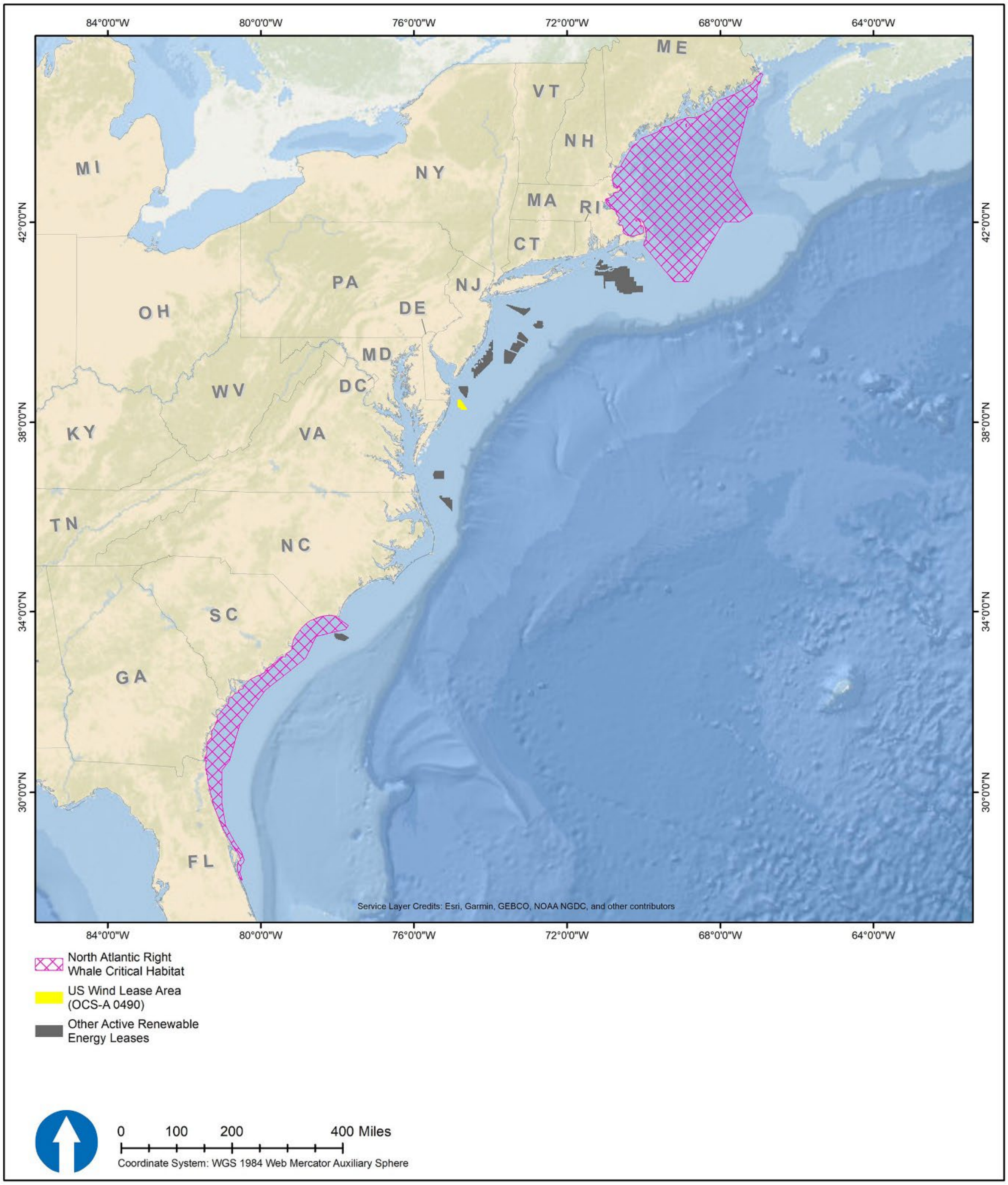


Figure 3.5.6-2. North Atlantic right whale Critical Habitat Areas

Increasingly important NARW foraging habitat exists on and in the vicinity of Nantucket Shoals off southern Massachusetts (Hayes 2022; O'Brien et al. 2022; Meyer-Gutbrod et al. 2021; Quintana-Rizzo et al. 2021). This region supports dense aggregations of their preferred prey and is identified as the only known winter foraging area for NARW (Quintana-Rizzo et al. 2021; O'Brien et al. 2022a). The tidal front along the western edge of Nantucket Shoals, generally associated with the 30-meter isobath, is a well-mixed, productive region that is associated with NARW foraging aggregations (Quintana-Rizzo et al. 2021). As noted by Hayes (2022), additional stressors in this area, such as increased vessel traffic, habitat modifications, and underwater noise, can exacerbate NARW foraging disturbances, which may lead to energetic and population-level effects. However, Nantucket Shoals is located approximately 295 miles (475 kilometers) northeast of the proposed Project area and would not be affected by Project activities.

Visual surveys in the mid-Atlantic indicate that NARWs are present in the Lease Area primarily from January to March (Williams et al. 2015a; Barco et al. 2015), while year-round presence, with a peak in abundance during the late winter and early spring, is supported by acoustic studies (Bailey et al. 2018). The offshore waters of Maryland, including waters in and near the Project area, are used as a migration corridor for the species and are considered a Biologically Important Area (BIA) for their migrations between feeding grounds off the northeastern U.S. and calving grounds off the southeastern U.S. (LaBrecque et al. 2015).

There have been elevated numbers of NARW mortalities and injuries reported since 2017, which prompted NMFS to designate an Unusual Mortality Event (UME) for NARWs (NMFS 2023b). These elevated mortalities and injuries have continued into 2023, totaling 36 mortalities, 33 serious injuries, and 29 sublethal injuries or illness to date (NMFS 2023b). Entanglement in fishing gear and vessel strikes are the preliminary cause of mortality, serious injury, and morbidity (sublethal injury and illness) in most of these whales during the ongoing UME. Despite the recent optimistic number of births, the species continues to be in severe decline, which prompted the International Union for Conservation of Nature (IUCN) to update the species' Red List status in July 2020 from endangered to critically endangered, noting its high risk for global extinction (Cooke 2020). Data show the population of the endangered NARW declined in abundance from 2011 to 2020. Recruitment of new individuals from births remains low, with mortalities exceeding births by 3:2 during the 2017-to-2020-time frame (Pettis et al. 2021, 2022). Though births in 2021 were higher than in 2020, mortalities continue to exceed the species' calculated potential biological removal (PBR) (Pettis et al. 2021, 2022; NMFS 2023a).[18] The current PBR for NARWs is 0.7 individuals, whereas the total annual observed human-caused mortality and serious injury (M/SI) is 8.1 individuals (NMFS 2023a). Not all mortalities are detected (NMFS 2023a), and overall mortality rate is likely higher than the estimated value (Pace 2021). As such, modeling suggests the mortality rate could be as high as 31.2 animals per year (NMFS 2023a). Most recent data continue to indicate substantial population decline, up to 29.7 percent between 2011 and 2020. The current population estimate for NARWs is at its lowest point in nearly 20 years, with a best-estimated 338 individuals remaining (Pettis et al. 2022; NMFS 2023a). Additional information about the

[18] The calculated PBR is the maximum number of animals, not including in natural mortalities, which may disappear annually from a marine mammal stock while allowing that stock to reach or maintain its optimal sustainable population level.

current population status for NARWs is provided in the most recent draft SAR (NMFS 2023a). When coupled with the species' low fecundity and small population size, all human-caused mortalities could impact their population status. The species' high mortality rate is driven primarily by fishing gear entanglement and vessel strike (NMFS 2023a).

Other endangered species that could occur near the Offshore Project area are the fin whale, blue whale, sei whale, and sperm whale, however it should be noted that the Letter of Authorization (LOA) application submitted under the MMPA is not requesting take for blue whales and sperm whales resulting from the proposed Project activities (TRC Companies 2023a). Fin whales are common in continental shelf waters of the geographic analysis area north of Cape Hatteras, North Carolina and can occur year-round in the vicinity of the Project area, though seasonal densities are highest in the winter and spring (Barco et al. 2015; Bailey et al. 2018). BIAs for fin whale feeding have been identified to the north of the Project area, off Rhode Island Sound between March and October, and year-round for Georges Bank, Cape Cod Bay, and the Gulf of Maine (LaBrecque et al. 2015). Blue whales in the North Atlantic appear to target high-latitude feeding areas and may also utilize deep-ocean features such as sea mounts outside the feeding season (Pike et al. 2009; Lesage et al. 2017, 2018). Given their reported occurrence and habitat preferences, and that the species was not detected during visual or acoustic surveys off Maryland, blue whales' presence in the Project area is considered rare and are unlikely to be encountered. However, blue whales could be encountered by vessels transiting to the Lease Area from overseas ports. BIAs have not been identified for blue whales on the East Coast (LaBrecque et al. 2015). Sei whales are also considered rare in the Offshore Project area but are regular visitors to the offshore areas near the continental slope where they have been observed year-round. Sei whales typically express irregular movement patterns that appear to be associated with oceanic fronts, sea surface temperatures, and specific bathymetric features (Olsen et al. 2009; Hayes et al. 2022). BIAs for sei whale feeding have been identified north of the Project area, stretching from the Gulf of Maine to the continental shelf off Georges Bank between the months of March and November (LaBrecque et al. 2015). Sperm whales have been observed during scientific surveys conducted in summer over the continental shelf edge, over the continental slope, and into mid-ocean regions but are not common in shelf waters in or near the Project area (Hayes et al. 2020). Thus, sperm whales are considered rare in the Offshore Project area with peak abundances more likely to occur in the summer and fall. BIAs have not been identified for sperms whales on the East Coast (LaBrecque et al. 2015). The threatened West Indian manatee (*Trichechus manatus*) could occur in the Project area but is considered a rare visitor to the region.

Non-Endangered Marine Mammals

All marine mammals are protected pursuant to the MMPA (16 U.S.C. 1361 et seq.), and their populations are monitored by NOAA, except for the West Indian manatee, which is managed by the U.S. Fish and Wildlife Service (USFWS). Mysticetes that are not federally endangered or threatened and commonly occur in the Offshore Project area include the humpback whale and minke whale. Humpback whales are observed off the coast of Maryland year-round with peak abundances occurring during the winter and spring (Williams et al. 2015b; Bailey et al. 2018). The humpback whale was previously federally listed as endangered. However, based on the revised listing completed by NOAA in 2016, the

DPS of humpback whales that occurs along the East Coast of the U.S. (West Indies DPS) is no longer considered endangered or threatened (Hayes et al. 2020, 2021). This stock continues to experience a positive trend in abundance (Hayes et al. 2020). However, a currently active UME was declared for humpback whales in January 2016, and since then, four have stranded in Maryland, with 184 total along the Atlantic coast from Maine to Florida (NMFS 2023c). A suspected potential leading cause of the ongoing humpback UME is vessel strikes. Minke whales are present year-round in the Project area, with highest abundances recorded in the fall, winter, and spring months (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015b). A currently non-active (i.e., closure pending) UME was also declared for the minke whale in January 2017 (NMFS 2023d). A total of 141 individuals were stranded from Maine to South Carolina, and preliminary results of necropsy examinations indicate evidence of human interactions or infectious disease; however, these results are not conclusive (NMFS 2023d). This minke whale UME is currently considered nonactive and is pending closure by NMFS (NMFS 2023d).

Odontocetes known to occur near the Offshore Project area included bottlenose dolphins (*Tursiops truncatus*), common dolphins (*Delphinus delphis*), Atlantic spotted dolphins (*Stenella frontalis*), pantropical spotted dolphins (*Stenella attenuata*), Risso's dolphins (*Grampus griseus*), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), pilot whales (*Globicephala* spp.), and harbor porpoise (*Phocoena phocoena*), with bottlenose dolphins being the most commonly recorded of all marine mammals (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015b). Two distinct stocks of Western North Atlantic bottlenose dolphins can occur within the Offshore Project area: the migratory coastal stock and the offshore stock (Hayes et al. 2020, 2021). Although they can be difficult to identify from surveys, the two stocks exhibit slightly different ecotypes, with both morphological and genetic differences. During warmer months, the migratory coastal stock is found from the coastline out to the 20-meter isobath from Assateague, Virginia, north to Long Island, New York, and in the colder months this stock has been found to occupy coastal waters from Cape Lookout, North Carolina, north to the North Carolina/Virginia border (Hayes et al. 2021). Because the current assessment relies heavily on survey data, the two stocks are referred to collectively. Common dolphins occur year-round in the region but exhibit strong seasonal changes in abundance and are the second-most observed odontocete (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015b). Atlantic spotted dolphins and pantropical spotted dolphins have limited presence in the Offshore Project area and are most likely to be present in the summer months (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015a). Risso's dolphins have been observed throughout the mid-Atlantic, where they predominantly occur offshore and in proximity to the shelf break (Hayes et al. 2022). However, recent surveys reported Risso's dolphins off the coast Maryland and Virginia during the summer (NEFSC and SEFSC 2021). The species, therefore, may occur in shallower waters along the proposed export cable routes during the summer, though this would be an uncommon occurrence (Williams et al. 2015; Curtice et al. 2019; Hayes et al. 2022). Atlantic white-sided dolphins are uncommon in the waters off Maryland, with no confirmed sightings or detections made during recent acoustic and visual studies (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015a, b) and no take for this species being requested for this Project (TRC Companies 2023). Two species of pilot whale occur within the Western North Atlantic: the long-finned pilot whale (*G. melas*) and the short-finned pilot whale (*G. macrorhynchus*). These species are difficult to differentiate at sea and are generally referred to collectively. Pilot whales are typically in association with unique bathymetric features such as the shelf edge and George's Bank and are therefore considered uncommon in the Offshore Project area (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015a). Harbor porpoises prefer coastal waters shallower than 492.1 feet (150 meters) but can also be found farther offshore. The species is considered uncommon in the waters off Maryland (Bailey et al. 2018; Barco et al. 2015; Williams et al. 2015a).

The only pinniped species expected to occur in the Project area are harbor (*Phoca vitulina*) and gray seals (*Halichoerus grypus*), with the former being the most dominant. Both species are expected to occur seasonally in the nearshore areas of Maryland, with highest densities during the fall, winter, and spring, though they are not expected regularly in offshore waters, including the Lease Area (Barco et al. 2015; Williams et al. 2015a, b). However, data on habitat use and foraging of harbor and gray seals in the mid-Atlantic are limited. Since July 2018, increased numbers of gray seal and harbor seal mortalities have been recorded across Maine, New Hampshire, and Massachusetts, with strandings as far south as Virginia (NMFS 2022d). This event was declared a UME by NMFS and encompasses 3,152 seal strandings, with 8 reported in Maryland (NMFS 2022). The pathogen phocine distemper virus was found in the majority of deceased seals and based on this finding, has been identified as the cause of the UME. This UME was considered closed by NMFS in 2020 (NMFS 2022). Since June 2022, another UME for harbor and gray seals has been declared by NMFS off the southern and central coast of Maine, with 322 seal strandings between June 2022 and July 2023 (NMFS 2023e). Preliminary testing has found some of the harbor and gray seals affected by the June 2022 UME to be positive for highly pathogenic avian influenza H5N1 (NMFS 2023e).

3.5.6.1.1 The Importance of Sound to Marine Mammals

Marine mammals rely heavily on acoustic cues for extracting information from their environment. Sound travels faster and farther in water (approximately 4,921 ft/s [1,500 m/s]) than it does in air (approximately 1,148 ft/s [350 m/s]), making this a reliable mode of information transfer across large distances and in dark environments where visual cues are limited. Acoustic communication is used in a variety of contexts such as attracting mates, communicating to young, or conveying other relevant information (Bradbury and Vehrencamp 1998). Marine mammals can also glean information about their environment by listening to acoustic cues, like ambient sounds from a reef, the sound of an approaching storm, or the call from a nearby predator. Finally, odontocetes produce and listen to echolocation clicks to locate food and to navigate (Madsen and Surlykke 2013).

3.5.6.1.1.1 Hearing Anatomy

Like terrestrial mammals, the auditory anatomy of marine mammals generally includes the inner, middle, and outer ear (Ketten 1994). Not all marine mammals have an outer ear, but if it is present, it funnels sound into the auditory pathway, capturing the sound. The middle ear acts as a transformer, filtering and amplifying the sound. The inner ear is where auditory reception takes place. The key structure in the inner ear responsible for auditory perception is the cochlea, a spiral-shaped structure containing the basilar membrane, which is lined with auditory hair cells. Specific areas of the basilar membrane vibrate in response to the frequency content of the acoustic stimulus, causing hair cells mapped to specific frequencies to be differentially stimulated and send signals to the brain (Ketten 1994). While the cochlea and basiliar membrane are well conserved structures across all mammalian taxa, there are some key differences in the auditory anatomy of terrestrial versus marine mammals that require explanation. Marine mammals have the unique need to hear in aqueous environments. Amphibious marine mammals (including seals, sea otters, and sea lions) have evolved to hear in both air and under water, and all except phocid pinnipeds have external ear appendages. Cetaceans do not have external ears, do not have air-filled external canals, and the bony portions of the ear are much denser than those of terrestrial mammals (Ketten 1994).

All marine mammals have binaural hearing and can extract directional information from sound. But the pathway that sound takes into the inner ear is not well understood for all cetaceans and may not be the same for all species. For example, in mysticetes, bone conduction through the lower jaw may play a role in hearing (Cranford and Krysl 2015), while odontocetes have a fat-filled portion of the lower jaw which is thought to funnel sound towards the ear (Mooney et al. 2012). Hearing tests have been conducted on several species of odontocetes, but there has yet to be a hearing test on a mysticete, so most of our understanding comes from examining the ears from deceased whales (Erbe et al. 2016; Houser et al. 2017).

Many marine mammal species produce sounds through vibrations in their larynx (Frankel 2002). In mysticetes, for example, air in the lungs and laryngeal sac expands and contracts, producing vibrations and sounds within the larynx (Frankel 2002). Mysticetes produce low-frequency sounds that can be used to communicate with other animals over great distances (Clark and Gagnon 2002). Differences in sound production among marine mammals varies, in part, with their use of the marine acoustic environment. Odontocetes hunt for their prey using high-frequency echolocation signals. To produce these signals they have a specialized structure called the “melon” in the top of their head that is used for sound production. When air passes through the phonic lips, a vibration is produced, and the melon helps transmit the vibration from the phonic lips to the environment as a directed beam of sound (Frankel 2002). It is generally believed that if an animal produces and uses a sound at a certain frequency, its hearing sensitivity will at least overlap those particular frequencies. An animal’s hearing range is likely much broader than this, as they rely heavily on acoustic information—beyond the signals they produce themselves—to understand their environment.

3.5.6.1.1.2 Functional Hearing Groups

Marine mammal species have been classified into functional hearing groups based on similar anatomical auditory structures and frequency-specific hearing sensitivity obtained from hearing tests on a subset of species (Finneran 2015a; NMFS 2018; Southall et al. 2019). For those species for which empirical measurements have not been made, the grouping of phylogenetic and ecologically similar species is used for categorization. This concept of marine mammal functional hearing groups was first described by Southall et al. (2007) and included five groups: low-, mid-, and high-frequency cetaceans, pinnipeds in water, and pinnipeds in air. These were further modified by NMFS in its underwater acoustic guidance document (NMFS 2018)—mainly to separate phocid pinnipeds from otariid pinnipeds—and updated again by Southall et al. in 2019. Although the science (Southall et al. 2019) now supports the existence of at least eight functional hearing groups (i.e., low-frequency cetaceans, high-frequency cetaceans, very high-frequency cetaceans, sirenians, phocids in air, phocids in water, other marine carnivores in air, and other marine carnivores in water), current regulatory practice is still based on NMFS (2018) guidance (Table 3.5.6-2).

Table 3.5.6-2. Most current marine mammal hearing groups used in the regulatory process in the U.S.

Hearing Group	Generalized Hearing Range
Low-frequency cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (underwater; true seals)	50 Hz to 86 kHz
Otariid pinnipeds (underwater; sea lions and fur seals)	60 Hz to 39 kHz

Source: NMFS (2018)
Hz = hertz; kHz = kilohertz

3.5.6.1.1.3 Potential Impacts of Underwater Sound

Depending on the level of exposure, the context, and the type of sound, potential impacts of underwater sound on marine mammals may include non-auditory injury, permanent or temporary hearing loss, behavioral changes, acoustic masking, or increases in physiological stress (OSPAR Commission 2009). Each of these impacts is discussed below.

Non-auditory Injury: Non-auditory physiological impacts are possible for very intense sounds or blasts, such as explosions. This kind of impact is not expected for most of the activities associated with offshore wind development; it is only possible during detonation of unexploded ordnances or if explosives are used in decommissioning. Although many marine mammals can adapt to changes in pressure during their deep foraging dives, the shock waves produced by explosives expose the animal to rapid changes in pressure, which in turn causes a rapid expansion of air-filled cavities (e.g., the lungs). This forces the surrounding tissue or bone to move beyond its limits which may lead to tears, breaks, bleeding, or hemorrhaging. The extent and severity to which such injury will occur depends on several factors including the size of these air-filled cavities, ambient pressure, how close an animal is to the blast, and how large the blast is (DoN 2017). In extreme cases, this can lead to severe lung damage which can directly kill the animal; a less severe lung injury may indirectly lead to death due to an increased vulnerability to predation or the inability to complete foraging dives.

Permanent or Temporary Hearing Loss: An animal's auditory sensitivity to a sound depends on the spectral, temporal, and amplitude characteristics of the sound (Richardson et al. 1995). When exposed to sounds of significant duration and amplitude (typically within close range of a source), marine mammals may experience noise-induced threshold shifts. Permanent Threshold Shift (PTS) is an irreversible loss of hearing due to hair cell loss or other structural damage to auditory tissues (Henderson et al. 2008; Saunders et al. 1985). Temporary Threshold Shift (TTS) is a relatively short-term (e.g., within several hours or days), reversible loss of hearing following noise exposure (Finneran 2015b; Southall et al. 2007), often resulting from hair cell fatigue (Saunders et al. 1985; Yost 2000). While experiencing TTS, the hearing threshold rises, meaning that a sound must be louder in order to be detected. Prolonged or repeated exposure to sounds at levels that are sufficient to induce TTS, without adequate recovery time, can lead to PTS (Finneran 2015b; Southall et al. 2007).

Behavioral Disturbance: Marine mammals may show varying levels of behavioral disturbance ranging from no observable response to overt behavioral changes. They may flee from an area to avoid the noise source, may exhibit changes in vocal activity, stop foraging, or change their typical dive behavior, among other responses (National Research Council 2003). When exposed to the same sound repeatedly, it is possible that marine mammals may become either habituated (show a reduced response) or sensitized (show an increased response) (Bejder et al. 2009). Several contextual factors play a role in whether an animal exhibits a response to a sound source, including those intrinsic to the animal and those related to the sound source. Some of these factors include: (1) the exposure context, e.g., behavioral state of the animal, habitat characteristics; (2) the biological relevance of the signal, e.g., whether the signal is audible, whether the signal sounds like a predator; (3) the life stage of the animal, e.g., juvenile, mother and calf; (4) prior experience of the animal, e.g., is it a novel sound source; (5) sound properties, e.g., duration of sound exposure, sound pressure level, sound type, mobility/directionality of the source; and (6) acoustic properties of the medium, e.g., bathymetry, temperature, salinity (Southall et al. 2021a). Because of these many factors, behavioral disturbances are challenging to both predict and measure, and this remains an ongoing field of study within the field of marine mammal bioacoustics. Furthermore, the implications of behavioral disturbances can range from temporary displacement of an individual to long-term consequences on a population if there is a demonstrable reduction in fitness (e.g., due to a reduction in foraging success).

Auditory Masking: Auditory masking may occur over larger spatial scales than noise-induced threshold shift or behavioral disturbance. Masking occurs when a noise source overlaps in time, space, and frequency as a signal that the animal is either producing or trying to extract from its environment (Richardson et al. 1995, Clark et al. 2009). Masking can reduce an individual's "communication space," (the range at which it can effectively transmit and receive acoustic cues from conspecifics) or "listening space" (the range at which it can detect relevant acoustic cues from the environment). A growing body of research is focused on the risk of masking from anthropogenic sources, the ecological significance of masking, and what anti-masking strategies may be used by marine animals. This understanding is essential before masking can be properly incorporated into regulation or mitigation approaches (Erbe et al. 2016). As a result, most assessments only consider the overlap in frequency between the sound source and the hearing range of marine mammals.

Physiological stress: The presence of anthropogenic noise, even at low levels, can increase physiological stress in a range of taxa, including humans (Kight and Swaddle 2011; Wright et al. 2007). This is extremely difficult to measure in wild animals, but several methods have recently emerged that may allow for reliable measurements in marine mammals. Baleen plates store both adrenal steroids (stress biomarkers such as cortisol) and reproductive hormones and, at least in bowhead whales, can be reliably analyzed to determine the retrospective record of prior reproductive cycles (Hunt et al. 2014). Waxy earplugs from mysticetes can be extracted from museum specimens and assayed for cortisol levels; one study demonstrated a potential link between historical whaling levels and stress (Trumble et al. 2018). These retrospective methods are helpful for answering certain questions, while the collection of fecal samples is a promising method for addressing questions about more recent stressors (Rolland et al. 2005).

The effects of anthropogenic sound on marine life have been studied for more than half a century. In that time, it has become clear that this is a complex subject with many interacting factors and extreme variability in response from one sound source to another and from species to species. But some general trends have emerged from this body of work. First, the louder and more impulsive (Appendix B, *Supplemental Information*) the received sound is, the higher the likelihood that there will be an adverse physiological effect, such as PTS or TTS. These impacts generally occur at relatively close distances to a source, in comparison to behavioral effects, masking, or increases in stress, which can occur wherever the sound can be heard. Secondly, the hearing sensitivity of an animal plays a major role in whether it will be affected by a sound or not, and there is a wide range of hearing sensitivities among marine mammal species. Regulation to protect marine life from anthropogenic sound has formed around these general concepts. More information about the regulatory process associated with noise impacts can be found in Appendix B.

3.5.6.2 Impact Level Definitions for Marine Mammals

Definitions of potential impact levels for adverse and beneficial effects are provided in Table 3.5.6-3 and for intensity, extent, and reversibility are provided in Table 3.5.6-4. Definitions for duration and significance criteria are provided in Section 3.3, *Definition of Impact Levels*. Beneficial impacts are also described, as applicable, for each IPF. Beneficial impacts are those that result in a positive effect on marine mammals. Impact levels are intended to serve NEPA purposes only and they are not intended to incorporate similar terms of art used in other statutory or regulatory reviews. For example, the term “negligible” is used for NEPA purposes as defined here and is not necessarily intended to indicate a negligible impact or effect under the MMPA. Similarly, the use of “detectable” or “measurable” in the NEPA significance criteria is not necessarily intended to indicate whether an effect is “insignificant” or “adverse” for purposes of ESA Section 7 consultation. Table F-8 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts to marine mammals.

Table 3.5.6-3. Impact level definitions for marine mammals

Impact Level	Impact Type	Definition
Negligible	Adverse	The impacts on individual marine mammals or their habitat, if any, would be at the lowest levels of detection and barely measurable, with no perceptible consequences to individuals or the population.
Negligible	Beneficial	Impacts on species or habitat would be beneficial but so small as to be unmeasurable.
Minor	Adverse	Impacts on individual marine mammals or their habitat would be detectable and measurable; however, they would be of low intensity, short term, and localized. Impacts on individuals or their habitat would not lead to population-level effects.
Minor	Beneficial	If beneficial impacts occur, they may result in a benefit to some individuals and would be temporary to short term in nature.
Moderate	Adverse	Impacts on individual marine mammals or their habitat would be detectable and measurable; they would be of medium intensity, can be short term or long term, and can be localized or extensive. Impacts on individuals or their habitat could have population-level effects, but the population can sufficiently recover from the impacts or enough habitat remains functional to maintain the viability of the species both locally and throughout their range.
Moderate	Beneficial	Beneficial impacts on species would not result in population-level effects. Beneficial impacts on habitat may be short term, long term, or permanent but would not result in population-level benefits to species that rely on them.
Major	Adverse	Impacts on individual marine mammals or their habitat would be detectable and measurable; they would be of severe intensity, can be long lasting or permanent, and would be extensive. Impacts on individuals and their habitat would have severe population-level effects and compromise the viability of the species.
Moderate	Beneficial	Beneficial impacts would promote the viability of the affected population or increase population resiliency. Beneficial impacts on habitats would result in population-level benefits to species that rely on them.

Table 3.5.6-4. Criteria used to characterize impact level definitions for marine mammals

Criteria	Description	Definition
Intensity	Expected size or severity of the impact	Low: Project is likely to result in one or more of the following: • Localized alteration of habitat including exceedances of underwater noise Level B harassment (behavioral or TTS) thresholds • Temporary disruption of critical activities (e.g., breeding, nursing) or localized damage to sensitive or critical habitats Medium: Project is likely to result in one or more of the following: • Localized alteration of habitat including exceedances of underwater noise Level A harassment (PTS) thresholds and non-auditory injury thresholds for explosions • One or more death or injury of a non-listed population • Regular disruption of critical activities (e.g., foraging, breeding, or nursing grounds) or localized damage to sensitive or critical habitats Severe: Project is likely to result in one or more of the following: • Widespread degradation of habitat in excess of underwater noise thresholds (both Level A and Level B harassment) as well as non-auditory mortality thresholds for explosions • One or more death or injury of a species at risk • Extensive disruption of critical activities (e.g., foraging, breeding, or nursing grounds) or damage to sensitive or critical habitats
Geographic Extent	Spatial scale over which the impact is expected to occur	Localized: Effects confined to the Offshore Project area (WTGs and their foundations, OSSs and their foundations, scour protection for foundations, inter-array and substation interconnection cables, and offshore export cables) and vessel transit routes. Extensive: Effect extends beyond the localized area and into the greater geographic analysis area.
Frequency	How often the activity causing the effect is expected to occur	Infrequent: Effect occurs once or rarely (less than once per year) over the specified duration of the Project. Frequent: Effect occurs repeatedly (monthly to yearly) over the specified duration of the Project. Continuous: Effect occurs continuously (weekly or more frequently) over the specified duration of the Project.
Likelihood	The probability of the effect caused by the impacts to occur	Low: Past experience and professional judgment indicate that the effect is unlikely but could occur. Moderate: Past experience and professional judgment indicate that there is a moderate likelihood that the effect could occur. High: Past experience and professional judgment indicate that the effect is likely to occur.

OSS = offshore substation; PTS = permanent threshold shift; TTS = temporary threshold shift; WTG = wind turbine generator

3.5.6.3 Impacts of Alternative A – No Action on Marine Mammals

Under the No Action Alternative, BOEM would not approve the COP and the project would not take place, thus baseline conditions for marine mammals would continue to follow current regional trends. Hence, not approving the COP would have no additional incremental effect on marine mammals. Similarly, under the No Action Alternative, NMFS would not issue the requested incidental take authorization, which would also result in no additional incremental impact on marine mammals and their habitat. Ongoing and planned activities other than offshore wind within the geographic analysis area that contribute to impacts on marine mammals include undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use (i.e., sonar); marine transportation; fisheries use and management; NMFS research initiatives; oil and gas activities; installation of new structures on the U.S. Continental Shelf; onshore development activities; and global climate change (Appendix D includes a complete description of ongoing and planned activities). These activities contribute to numerous IPFs, including accidental releases, which can have physiological effects on marine mammals; EMF, which can result in behavioral changes in marine mammals; cable emplacement and maintenance and port utilization, which can disturb benthic habitats and affect water quality; gear utilization, which can lead to an increased risk of interactions with fishing gear; lighting, which can result in behavioral changes in marine mammals and effects on prey species; noise, which can have physiological and behavioral effects on marine mammals; the presence of structures, which can result in behavioral changes in marine mammals, effects on prey species, which can affect prey availability for, and distribution of, marine mammals, and increased risk of interactions with fishing gear; and vessel traffic, which increases risk of vessel collision. The main known contributors to mortality events include collisions with vessels (i.e., ship strikes), entanglement with fishing gear, and fisheries bycatch. Many marine mammal migrations cover long distances, and these factors can have impacts on individuals over broad geographic and temporal scales. Ongoing and planned activities (excluding the Proposed Action) are expected to contribute to impacts on marine mammals.

Global climate change is also an ongoing risk for marine mammal species in the geographic analysis area. Climate change is known to increase temperatures, increase ocean acidity, change ocean circulation patterns, raise sea levels, alter precipitation patterns, increase the frequency and intensity of storms, and increase freshwater runoff, erosion, and sediment deposition. These effects have the potential to reduce long term foraging and reproductive success, increase individual mortality and disease occurrence, and affect the distribution and abundance of prey resources for marine mammals (Love et al. 2013; USEPA 2022; NASA 2023; Gulland et al. 2022). Altered habitat/ecology associated with warming has resulting in northward distribution shifts for some prey species and marine mammals are altering their behavior and distribution in response to these alterations (Davis et al. 2017, 2020; Hayes et al. 2020, 2021, 2022). Additionally, warming is expected to influence the prevalence, frequency, and severity of marine mammal diseases, particularly for pinnipeds (Burek et al. 2008; Burge et al. 2014). Over time climate change and coastal development would alter existing habitats, rendering some areas unsuitable for certain species and their prey, and more suitable for others. For example, shifts in NARW distribution patterns are likely in response to changes in prey densities driven in part by climate change (O'Brien et al. 2022; Reygondeau and Beaugrand 2011; Meyer-Gutbrod et al. 2015, 2021). These long-term, high-consequence impacts could include increased energetic costs associated with altered migration routes, reduction of suitable breeding, foraging habitat, or both, and reduced individual fitness. These factors individually and in combination can influence individual survivorship and fecundity over broad geographical and temporal scales. Therefore, global climate change and its associated consequences could lead to long-term, high-consequence impacts on marine mammals.

3.5.6.3.1 Future Offshore Wind Activities (without Proposed Action)

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on marine mammals include:

- The construction and installation of two offshore wind projects: South Fork Wind (12 WTGs and 1 OSS) in OCS-A 0517 and Vineyard Wind 1 (62 WTGs and 1 OSS) in OCS-A 0501,
- Continued O&M of the BIWF (5 WTGs) installed in Rhode Island state waters and CVOW-Pilot (2 WTGs) in OCS-A 0497 projects.

In addition to the approved Vineyard Wind 1 and South Fork Wind projects, a number of additional offshore wind projects are planned to be constructed in the geographic analysis area (Appendix D). These planned projects (excluding the Proposed Action) would result in an additional 3,081 WTG and OSS foundations in the geographic analysis area (Appendix D). The impacts of the ongoing and planned offshore wind projects are discussed in this section.

Accidental releases: Marine mammals are particularly susceptible to the effects of contaminants from pollution and discharges as they accumulate through the food chain or are ingested with garbage. Polychlorinated biphenyls (PCBs) and chlorinated pesticides (e.g., DDT, DDE, dieldrin) are of most concern and can cause long-term chronic impacts. These contaminants can lead to issues in reproduction and survivorship, and other health concerns (e.g., Pierce et al. 2008; Jepson et al. 2016; Hall et al. 2018; Murphy et al. 2018); however, the population-level effects of these and other contaminants are unknown. Research on contaminant levels for many marine mammal species is lacking. Some information has been gathered from necropsies conducted from bycatch and therefore focus on smaller whale species and seals. Moderate levels of these contaminants have been found in pilot whale blubber (Taruski et al. 1975; Muir et al. 1988; Weisbrod et al. 2000). Weisbrod et al. (2000) examined PCBs and chlorinated pesticide concentrations in bycaught and stranded pilot whales in the western North Atlantic. Contaminant levels were similar to or lower than levels found in other odontocetes in the western North Atlantic, perhaps because they are feeding farther offshore than other species (Weisbrod et al. 2000). Dam and Bloch (2000) found very high PCB levels in long-finned pilot whales in the Faroe Islands. Also, high levels of toxic metals (e.g., mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Islands drive fishery (Nielsen et al. 2000).

Accidental releases of fuel, fluids, hazardous materials, trash, and debris may increase as a result of offshore wind activities. The risk of any type of accidental release would be increased primarily during construction when additional vessels are present, but are also possible during operations and decommissioning of offshore wind facilities.

In the planned activities (excluding the Proposed Action) scenario (Appendix D), there would be a low risk of a leak of fuel, fluids, or hazardous materials from any one of approximately 3,081 WTG and OSS foundations, each with approximately 5,300 gallons (19,041 liters) stored. According to BOEM's modeling (Bejarano et al. 2013), a release of 128,000 gallons (484,533 liters), which represents all available oils and fluids from 130 WTGs and 1 OSS, is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons (7,571 liters) or less is likely to occur every 5 to 20 years. The likelihood of a spill occurring from multiple WTGs and OSSs at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons (7,571 liters) are largely discountable. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on individual fitness, including adrenal effects, hematological effects, liver effects, lung disease, poor body condition, skin lesions, and several other health effects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Based on the volumes potentially involved, the likely amount of additional accidental releases associated with offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities.

Trash and debris may be released by vessels during construction, operations, and decommissioning of offshore wind facilities. Operators would be required to comply with federal and international requirements to minimize releases. In the unlikely event of a trash or debris release, it would be accidental and localized in the vicinity of offshore wind lease areas. Worldwide, 62 of 123 (about 50 percent) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). The global stranding data indicate potential debris-induced mortality rates of 0 to 22 percent. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive tract, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological effects on individuals to population-level impacts (Browne et al. 2015). While precautions to prevent accidental releases will be employed by vessels and port operations associated with offshore wind development, it is likely that some debris could be lost overboard during construction, maintenance, and routine vessel activities. However, the amount would likely be miniscule compared to other inputs already occurring and considered negligible. If a release were to occur, it would be an accidental, low-probability event in the vicinity of offshore wind lease areas or the ports to the offshore wind lease areas used by vessels.

Intakes and discharges related to cooling offshore wind conversion stations are possible for other offshore wind projects. Potential effects resulting from intake and discharge use include altered micro-climates of warm water surrounding outfalls, altered hydrodynamics around intakes/discharges, prey entrainment, and association with intakes if prey are aggregated on intake screens from which marine mammals scavenge. The number of OSSs per project is likely small; therefore, these impacts, though long term, would be low in intensity and localized.

Impacts from accidental releases and discharges from ongoing and planned non-offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable. Impacts from accidental release and discharges from other offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are likely to result in long-term consequences to individuals that are detectable and measurable but do not lead to population-level effects.

Cable emplacement and maintenance: Other offshore wind projects could disturb up to 33,692 acres (13,635 hectares) of seafloor while installing associated undersea cables, causing an increase in suspended sediment (Appendix D, *Planned Activities Scenario,* Table D2-2). Those effects would be similar in nature to those observed during construction of the Block Island Wind Farm including localized seafloor disturbances and increased suspended sediments and turbidity around the site where cable emplacement and maintenance would occur (Elliot et al. 2017). While suspended sediment impacts would vary in extent and intensity depending on project- and site-specific conditions, measurable impacts are likely to be on the order of 500 mg/L or lower, short term (lasting for minutes to hours), and limited in extent to within a few feet vertically and a few hundred feet horizontally from the point of disturbance.

Impacts from cable emplacement and maintenance from ongoing and planned non-offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are likely to result in short-term, localized consequences to individuals that are detectable and measurable but do not lead to population-level effects. Impacts from cable emplacement and maintenance from other offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are likely to result in short-term, localized consequences to individuals that are detectable and measurable but do not lead to population-level effects.

EMFs and cable heat: In the planned activities (excluding the Proposed Action) scenario, up to 10,926 miles (17,584 kilometers) of inter-array and export cable would be added in the marine mammal geographic analysis area, producing EMF in the immediate vicinity of each cable during operations (Appendix D, Table D2-1). Studies documented electric or magnetic sensitivity up to 0.05 microTesla or Earth's magnetic field for fin whale, humpback whale, sperm whale, bottlenose dolphin, common dolphin, long-fin pilot whale, Atlantic white-sided dolphin, striped dolphin, Atlantic spotted dolphin, Risso's dolphin, and harbor porpoise (Tricas and Gill 2011). However, evidence used to make the determinations was only observed behaviorally/ physiologically for bottlenose dolphins and the remaining species were concluded based on theory or anatomical details.

Recent reviews by Bilinski (2021) of the effects of EMF on marine organisms concluded that measurable, though minimal, effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. Electrical telecommunications cables are likely to induce a weak EMF on the order of 1 to 6.3 microvolts per meter within 3.3 feet (1 meters) of the cable route (Gill et al. 2005). Fiber-optic communications cables with optical repeaters would not produce EMF effects. Under the No Action Alternative, export cables would be added in 26 BOEM offshore wind lease areas. As of March 30, 2023, 16 of these projects have a COP under review and are presumed to include at least one identified cable route, which will produce EMF in the immediate vicinity of each cable during operations. Transmission cables using HVAC emit ten times less magnetic field than HVDC (Taormina et al. 2018); therefore, HVAC cables are likely to have less EMF impacts on marine mammals.

This EIS anticipates the proposed offshore energy projects would use HVAC transmission, but HVDC designs are possible and could occur.

Exponent Engineering, P.C. (2018) modeled EMF levels that could be generated by the South Fork Wind Farm export cable and inter-array cable. The model estimated induced magnetic field levels ranging from 13.7 to 76.6 milligauss on the seafloor surface above the buried and exposed South Fork Wind Farm export cable and 9.1 to 65.3 milligauss above the inter-array cable, respectively. Induced field strength would decrease effectively to 0 milligauss within 25 feet (7.6 meters) of each cable. By comparison, Earth's natural magnetic field produces more than five times the maximum potential EMF effect from projects similar to the Proposed Action (Appendix F, Figure F-8 in BOEM 2021). Background magnetic field conditions would fluctuate by 1 to 10 milligauss from the natural field effects produced by waves and currents. The maximum induced electrical field experienced by any organism close to the exposed cable would be no greater than 0.48 millivolt per meter (Exponent Engineering, P.C. 2018). BOEM performed literature reviews and analyses of potential EMF effects from offshore renewable energy projects (CSA Ocean Sciences Inc. 2021; Inspire Environmental 2019; Normandeau et al. 2011). These and other available reviews and studies (Gill et al. 2005; Kilfoyle et al. 2018) suggest that most marine species cannot sense low-intensity EMF generated by the HVAC power transmission cables commonly used in offshore wind energy projects. Marine mammal species that are more likely to forage near the benthos, such as certain delphinids, have more potential to experience EMF above baseline levels (Tricas and Gill 2011). Normandeau et al. (2011) concluded that marine mammals are unlikely to detect magnetic field intensities below 50 milligauss, suggesting that these species would be insensitive to EMF effects from the renewable energy projects.

EMF effects on marine mammals from these other projects would vary in extent and magnitude depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., HVAC or HVDC, transmission voltage). However, measurable EMF effects are generally limited to within tens of feet of cables. BOEM would require these submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation.

Heat transfer into surrounding sediment associated with buried submarine high-voltage cables is possible (Emeana et al. 2016). However, heat transfer is not expected to extend to any appreciable effect into the water column due to the use of thermal shielding, the cable's burial depth, and additional cable protection such as scour protection or concrete mattresses for cables unable to achieve adequate burial depth. As a result, heat from submarine high-voltage cables is not expected to affect marine mammals.

Impacts from EMF from ongoing and planned non-offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds, of the lowest level of detection, and barely measurable, with no perceptible consequences to individuals or the population. Impacts from EMF from other offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or the population.

Gear utilization (biological/fisheries monitoring surveys): Future offshore wind projects are likely to include plans that monitor biological resources in and nearby associated project areas throughout various stages of development. These could include acoustic, trawl, and trap surveys, as well as other methods of sampling the biota in the area. The presence of monitoring gear could affect marine mammals by entrapment or entanglement (risk of entanglement in fishing gear is discussed in the *Presence of Structures* IPF); however, it is expected that monitoring plans will have sufficient mitigation procedures in place to reduce potential impacts.

Theoretically, any line in the water column, including line resting on or floating above the seafloor set in areas where whales occur, could entangle a marine mammal (Hamilton et al. 2019; Johnson et al. 2005). Entanglements may involve the head, flippers, fluke, or multiple body parts; effects range from no apparent injury to death. Entanglement in fishing gear has been identified as one of the leading causes of mortality in NARW and may be a limiting factor in the species recovery (NMFS 2023a; Knowlton et al. 2012). NOAA Fisheries estimates that over 85 percent of individuals have been entangled in fishing gear at least once (NMFS 2023a) and 60 percent of individuals show evidence of multiple fishing gear entanglements, with rates increasing over the past 30 years (King et al. 2021; Knowlton et al. 2012). Of documented NARW entanglements in which gear was recovered, 80 percent was attributed to non-mobile fishing gear (i.e., lobster and gillnet gear) (Knowlton et al. 2012). Additionally, recent literature indicates that the proportion of NARW mortality attributed to fishing gear entanglement is likely higher than previously estimated from recovered carcasses (Pace 2021). Entanglement may also be responsible for high mortality rates in other large whale species, including fin whales (Henry et al. 2020; Read et al. 2006).

Potential impacts from gear utilization from planned offshore wind activities on mysticetes, odontocetes, and pinnipeds are likely to be negligible and are expected to occur at short-term, regular intervals over the lifetime of the projects and to have no perceptible consequences to individuals or the population. However, the potential extent and number of animals potentially exposed cannot be determined without project-specific information.

Lighting: Shoreline development is the predominant existing artificial lighting source in the nearshore component of the geographic analysis area while vessels are the predominant source of artificial lighting offshore. The addition of over 3,081 WTGs and OSSs in the geographic analysis area (without the Proposed Action) with long-term hazard and aviation lighting, as well as lighting associated with construction vessels, would increase artificial lighting. Artificial lighting may disrupt the diel migration (vertical distribution) of some prey species, including zooplankton, which may secondarily influence marine mammal distribution patterns (Orr et al. 2013). Observations at offshore oil rigs showed dolphin species foraging near the surface and staying for longer periods of time around platforms that were lit (Cremer et al. 2009). Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities to marine mammal distribution, behavior, and habitat use were uncertain but likely negligible if recommended design and operating practices are implemented. Specifically, using low-intensity shielded directional lighting on structures, activating work lights only when needed, and using red navigation lights with low strobe frequency would reduce the amount of detectable light reaching the water surface to negligible levels.

Noise: The siting, construction, operation, maintenance, and decommissioning of other offshore wind farms is expected to introduce several types of underwater sound into the marine environment. Physical descriptions of sounds associated with these activities can be found in Appendix B, *Supplemental Information*. The expected impacts of each of these sources on marine mammals is discussed below.

Geophysical and Geotechnical Surveys

For the purposes of future offshore wind projects, geophysical and geotechnical surveys use active acoustic sources to evaluate the feasibility of turbine installation and to identify potential hazards. A description of the physical qualities of geophysical sound sources can be found in Appendix B, Section B.2.1. Recently, BOEM and USGS characterized underwater sounds produced by high-resolution geophysical sources and their potential to affect marine mammals (Ruppel et al. 2022). Although some geophysical sources can be detected by marine mammals, given several key physical characteristics of the sound sources—including source level, frequency range, duty cycle, and beamwidth—most HRG sources are unlikely to result in behavioral disturbance of marine mammals, even without mitigation (Ruppel et al. 2022). This finding is supported empirically: Kates Varghese et al. (2020) found no change in three of four beaked whale foraging behavior metrics (i.e., number of foraging clicks, foraging event duration, click rate) during two deepwater mapping surveys using a 12-kilohertz multibeam echosounder. There was an increase in the number of foraging events during one of the mapping surveys, but this trend continued after the survey ended, suggesting that the change was more likely in response to another factor, such as the prey field of the beaked whales, than to the mapping survey. During both multibeam mapping surveys, foraging continued in the survey area and the animals did not leave the area (Kates Varghese et al. 2020, 2021). Vires (2011) found no change in Blainville's beaked whale click durations before, during, and after a scientific survey with a 38-kilohertz EK-60 echosounder, while Cholewiak et al. (2017) found a decrease in beaked whale echolocation click detections during use of an EK-60 echosounder and Quick et al. (2017) found that short-finned pilot whales did not change foraging behavior but did increase their heading variance during use of an EK-60 echosounder. For some of the higher-amplitude sources such as bubble guns, some boomers, and the highest-power sparkers, behavioral disturbance is possible, but unlikely if mitigation measures such as clearance zones and shutdowns are applied. Geotechnical surveys may introduce low-level, intermittent, broadband noise into the marine environment. These sounds could result in acoustic masking in low or mid-frequency cetaceans but are unlikely to result in behavioral disturbance given their low source levels and intermittent use.

Considering the empirical evidence together, the likelihood of geophysical and geotechnical survey noise from future offshore wind projects to adversely affect marine mammals is low and would be a negligible to minor impact. Minor impacts such as behavioral disturbance or masking may occur in more sensitive species such as some beaked whale species and those with a hearing range that directly overlaps the sound sources, specifically mid- and high-frequency cetaceans.

Unexploded Ordnance Detonations

UXOs on the seafloor may be encountered in offshore wind lease areas or along export cable routes. If found, UXO may be left alone, moved, or removed by controlled explosive detonation or low-order deflagration. Further information on UXO detonations can be found in Appendix B. Underwater explosions generate shock waves, or a nearly instantaneous wave characterized by extreme changes in pressure, both positive and negative. This shock wave can cause injury and mortality to a marine mammal, depending on how close an animal is to the blast. The physical range at which injury or mortality could occur will vary based on the amount of explosive material in the UXO, size of the animal, and the location of the animal relative to the explosive. Injuries may include hemorrhages or damage to the lungs, liver, brain, or ears, as well as auditory impairment such as PTS and TTS (Ketten 2004). Smaller animals are generally at a higher risk of blast injuries.

Blast injuries have been documented in close association with explosive detonations, including after 42 British ground mines (MK 1-7) were cleared in the Baltic Sea in 2019 (Siebert et al. 2022). Within a week and in the two months following, a total of 24 harbor porpoises were found dead in the general area, 8 of which had clear signs of blast injury as the primary cause of death, i.e., dislocated ear bones, bleeding in the acoustic fat and melon, and several more had blast injury in addition to other signs of potential mortal stressors (e.g., found as bycatch, blunt force trauma). As the precise timing of the injuries were not known, it is not clear whether the observed injuries were due to this blast event or an unrelated event. In 2011, an underwater detonation (8.75 pound [3.97 kilogram]) at the Silver Strand Training Complex in San Diego, California resulted in blast injury and death to at least three long-beaked common dolphins that had entered the 2,100-feet (640-meter) mitigation zone minutes before the detonation (Danil and Ledger 2011).

To predict the potential impacts of UXOs on marine species, several models have been developed. Goertner (1982) developed a model for physical injuries to cetaceans at a range of depths, and a modified version of this model is recommended by NMFS for predicting injury impacts to marine mammals (NMFS 2022e). von Benda-Beckman et al. (2015) modeled PTS effect distances for charge masses ranging from 2.2 to 2,205 pounds (1 to 1,000 kilograms) at depths up to 98.4 feet (30 meters) based on recordings from several UXO detonations in the North Sea and predicted PTS effect ranges for harbor porpoises from hundreds of meters to 9.3 miles (15 kilometers), and the effect range generally increased with increasing charge mass and depth. Hannay and Zykov (2022) focused on auditory injury rather than physical injury. They modeled the distance to NMFS auditory exceedance thresholds (Appendix B, Section B.3.3 in Hannay and Zykov 2022) for five species groups (low-, mid-, and high-frequency cetaceans; phocid pinnipeds; otariid pinnipeds/sea turtles) exposed to UXO detonations of various charge masses at four sites in the Revolution Wind Project area. While exposure ranges will vary among lease areas based on environmental conditions and other factors, their results provide an example of predicted exposure ranges in U.S. waters. The largest effect ranges were predicted for high-frequency cetaceans exposed to a 1,000-pound (454-kilogram) detonation (the largest charge mass modeled) at 9.9 miles (16 kilometers) (peak sound pressure level [L_{pk}]) and 7 mi (11.3 kilometer) (sound exposure level over 24 hours [SEL_{24h}]) for PTS, and 12.6 mi (20.2 kilometer) for TTS (SEL_{24h}; used by NMFS for the behavioral threshold for a single detonation) (Hannay and Zykov 2022). The distances to auditory injury were always greater than the predicted ranges for non-auditory injury associated with the blast impulse. It is worth noting that when UXOs are detonated they do not always fully detonate, meaning the explosion may not be as large as predicted by the charge mass. The modeling studies presented previously are based on the assumption that the charge fully detonates.

Behavioral effects are also possible out to farther ranges, but because the explosion is nearly instantaneous, behavioral effects are expected to be short-term, challenging to observe, and of less concern compared to potential injury and mortality effects. Todd et al. (1996) observed humpback whales near underwater explosions and did not note any overt behavioral changes (e.g., changing course, abrupt dive behavior) within 1.1 miles (1.8 kilometers) from the blast, with received L_{pk} of 123 dB re 1 µPa. They saw no overall trend in humpback whale movements during the course of the month when intermittent blasting was taking place.

The number, charge mass, and location of UXOs that may need controlled detonation for other projects are relatively unknown until a site assessment is performed. Additionally, as evidenced in the Proposed Action (Section 3.5.6.5), not all offshore wind projects will require controlled detonations as avoidance or non-explosive methods of disposing with UXOs will be effective. Therefore, it is difficult to predict the potential likelihood and frequency of effects of UXO detonation from other projects in the geographic area. However, while the likelihood of encountering this stressor is unknown, the effects are well documented. At close ranges, UXO detonations can be injurious or lethal. Mitigative measures for handling UXOs are likely to be required to decrease the chance that a marine mammal will be severely injured or killed from an explosion. For example, seasonal and time of day restrictions can be put in place to avoid times when marine mammals may be present, noise mitigation devices (e.g., double bubble curtain) can be applied to reduce noise beyond a certain radius of the detonation, and visual and passive acoustic monitoring of clearance zones can be used to reduce the number of marine mammals present within the predicted distance from a UXO that could cause injury or death. In addition, lower-order detonation methods, such as deflagration, are in development and could substantially decrease the energy released into the environment, therefore decreasing the effect ranges (Robinson et al. 2020). With mitigative measures in place, the intensity of this IPF is expected to be reduced from severe to medium. Due to the impulsive nature of an explosion, UXO detonation impact is expected to be similar across all marine mammal groups, with severe non-auditory impacts more likely for smaller animals. The likelihood of UXO detonation associated with planned offshore wind projects is unknown; however, impacts may range from minor to moderate due to the intensity of the IPF and based on the type of mitigation used.

Impact and Vibratory Pile-driving

In the planned activities scenario (Appendix D), the construction of up to 3,081 new WTG and OSS foundations in the geographic analysis area is expected to occur intermittently over a 7-year period. During the installation of WTG foundations, underwater sound related to pile-driving would likely occur for 2 to 4 hours per day. The sound generated during pile-driving will vary depending on the piling method (impact or vibratory), pile material, size, hammer energy, water depth, and substrate type. A description of the physical qualities of pile-driving noise can be found in Appendix B, *Supplemental Information*. These sounds may affect marine mammal species in the area. The impacts would vary in extent and intensity based on the scale and design of each project, as well as the schedule of project activities.

There are three potential exposure scenarios that marine mammals could experience:

- Concurrent exposure to sound from simultaneous construction of two nearby wind farms;

- Non-concurrent exposure to sound from construction of multiple windfarms within the same year; and
- Exposure to two or more concurrent or non-concurrent pile-driving events over multiple years.

Within a concurrent exposure scenario, an individual marine mammal in the area could be exposed to the sounds from more than one pile-driving event per day, repeated over a period of days. Concurrent pile-driving scenarios would increase the geographical extent of noise that is introduced into the marine environment, but would decrease the total number of days that the environment is ensonified. Results from Southall et al. (2021a) showed that concurrent construction of multiple windfarms, if scheduled to avoid critical periods when NARW are present in higher densities, minimizes the overall risk to the species. Under a non-concurrent exposure scenario, individual marine mammals could be exposed to pile-driving noise on different days within the same year. This would increase the total number of exposure days, but would likely occur intermittently over the range of an animal. Given the migratory movements and seasonal abundances of marine mammals throughout the offshore wind energy areas, it is likely that some individuals would be exposed to multiple days of construction noise within the same year.

Pile-driving activities from future offshore wind development projects could affect all marine mammal functional hearing groups within a certain radius around each project site. Depending on the hearing sensitivity of the species, exceedance of PTS and TTS thresholds may occur on the scale of several kilometers, and behavioral effects up to tens of kilometers from the center of pile-driving activity. However, based on the mobility of most marine mammals and the likelihood that they will avoid the area to a certain extent (e.g., Schakner and Blumstein 2013), certain marine mammal species (mid-frequency cetaceans [MFC], high-frequency cetaceans [HFC], and pinnipeds) may not be exposed to underwater sound for sufficient duration to cause PTS or TTS. In addition, if mitigations are applied (e.g., bubble curtains, exclusion zones), all effects and exposure ranges can be reduced.

The most commonly reported behavioral effect of pile-driving activity on marine mammals has been short-term avoidance or displacement from the pile-driving site. This has been well-documented for harbor porpoises, a species of high concern in European waters. Given that odontocetes produce echolocation clicks nearly constantly, strategically placed passive acoustic instruments allow researchers to derive insights about the animals' presence and behavior around wind farms by listening for their clicks. A 2011 study of harbor porpoise acoustic activity in the North Sea at the Horns Rev II wind farm revealed that porpoise vocal activity was reduced as far as 11.1 miles (17.8 kilometers) from the construction site during pile-driving. At the closest measured distance of 1.6 miles (2.5 kilometers), vocal activity completely ceased at the start of pile-driving, did not recommence for up to 1 hour after pile-driving ended, and remained below average levels for 24 to 72 hours (Brandt et al. 2011). Dahne et al. (2013) visually and acoustically monitored harbor porpoises during construction of the Alpha Ventus wind farm in German waters, and found a decline in porpoise detections at distances up to 6.7 miles (10.8 kilometers) from pile-driving, while an increase in porpoise detections occurred at points 15.5 and 31.1 miles (25 and 50 kilometers) away, suggesting displacement away from the pile-driving activity. During several construction phases of two Scottish windfarms, an 8 percent to 17 percent decline in porpoise acoustic presence was seen in the 15.5- by 31.1-mile (25- by 50-kilometer) block containing pile-driving activity in comparison to a control block. Displacement within the pile-driving monitored area was seen up to 7.5 miles (12 kilometers) away (Benhemma-Le Gall et al. 2021).

A more recent analysis in the North Sea looked at harbor porpoise density and acoustic occurrence relative to the timing and location of pile-driving activity, as well as the sound levels generated during the development of eight wind farms (Brandt et al. 2016). Using data from passive acoustic monitoring pooled across all projects, changes in porpoise detections across space and time were modeled. Compared to the 25- to 48-hour pre-piling baseline period, porpoise detections during construction declined by about 25 percent at SEL_{24h} between 145 and 150 dB re 1 μPa^2 s and 90 percent at SEL_{24h} above 170 dB re 1 μPa^2 s. Across the eight projects, a graded decline in porpoise detections was observed at different distances from pile-driving activities. The results revealed a 68 percent decline in detections within 3.1 miles (5 kilometers) of the noise source during construction, 33 percent decline 3.1 to 6.2 miles (5 to 10 kilometers) away, 26 percent decline 6.2 to 9.3 miles (10 to 15 kilometer) away, and a decline of less than 20 percent at greater distances, up to the 37.3-mile (60-kilometer) range modeled (Note: I authors used a 20 percent decline to indicate an adverse effect had occurred). However, within 20 to 31 hours after pile-driving, porpoise detections increased in the 0- to 3.1-mile (0- to 5-kilometer) range, suggesting no long-term displacement of the animals. Little to no habituation was found, i.e., over the course of installation, porpoises stayed away from pile-driving activities. It is worth noting that there was substantial inter-project variability in the reactions of porpoises that were not all explained by differences in noise level. The authors hypothesized that the varying qualities of prey available across the sites may have led to a difference in motivation for the animals to remain in an area. Temporal patterns were observed as well: porpoise abundance was significantly reduced in advance of construction up to 6.2 miles (10 kilometers) around the wind farm area, likely due to the increase in vessel traffic activity. This study showed that although harbor porpoises actively avoid pile-driving activities during the construction phase, these short-term effects did not lead to population level declines over the 5-year study period (Brandt et al. 2016).

A study conducted during wind farm construction in Cromarty Firth, Scotland compared the effect of impact and vibratory pile-driving on the vocal presence of both bottlenose dolphins and harbor porpoises in and outside the Cromarty Firth area (Graham et al. 2017). The researchers found a similar level of response, of both species to both impact and vibratory piling, likely due to the similarly low, received SEL_{24h} from the two approaches (129 dB re 1 μPa^2 s [vibratory] and 133 dB re 1 μPa^2 s [impact], both at 2,664 feet [812 meters] from the pile). There were no statistically significant responses attributable to either type of pile-driving activity in the three metrics considered: daily presence/absence of a species, number of hours in which a species was detected, or duration of daytime (between 06:00 and 18:00) encounters of a species. The only exception was seen in bottlenose dolphins on days with impact pile-driving. The duration of bottlenose dolphin acoustic encounters decreased by an average of approximately 4 minutes at sites within the Cromarty Firth (closest to pile-driving activity) in comparison to areas outside the Cromarty Firth. The authors hypothesized that the lack of a strong response was because the received levels were very low in this particularly shallow environment, despite similar size piles and hammer energy to other studies. This study underscores the important influence of environmental conditions on the propagation of sound and its subsequent impacts to marine mammals.

In addition to avoidance behavior, several studies have observed other behavioral responses in marine mammals. A playback study on two harbor porpoises revealed that high-amplitude sounds, like pile-driving, may adversely affect foraging behavior in this species by decreasing catch success rate (Kastelein et al. 2019). In another playback study, trained dolphins were asked to perform a target detection exercise during increasing levels of vibratory pile-driver playback sounds (up to 140 dB re 1 µPa) (Branstetter et al. 2018). Three of the five dolphins exhibited either a decrease in their ability to detect targets in the water, or a near complete cessation of echolocation activity, suggesting the animals became distracted from the task by the vibratory pile-driving sound.

In addition to bottlenose dolphins and harbor porpoises, the effects of pile-driving have been studied on a limited set of additional species. Würsig et al. (2000) studied the response of Indo-Pacific hump-backed dolphins to impact pile-driving in the seabed in water depths of 19.7 to 26.2 feet (6 to 8 meters). No overt behavioral changes were observed in response to the pile-driving activities, but the animals' speed of travel increased, and some dolphins remained in the vicinity while others temporarily abandoned the area. Once pile-driving ceased, dolphin abundance and behavioral activities returned to pre-pile-driving levels. A study using historical telemetry data collected before and during the construction and operation of a British wind farm showed that harbor seals may temporarily leave an area affected by pile-driving sound beginning at estimated received peak to peak pressure levels between 166 and 178 dB re 1 µPa (Russell et al. 2016). Seal abundance was reduced 19 percent to 83 percent during individual piling events (i.e., the installation of a single pile) within 15.5 miles (25 kilometers) of the center of the pile. Displacement lasted no longer than 2 hours after the cessation of pile-driving activities, and the study found no significant displacement during construction as a whole. Interestingly, the study also showed that seal usage in the wind farm area increased during the operational phase of the wind farm, although this may have been due to another factor, as seal density increased outside the wind farm area as well.

As no studies have directly examined the behavioral responses of mysticetes to pile-driving, studies using other impulsive sound sources such as seismic airguns are the best available proxies. With seismic airguns, the distance at which responses occur depends on many factors, including the volume of the airgun (and consequently source level), as well as the hearing sensitivity, behavioral state, and even life stage of the animal (Southall et al. 2021b). In a 1986 study, researchers observed the responses of feeding gray whales to a 100-cubic-inch airgun and found that there was a 50 percent probability that the whales would stop feeding and move away from the area when the received SPL reached 173 dB re 1 µPa (Malme et al. 1986). Other studies have documented mysticetes initiating avoidance behaviors to full-scale seismic surveys at distances as short as 1.9 miles (3 kilometers) away (McCauley et al. 1998; Johnson 2002; Richardson et al. 1986) and as far away as 12.4 miles (20 kilometers) (Richardson et al. 1999). Bowhead whales have exhibited other behavioral changes, including reduced surface intervals and dive durations, at received SPL between 125 and 133 dB re 1 µPa (Malme et al. 1988). A more recent study by Dunlop et al. (2017) compared the migratory behavior of humpback whales exposed to a 3,130-cubic-inch airgun array with those that were not. There was no gross change in behavior observed (including respiration rates), although whales exposed to the seismic survey made a slower progression southward along their migratory route compared to the control group. This was largely seen in female-calf groups, suggesting there may be differences in vulnerability to underwater sound based on life-stage (Dunlop et al. 2017). The researchers produced a dose-response model, which suggested behavioral change was most likely to occur within 2.5 miles (4 kilometers) of the ship at SEL_{24h} over 135 dB re 1 μPa^2 s (Dunlop et al. 2017).

Acoustic masking can occur if the frequencies of the sound source overlap with the frequencies of sound used by marine species. Given that most of the acoustic energy from pile-driving is below 1 kilohertz, low-frequency cetaceans and pinnipeds are more likely to experience acoustic masking from pile-driving than mid-or high-frequency cetaceans. In addition, low-frequency sound can propagate greater distances than higher frequencies, meaning masking may occur over larger distances than masking related to higher frequency noise. There is evidence that some marine mammals can avoid acoustic masking by changing their vocalization rates (e.g., bowhead whale, Blackwell et al. 2013; blue whale, Di Iorio and Clark 2010; humpback whale, Cerchio et al. 2014), increasing call amplitude (e.g., beluga whale, Scheifele et al. 2004; killer whale, Holt et al. 2009), or shifting dominant frequencies (Lesage et al. 1999; Parks et al. 2007). When masking cannot be avoided, increasing noise could affect the ability to locate and communicate with other individuals. However, given that pile-driving occurs intermittently, with some quiet periods between pile-strikes, it is unlikely that complete masking would occur.

Overall, it is reasonable to assume that there would be greater impacts to low-frequency cetaceans (i.e., mysticetes) than other species groups, even though direct research on pile-driving noise on mysticetes is limited. As discussed earlier, there is evidence suggesting that mysticetes may avoid or change their behavior when exposed to impulsive sounds. Secondly, their primary frequency range for listening to their environment and communicating with others overlaps with the dominant frequency of impact and vibratory pile-driving noise. Finally, because mysticetes have specific feeding and breeding grounds (unlike odontocetes who can perform these life functions over broader spatial scales), disturbance by anthropogenic noise occurring in one of these key geographic areas may come at an increased cost to these species. Considering the number and extent of projects planned in the geographic analysis area, moderate impacts, such as some individual level fitness effects, are expected to marine mammals from pile-driving activities. These impacts could be reduced with implementation of project-specific avoidance, mitigation, and monitoring measures. For example, noise abatement devices, such as double-bubble curtains, can be used to reduce the overall acoustic energy that is introduced and decrease the geographic extent of noise-related impacts. The implementation of shut-down zones and seasonal restrictions based on species presence in an area can reduce the intensity and likelihood of effects to minor, by only allowing activity when animals are not present. Many of these are requirements as conditions of compliance with the ESA, MMPA, and other federal regulations. These measures would reduce the potential for PTS and TTS effects from pile-driving on all marine mammals. The likelihood of behavioral avoidance and masking effects are still high, especially for mysticetes.

Vessels

Noise from large commercial ships, as well as smaller fishing and recreational vessels, is likely to be present and persistent in the geographical area. A description of the physical qualities of vessel noise can be found in Appendix B, *Supplemental Information*. Note that the specific effects of dynamic positioning noise on marine mammals have not been studied but are expected to be similar to that of transiting vessels as described below.

Comprehensive reviews of the literature (Richardson et al. 1995; Erbe et al. 2019) revealed that most of the reported adverse effects of vessel noise and presence are changes in behavior, though the specific behavioral changes vary widely across species. Physical behavioral responses include changes to dive patterns (e.g., longer dives in beluga whales, Finley et al. 1990), disruption to resting behavior (harbor seals, Mikkelsen et al. 2019), increases in swim velocities (belugas, Finley et al. 1990; humpback whales, Sprogis et al. 2020; narwhals, Williams et al. 2022), and changes in respiration patterns (longer inter-breath intervals in bottlenose dolphins, Nowacek et al. 2006; increased breathing synchrony in bottlenose dolphin pods, Hastie et al. 2003; increased respiration rates in humpback whales, Sprogis et al. 2020). A playback study of humpback whale mother-calf pairs exposed to varying levels of vessel noise revealed that the mother's respiration rates doubled and swim speeds increased by 37 percent in the high noise conditions (low-frequency weighted received root-mean-square sound pressure level [SPL] at 328.1 feet [100 meters] was 133 dB re 1 µPa) compared to control and low-noise conditions (SPL of 104 dB re 1 µPa and 112 dB re 1 µPa, respectively; Sprogis et al. 2020). Changes to foraging behavior, which can have a direct effect on an animal's fitness, have been observed in porpoises (Wisniewska et al. 2018) and killer whales (Holt et al. 2021) in response to vessel noise. Thus far, one study has demonstrated a potential correlation between low-frequency anthropogenic noise and physiological stress in mysticetes. Rolland et al. (2012) showed that fecal cortisol levels in NARWs decreased following the 9/11 terrorist attacks, when vessel activity was significantly reduced. Interestingly, NARWs do not seem to avoid vessel noise nor vessel presence (Nowacek et al. 2004), yet they may incur physiological effects as demonstrated by Rolland et al. (2012). This lack of observable response, despite a physiological response, makes it challenging to assess the biological consequences of exposure. In addition, there is evidence that individuals of the same species may have differing responses if the animal has been previously exposed to the sound versus if it is completely novel interaction (Finley et al. 1990). Reactions may also be correlated with other contextual features, such as the number of vessels present, their proximity, speed, direction or pattern of transit, or vessel type. For a more detailed and comprehensive review of the effects of vessel noise on specific marine mammal groups the reader is referred to Erbe et al. (2019).

Some marine mammals may change their acoustic behaviors in response to vessel noise, either due to a sense of alarm or in an attempt to avoid masking. For example, fin whales (Castellote et al. 2012) and belugas (Lesage et al. 1999) have altered frequency characteristics of their calls in the presence of vessel noise. When vessels are present, bottlenose dolphins have increased the number of whistles (Buckstaff 2006; Guerra et al. 2014), while sperm whales decrease the number of clicks (Azzara et al. 2013), and humpbacks and belugas have been seen to completely stop vocal activity (Tsujii et al. 2018; Finley et al. 1990). Some species may change the duration of vocalizations (fin whales shortened their calls – Castellote et al. 2012) or increase call amplitude (killer whales – Holt et al. 2009) to avoid acoustic masking from vessel noise.

Understanding the scope of acoustic masking is difficult to observe directly, but several studies have modeled the potential decrease in "communication space" when vessels are present (Clark et al. 2009;

Erbe et al. 2016; Putland et al. 2017). For example, Putland et al. (2017) showed that during the closest point of approach (less than 6.2 miles [10 kilometers]) of a large commercial vessel, the potential communication space of Bryde's whale was reduced by 99 percent compared to ambient conditions.

Although there have been many documented behavioral changes in response to vessel noise (Erbe et al. 2019), it is necessary to consider what the biological consequences of those changes may be. One of the first attempts to understand the energetic cost of a change in vocal behavior found that metabolic rates in bottlenose dolphins increased by 20-50 percent in comparison to resting metabolic rates (Holt et al. 2015). Although this study was not tied directly to exposure to vessel noise, it provides insight about the potential energetic cost of this type of behavioral change documented in other works (i.e., increases in vocal effort such as louder, longer, or increased number of calls). In another study, the energetic cost of high-speed escape responses in dolphins was modeled, and the researchers found that the cost per swimming stroke was doubled during such a flight response (Williams et al. 2017). When this sort of behavioral response was also coupled with reduced glide time for beaked whales, the researchers estimated that metabolic rates would increase by 30.5 percent (Williams et al. 2017). Differences in response have been reported both within and among species groups (Finley et al. 1990; Tsujii et al. 2018). Despite demonstrable examples of biological consequences to individuals, there is still a lack of understanding about the strength of the relationship between many of these acute responses and the potential for long-term or population-level effects.

Vessel noise associated with non-offshore wind activities is likely to be present throughout the marine mammal geographical analysis area at a nearly continuous rate due to the prevalence of commercial shipping, fishing, and recreational boating activities which are ongoing and would be expected to continue in the geographic analysis area.

During both the construction and operational phases of future offshore wind projects, several types of vessels will be used to transport crew and supplies, and during construction, dynamic positioning systems may be used to keep the pile-driving vessel in place. A description of the physical qualities of vessel noise can be found in Appendix B, *Supplemental Information*. For a summary of the effects of vessel noise on marine mammals the reader is referred to previously under the Non-Offshore Wind Activity of the No Action Alternative. Note that the specific effects of dynamic positioning noise on marine mammals have not been studied but are expected to be similar to that of transiting vessels.

Vessel noise associated with future offshore wind projects will be present throughout the geographical analysis area. Vessel noise during construction is expected to be nearly continuous and have extensive geographical extent given the size of the vessels, and may therefore have minor impacts on marine mammals. During the operational phase of offshore wind projects, vessel noise is expected to be infrequent (occurring mostly for maintenance work) and should be localized in extent because smaller vessels would be used, and thus is expected to have negligible impacts on marine mammals. The required vessel slow-downs to reduce strike risk are expected to reduce the amount of noise that is emitted into the environment (Joy et al. 2019). In addition, helicopters may be used to transport crew from land to the construction site, which would further reduce noise transmitted into the water.

Dredging, Trenching, and Cable-Laying

Preparing a lease area for turbine installation and cable-laying may require jetting, plowing, or removal of soft sediments, as well as the excavation of rock and other material through various dredging methods. Cable installation vessels are likely to use dynamic positioning systems while laying the cables. The sound associated with dynamic positioning generally dominates other sound sources present especially in the situation of cable-laying. A description of the physical qualities of these sound sources can be found in Appendix B, *Supplemental Information*. Given the low source levels and transitory nature of these sources, exceedance of PTS and TTS levels are not likely for harbor porpoise and seals, according to measurements and subsequent modeling by Heinis et al. (2013). Of the few studies that have examined behavioral responses from dredging noise, most have involved other industrial activities, making it difficult to attribute responses specifically to dredging noise. Some found no observable response (beluga whales – Hoffman 2012), while others showed avoidance behavior (bowhead whales in a playback study of drillship and dredge noise – Richardson et al. 1990, bottlenose dolphins in response to real dredging operations – Pirotta et al. 2013). Impacts to marine mammals are expected to be negligible to minor due to the low intensity and localized nature of the sound source. Minor impacts, such as brief behavioral effects or acoustic masking over small spatial scales, may occur for mysticetes due to the low-frequency nature of these sound sources.

Aircraft

Other offshore wind activities may employ helicopters and fixed-wing aircraft for transporting construction and maintenance crew, or monitoring during construction activities, which emit sound that could affect marine mammals. A description of the physical qualities of aircraft noise can be found in Appendix B, *Supplemental Information*. In general, marine mammal behavioral responses to aircraft have most commonly been observed at altitudes of less than 492.1 feet (150 meters) from the aircraft (Patenaude et al. 2002; Smultea et al. 2008). Aircraft operations have resulted in temporary behavioral responses including short surface durations (bowhead and beluga whales, Patenaude et al. 2002; transient sperm whales, Richter et al. 2006), abrupt dives (sperm whales, Smultea et al. 2008), and percussive behaviors (i.e., breaching and tail slapping, Patenaude et al. 2002). Responses appear to be heavily dependent on the behavioral state of the animal, with the strongest reactions seen in resting individuals (Würsig et al. 1998). BOEM requires all aircraft operations to comply with current approach regulations for NARWs or unidentified large whales (50 CFR 222.32). These include the prohibition of aircraft from approaching within 1,500 feet (457 meters), which would minimize the potential responses of marine mammals to aircraft noise. In addition, based on the physics of sound propagation across different media (e.g., air, water), an animal must be directly below an aircraft (within a 13-degree cone; Appendix B, *Supplemental Information*) to hear the sound from the aircraft. With the implementation of BMPs, noise impacts from aircraft are expected to be negligible to marine mammals.

WTG Operations

The operation of turbines on nearby windfarms may result in long-term, low-level, continuous sound in the offshore environment. A description of the physical qualities of turbine operational noise can be found in Appendix B, *Supplemental Information*.

Based on the currently available sound field data for turbines smaller than 6.2 MW (Tougaard et al. 2020) and comparisons to acoustic impact thresholds (NMFS 2018), underwater sound from offshore wind turbine operations (without the Proposed Action) is not likely to cause PTS or TTS in marine mammals but could cause behavioral and masking effects at close distances. Tougaard et al. (2020) aggregated the existing sound field measurements from 17 operating wind farms and modeled the received sound levels as a function of recording distance, wind speed, and turbine size. Based on their model, the mean of all the data normalized to a measurement made at 328.1 feet (100 meters), for a turbine 1 MW in size operating at a wind speed of 32.8 ft/s (10 m/s) was a received SPL of 109 dB re 1 µPa (with a standard error of 1.7 dB). Based on the model, the noise from a single, 1 MW turbine dropped below ambient conditions within 1,312.34 feet (400 meters) of the foundation or a few kilometers for an array of 81 turbines. For high ambient noise conditions, the distance at which the turbine can be heard above ambient noise was even less. It is important to note that just because a sound is audible, that does not mean that it would be disturbing or be at a sufficient level to mask important acoustic cues. There are many natural sources of underwater sound which vary over space and time and would affect an animal's ability to hear turbine operational noise over ambient conditions. Lucke et al. (2007) explored the potential for acoustic masking from operational noise by conducting hearing tests on trained harbor porpoises while they were exposed to sounds resembling operational wind turbines (i.e., less than 1 kilohertz). They saw masking effects at SPLs of 128 dB re 1 µPa at frequencies of 700, 1,000, and 2,000 hertz, but found no masking at SPLs of 115 dB re 1 µPa. Based on propagation loss in a shallow water environment, the sound would attenuate to 115 dB re 1 µPa within 65.6 feet (20 meters) of the operating turbine (Lucke et al. 2007), suggesting the range for masking for high-frequency cetaceans is very small.

Very few empirical studies have looked at the effect of operational wind turbine noise on wild marine mammals. Some have shown an increase in acoustic occurrences of marine mammals during the operational phase of wind farms (harbor seal, Russell et al. 2016; harbor porpoise, Scheidat et al. 2011), while another study showed a decrease in the abundance of porpoises 1 year after operation began in comparison with the pre-construction period (Tougaard et al. 2005). However, no change in acoustic behavior was detected in the animals that were present (Tougaard et al. 2005). In these field monitoring studies, it is not always clear if the behavioral responses have anything to do with operational noise, or merely the presences of turbine structures. Regardless, these findings suggest that turbine operational noise did not have any gross adverse effect on the acoustic behavior of the animals.

Due to their low sound levels, behavioral and masking effects associated with turbine operational noise are not expected to have significant impacts on individual survival, population viability, distribution, or behavior, and are not expected to occur outside a very small radius around a given turbine. In addition, the audibility of turbine operational noise may be further limited by the ambient noise conditions of the environment (e.g., Jansen and de Jong 2016). Therefore, turbine operational noise is expected to have a negligible to minor impact on marine mammals. Minor impacts, such as masking in low ambient noise conditions, may be more likely for low-frequency cetaceans (LFC), due to the low-frequency nature of operational noise and this group's hearing sensitivity (note: PPW also have low-frequency hearing but their threshold of underwater hearing is higher). As larger turbines with differing technologies (e.g., direct-dive) come online, more acoustic measurements are necessary to characterize the relationship between foundation size, type, and the sound levels associated with operation of a single or an array of WTGs, as this may affect the physical distance in which potential behavioral or masking impacts may be possible (Thomsen and Stober 2022).

These findings are consistent with the best available information regarding impacts of underwater sound on marine mammals, which predicts a range of effects depending on the duration and intensity of exposure, as well as species and behavioral state of the animal (e.g., migrating, foraging).

Considering the extent of offshore wind projects planned in the geographic analysis area, it is likely that underwater noise could cause adverse effects to marine mammals. Sound generated from other offshore wind activities include impulsive (e.g., impact pile-driving, UXO detonations, some geophysical sources) and non-impulsive sources (e.g., vibratory pile diving, some geophysical sources, vessels, aircraft, cable-laying, dredging, WTG operations). Of those activities, only impact pile-driving, UXO detonations, and, to a lesser extent, vibratory pile-driving could cause auditory injury (i.e., PTS) in marine mammals. UXO detonation may also cause non-auditory injury or even mortality at close range. All sound sources could cause masking and behavioral effects, and some may also cause TTS in certain species at certain ranges. All projects are expected to comply with mitigation measures (e.g., exclusion zones, protected species observers, sound abatement), which would minimize underwater sound impacts on marine mammals.

The intensity of the noise IPF Is considered minor to moderate for UXO detonations as mortality thresholds could be exceeded, but mitigation would be expected to eliminate the risk of mortality occurring; moderate for impact and vibratory pile-driving, as PTS thresholds could be exceeded; and negligible to minor for all the other noise-producing activities in which behavioral thresholds could be exceeded, or in which auditory masking may occur. The predicted effect would be long-term in the case of some PTS effects and non-auditory injury resulting from UXO detonations and short term with respect to TTS, behavioral effects, and masking. The geographic extent is considered localized for PTS effects and extensive for behavioral disturbance effects, as sound could exceed behavioral thresholds more than 6.2 miles (10 kilometers) away depending on the activity. The frequency of the activity causing the effect is considered infrequent for UXO detonations, aircraft, and dredging sound; frequent for impact pile-driving, vibratory pile-driving, cable laying, and HRG survey sound; near continuous for vessel noise; and continuous for WTG operation sound. With the application of mitigation measures for UXO detonations, the likelihood of mortality of a marine mammal from UXO detonations is considered low. Based on the source levels available in the literature (Appendix B, *Supplemental Information*), some PTS, TTS, behavioral disturbance, and masking effects on LFC, MFC, HFC, and PPW are considered likely but would vary by species and population. Due to the overlap between their hearing range and the dominant frequency of many sound sources associated with offshore wind (Appendix B), mysticetes may be more susceptible to behavioral disturbance and masking effects compared to other functional hearing groups. Based on the available information regarding offshore wind activities in the geographic analysis area, the overall impact of underwater noise is considered to be moderate for LFC, MFC, HFC, and PPW.

Port utilization: The development of an offshore wind industry in the marine mammal geographic analysis area may incentivize the expansion or improvement of regional ports to support planned projects. Three main activities surrounding port utilization could affect marine mammals: port expansion/construction, increased vessel traffic, and increased dredging. The State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek (Appendix D, *Planned Activities Scenario*). The Atlantic Shores South Offshore Wind project would construct an O&M facility in Atlantic City, New Jersey, on a shoreside parcel that was formerly used for vessel docking and other port activities. At larger ports such as Charleston and Norfolk, offshore wind-related activities would make up a small portion of the total activities at the port; therefore, offshore wind activities are likely to have a negligible impact on marine mammals through increased port utilization at these ports. However, for smaller ports within the geographic analysis area, such as Paulsboro, and Hope Creek, New Jersey port expansion may be necessary to accommodate the increased activity, resulting in more significant increases to vessel traffic, dredging, and shoreline construction. The USACE has proposed maintenance dredging of portions of the Newark Bay, New Jersey, federal navigation channel, including the removal of material from the Port Elizabeth Channel, to occur between July 2021 and February 2022 (USACE 2021). Additionally, in 2017, the USACE Charleston District awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot (15.8-meter) depth at the entrance channel to Charleston Harbor in South Carolina. Port improvements could lead to an increase in vessel traffic during construction (see *Traffic* IPF below), underwater noise (pile-driving and dredging), O&M, and conceptual decommissioning. The realized impacts on marine mammals in the geographic analysis area from the activities described earlier include potential increased vessel interaction, exposure to noise, and disturbance of benthic habitat. Most port expansion activities are localized to nearshore habitats and are expected to result in temporary, short-term impacts, if any, on marine mammals. Vessel noise may affect marine mammals, but response would be expected to be temporary and short term (see *Noise* IPF above). The impacts on water quality from sediment suspension during port expansion activities would be temporary and short-term and would be similar to those described for the *Cable emplacement and maintenance* IPF discussed above. Increases in port utilization due to other offshore wind energy projects would lead to increases in vessel traffic and associated risk of vessel strike (see *Traffic* IPF below).

Impacts from port utilization from other offshore wind activities on mysticetes, odontocetes, and pinnipeds would likely be minor, with effects that would be detectable and measurable but not lead to population-level impacts. However, any future port expansion and associated increase in vessel traffic would be subject to independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on marine mammals regionwide.

Presence of structures: The addition of up to 3,081 new WTG and OSS foundations in the geographic analysis area would result in artificial reef and hydrodynamic effects that influence primary and secondary productivity and the distribution and abundance of fish and invertebrate community structure within and in proximity to project footprints. Depending on proximity and extent, hydrodynamic and reef effects from planned activities could influence the availability of prey and forage resources for marine mammals. Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant hydrodynamic effects and broader scales. This could in turn lead to more significant effects on prey and forage resources, but the extent and significance of these effects cannot be predicted based on currently available information.

The long-term presence of WTG structures could displace marine mammals from preferred habitats or alter movement patterns, potentially resulting in exposure to commercial and recreational fishing activity. The evidence for long-term displacement is unclear and varies by species. For example, marine mammals, including baleen whales, have been regularly sighted around offshore oil and gas platforms (Barkaszi and Kelly 2019; Delefosse et al. 2018; Todd et al. 2020), suggesting the physical presence of a structure in OCS waters did not deter individuals from utilizing the same area of habitat. Long (2017) studied marine mammal habitat use around two commercial wind farm facilities before and after construction and found that habitat use appeared to return to normal after construction. In contrast, Teilmann and Carstensen (2012) observed clear long-term (greater than 10 years) displacement of harbor porpoise from commercial wind farm areas in Denmark. Displacement effects remain a focus of ongoing study (Kraus et al. 2019). Other studies have documented apparent increases in marine mammal density around wind energy facilities. Russel et al. (2014) found clear evidence that seals were attracted to a European wind farm, apparently attracted by the abundant concentrations of prey created by the artificial reef effect. However, attraction to the windfarm area due to the increased presence of prey could result in exposure to additional or other risks. For example, gray and harbor seals are susceptible to entrapment in gillnet fisheries, as well as trawl fisheries to a lesser degree (Orphanides 2020; Moreno et al. 2020; Precoda and Orphanides 2022; Lyssikatos 2015). If commercial trawling were to occur near wind farms, increased interactions and resulting mortality of gray and harbor seals could occur.

NARWs engage in a common social behavior called a surface active group (SAG), in which two or more individuals interact at the surface (Kraus and Hatch 2001). While no published reports exist that indicate the presence of SAGs in the vicinity of the Lease Area, SAG occurrence in habitat areas other than foraging and calving grounds (including the mid-Atlantic) cannot be ruled out. Based on this, SAGs in mid-Atlantic waters do not likely represent a significant portion of biologically necessary behaviors for individuals migrating though the Project area. As such, if they were to occur, group sizes would be expected to be closer to the mean (3.7 individuals; Kraus and Hatch 2001), and the physical distance between turbines would therefore not likely pose a barrier or obstruction to individuals engaged in SAG behaviors.

The presence of vertical structures in the water column could cause a variety of hydrodynamic effects. The general understanding of offshore wind-related impacts on hydrodynamics is derived primarily from European based studies. A synthesis of European studies by van Berkel et al. (2020) summarized the potential effects of wind turbines on hydrodynamics, the wind field, and fisheries. Local to a wind facility, the range of potential impacts include increased turbulence downstream, remobilization of sediments, reduced flow inside wind farms, downstream changes in stratification, redistribution of water temperature, and changes in nutrient upwelling and primary productivity.

Human-made structures, especially tall vertical structures such as foundations, alter local water flow at a fine scale by potentially reducing wind-driven mixing of surface waters or increasing vertical mixing as water flows around the structure (Carpenter et al. 2016; Cazenave et al. 2016; Segtnan and Christakos 2015). A reduction in wind-driven mixing is mainly caused by is the extraction of kinetic wind energy by turbine operations, which reduces wind stress at the air-sea interface and can lead to changes in horizontal and vertical water column mixing patterns (Miles et al. 2021). In addition, when water flows around the structure, turbulence is introduced that influences local current speed and direction. Turbulent wakes have been observed and modeled at the kilometer scale (Cazenave et al. 2016; Vanhellemont and Ruddick 2014). While impacts on current speed and direction decrease rapidly around monopiles and are mainly driven by interactions at the air-sea surface interface, there is also the potential for tidal current wakes out to a kilometer from a monopile (Li et al. 2014). Direct observations of the influence of a monopile extending to at least 984 feet (300 meters), however, was indistinguishable from natural variability in a subsequent year (Schultze et al. 2020). The range of observed changes in current speed and direction 984 to 3,280 feet (300 to 1,000 meters) from a monopile is likely related to local conditions, wind farm scale, and sensitivity of the analysis.

The presence of vertical structures in the water column could also cause a variety of long-term hydrodynamic effects, which could impact marine mammal prey species. Atmospheric wakes, characterized by reduced downstream mean wind speed and turbulence along with wind speed deficit, are documented with the presence of vertical structures. The magnitude of atmospheric wakes can change relative to instantaneous velocity anomalies. In general, lower impacts of atmospheric wakes are observed in areas of low wind speeds. Several hydrodynamic processes have been identified to exhibit changes from vertical structures:

- Advection and Ekman transport are directly correlated with shear wind stress at the sea surface boundary. Vertical profiles from Christiansen et al. (2022) exhibit reduced mixing rates over the entire water column. As for the horizontal velocity, the deficits in mixing are more pronounced in deep waters than in well-mixed, shallow waters, which is likely favored by the influence of the bottom mixed layer in shallow depths. In both cases, the strongest deficits occur near the pycnocline depth.
- Additional mixing downstream has been documented from Kármán vortices and turbulent wakes due to the pile structures of wind turbines (Carpenter et al. 2016; Grashorn and Stanev 2016; Schultze et al. 2020).
- Up-dwelling and down-dwelling dipoles under contact of constant wind directions affecting average surface elevation of waters have been documented as the result of offshore wind farms (Broström 2008; Paskyabi and Fer 2012; Ludewig 2015). Mean surface variability is between 1 and 10 percent.
- With sufficient salinity stratification, vertical flow of colder/saltier water to the surface occurs in lower sea surface level dipoles and warmer/less saline water travels to deeper waters in elevated sea surface heights (Ludewig 2015; Christiansen et al. 2022). This observation also suggested impacts on seasonal stratification, as documented in Christiansen et al. (2022). However, the

magnitude of salinity and temperature changes with respect to vertical structures is small compared to the long-term and interannual variability of temperature and salinity.

The potential hydrodynamic effects identified above from the presence of vertical structures in the water column therefore affect nutrient cycling and could influence the distribution and abundance of fish and planktonic prey resources (van Berkel et al. 2020). Turbulence resulting from vertical structures in the water column could lead to localized changes in circulation and stratification patterns, with potential implications for primary and secondary productivity and fish distribution. Additionally, as the WTGs withdraw kinetic energy from the atmosphere, the resulting atmospheric wakes may then reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016). During summer, when water is more stratified, increased mixing could increase pelagic primary productivity near the structure, increasing the algal food source for zooplankton and filter feeders. Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish at the southern or inshore extent of the range of suitable temperatures. Changes in cold pool dynamics resulting from future activities, should they occur, could conceivably result in changes in habitat suitability and fish community structure, but the extent and significance of these potential effects are unknown. Daewel et al. (2022) modeled the effects of offshore wind farm projects in the North Sea on primary productivity and found that there were areas with both increased and decreased productivity within and around the wind farms. There was a decrease in productivity in the center of large wind farm clusters but an increase around these clusters in the shallow, near-coastal areas of the inner German Bight and Dogger Bank (Daewel et al. 2022). A change in the spatial distribution of primary productivity could have notable impacts on marine mammal prey. However, the authors noted that when integrated over a larger area, the local decreases and increases averaged to a nominal (0.2 percent) change.

The extraction of kinetic wind energy by turbine operations and reduction in wind stress at the air-sea interface can lead to changes in horizontal and vertical water column mixing patterns (Miles et al. 2021). However, the scale of vertical mixing is highly location- and infrastructure-specific. Strong thermoclines act as a barrier to vertical mixing and transport. In extreme scenarios, as seen near islands, enhanced mixing could prevent stratification; however, at regional scales, water columns typically re-stratify by natural buoyancy forcing (Dorrell et al. 2022). The waters surrounding offshore wind farms are characterized by strong seasonal stratification and localized turbulence and upwelling effects around the monopiles are likely to transport nutrients into the surface layer, potentially increasing primary and secondary productivity. That increased productivity could be partially offset by the formation of abundant colonies of filter feeders on the monopile foundations. While the net impacts of these interactions are difficult to predict, they are not likely to result in more than localized effects on the abundance of zooplankton. Turbulent mixing would be increased locally within the flow divergence and in the wake, which would enhance local dispersion and dissipation of flow energy. However, because the monopiles would be spaced approximately 1 nautical mile (1.9 kilometer) apart, there would be less than 1 percent areal blockage and the net effect over the spatial scale of a single Project would be negligible. When considered relative to the broader oceanographic factors that determine primary and secondary productivity in the region, localized impacts on zooplankton abundance and distribution are not likely to measurably affect the availability of prey resources for marine mammals.

In summary, the waters surrounding offshore wind farms are characterized by strong seasonal stratification, which is expected to limit measurable hydrodynamic effects to within 600 to 1,300 feet (183 to 396 meters) down current of each monopile. Therefore, the effects from individual turbines could be limited to areas within or close to wind farm footprints. However, Christiansen et al. (2022) demonstrated that wind wakes and their effects on surrounding hydrodynamic patterns likely extend tens of kilometers outside the border of wind developments. Hydrodynamic effects, therefore, may not be localized to areas within or close to wind farm footprints if multiple adjacent wind farms are built out.

The widespread development of offshore renewable energy facilities may facilitate climate change adaptation for certain marine mammal prey and forage species. Hayes et al. (2022) note that marine mammals are following shifts in the spatial distribution and abundance of their primary prey resources driven by increased water temperatures and other climate-related impacts. These range shifts are primarily oriented northward and toward deeper waters. The artificial reef effect created by these structures forms biological hotspots that could support species range shifts and expansions and changes in biological community structure resulting from a changing climate (Degraer et al. 2020; Methratta and Dardick 2019; Raoux et al. 2017). There is no example of a large-scale offshore renewable energy project within the geographic analysis area for marine mammals. However, in a smaller-scale project, it is not expected that any reef effect would result in an increase in species preyed on by NARWs, fin whales, or sei whales, and sperm whales are not expected to forage in the shallow waters of the offshore wind lease areas (NMFS 2021). Although reef effects may aggregate fish species and potentially attract increased predators, they are not anticipated to have any measurable effect on marine mammals. Furthermore, it is not expected that any effects on the distribution, abundance, or use of the offshore wind lease areas by ESA-listed whales would be attributable to the physical presence of the foundations (NMFS 2021).

In contrast, broadscale hydrodynamic impacts could alter zooplankton distribution and abundance (van Berkel et al. 2020). This possible effect is primarily relevant to NARWs, as their planktonic prey (calanoid copepods) are the only listed species' prey in the region whose aggregations are primarily driven by hydrodynamic processes. As aggregations of plankton, which provide a dense food source for NARWs to efficiently feed on, are concentrated by physical and oceanographic features, increased mixing may disperse aggregations and may decrease efficient foraging opportunities. Potential effects of hydrodynamic changes in prey aggregations are specific to listed species that feed on plankton, whose movement is largely controlled by water flow, as opposed to other listed species that eat fish, cephalopods, crustaceans, and marine vegetation, which are either more stationary on the seafloor or are more able to move independent of typical ocean currents (NMFS 2021). There is considerable uncertainty as to how these broader ecological changes will affect marine mammals in the future, and how those changes will interact with other human-caused impacts. The effect of the increased presence of structures on marine mammals and their habitats is likely to be negative, varying by species, and their significance is unknown.

The presence of structures could lead to an increased risk of interaction with fishing gear, potentially resulting in entanglement leading to injury or death. Offshore structures and the anticipated reef effect could lead to increased recreational fishing within the lease areas and result in moderate exposure and high-intensity risk of interactions with fishing gear that may lead to entanglement, ingestion, injury, and death (Moore and van der Hoop 2012). The reef effect may result in drawing in recreational fishing effort from inshore areas, and overall interaction between marine mammals and fisheries could increase if marine mammals are also drawn to the Lease Areas due to increased prey abundance. Additionally, commercial and recreational fishing vessels may be displaced outside of Lease Areas. Bottom-tending mobile gear is more likely to be displaced to areas outside of the Lease Areas than fixed gear. Future offshore wind projects would be more likely to displace larger fishing vessels with small mesh bottom-trawl gear and mid-water trawl gear, compared to smaller fishing vessels with similar gear types that may be easier to maneuver. In addition, some potential exists for a shift in gear types from fixed to mobile, or from mobile to fixed gear, due to displacement from the Lease Areas. The potential impact on marine mammals from these changes is uncertain. However, if a shift from mobile gear to fixed gear occurs due to inability of the fishermen to maneuver mobile gear, there would be a potential increase in the number of vertical lines, resulting in an increased risk of marine mammal interactions with fishing gear. These fisheries interactions may result in demographic impacts on marine mammal species.

Entanglement in fishing gear has been identified as one of the leading causes of mortality in NARW and may be a limiting factor in the species recovery (Knowlton et al. 2012). Current estimates indicate that 83 percent of NARWs show evidence of at least one past entanglement and 60 percent with evidence of multiple fishing gear entanglements, with rates increasing over the past 30 years (King et al. 2021, Knowlton et al. 2012). Of documented NARW entanglements in which gear was recovered, 80 percent was attributed to non-mobile fishing gear (i.e., lobster, gillnet) (Knowlton et al. 2012). Additionally, recent literature indicates that the proportion of NARW mortality attributed to fishing gear entanglement is likely higher than previously estimated from recovered carcasses (Pace 2021, 2022). Entanglement may also be responsible for high mortality rates in other large whale species, most notably humpback, minke, and fin whales (Henry et al. 2020; Read et al. 2006).

Abandoned or lost fishing gear, including that associated with pre- and post-construction fisheries monitoring surveys, may get tangled with foundations. Although this would result in a reduction in entanglement risk from free-floating abandoned gear, debris tangled with WTG foundations will still pose an entanglement risk to marine mammals in the vicinity of windfarm foundations. These potential long-term and intermittent impacts would persist until decommissioning is complete and structures are removed.

Some level of displacement of marine mammals out of the lease areas into areas with a higher potential for interactions with ships or fishing gear during construction of future offshore wind development may occur. Additionally, some marine mammals may avoid the lease areas during all stages (construction, operations, and decommissioning) of the future offshore wind development. Potential spatial displacement into areas with higher risk of interactions with fishing and commercial vessels (see *Traffic* IPF below) may also contribute to impacts on marine mammals.

Impacts from the presence of structures from other offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds; although impacts on individuals would be detectable and measurable, they would not lead to population-level effects for most species, with the exception of the

NARW; due to the heightened risk for entanglement in fishing gear and that a single NARW death could have population-level consequences, impacts to NARWs are considered major. Impacts on odontocetes and pinnipeds may result in slight beneficial effects due to increases in aggregations of prey species.

Traffic: Studies indicate that maritime activities can have adverse effects on marine mammals due to vessel strikes (Laist et al. 2001; Moore and Clarke 2002). Almost all sizes and classes of vessels have been involved in collisions with marine mammals around the world, including large container ships, ferries, cruise ships, military vessels, recreational vessels, commercial fishing boats, whale-watch vessels, research vessels, and even jet-skis (Dolman et al. 2006). Research into vessel strikes and marine mammals has focused largely on mysticetes given their higher susceptibility to a strike because of their larger size, slower maneuverability, larger proportion of time spent at the surface foraging, and inability to actively detect vessels using sound (i.e., echolocation). Focused research on vessels strikes on odontocetes is lacking. Factors that affect the probability of a marine mammal vessel strike and its severity include number, species, age, size, speed, health, and behavior of animal(s) (Martin et al. 2016; Vanderlaan and Taggart 2007); number, speed, and size of vessel(s) (Martin et al. 2016; Vanderlaan and Taggart 2007); habitat type characteristics (Gerstein et al. 2006; Vanderlaan and Taggart 2007); operator's ability to avoid collisions (Martin et al. 2016); vessel path (Martin et al. 2016; Vanderlaan and Taggart 2007); and the ability of a marine mammal to detect and locate the sound of an approaching vessel.

Vessel speed and size are important factors for determining the probability and severity of vessel strikes. The size and bulk of the large vessels inhibit the ability for crew to detect and react to marine mammals along the vessel's transit route. Vessel strikes have been preliminarily determined as a leading cause of death for humpback whales during the current UME (NOAA Fisheries 2022a). Two vessel types that carry AIS transponders were thought to be of the highest threat to humpback whales in the New York Bight apex: tug/tow vessels due to their ability to traverse shallower waters outside shipping channels where humpbacks are frequently found, and passenger vessels due to their high rate of speed (Brown et al. 2019). In 93 percent of marine mammal collisions with large vessels reported in Laist et al. (2001), whales were either not seen beforehand or were seen too late to be avoided. Laist et al. 2001 reported that most lethal or severe injuries are caused by ships 262.5 feet (80 meters) or longer traveling at speeds greater than 13 knots (24.1 km/h). A more recent analysis conducted by Conn and Silber (2013) built on collision data collected by Vanderlaan and Taggart (2007) and Pace and Silber (2005) included new observations of serious injury to marine mammals as a result of vessel strikes at lower speeds (e.g., 2 and 5.5 knots [3.7 and 10.2 km/h]). The relationship between lethality and strike speed was still evident; however, the speeds at which 50 percent probability of lethality occurred was approximately 9 knots (16.7 km/h). Vanderlaan and Taggart (2007) reported that the probability of whale mortality increased with vessel speed, with greatest increases occurring between 8.6 and 15 knots (16.9 and 27.8 km/h), and that the probability of death declined by 50 percent at speeds less than 11.8 knots (21.9 km/h). As a result of these findings, NMFS implemented a seasonal, mandatory vessel speed rule in certain areas along the U.S. East Coast in 2008 to reduce the risk of vessel collisions with NARW. These Seasonal Management Areas require vessel operators to maintain speeds of 10 knots (18.5 km/h) or less and to avoid Seasonal Management Areas when possible. In 2017, vessel strikes were thought to be a leading cause of a UME for NARW (NMFS 2022a). From 2017 to 2022, a total of 34 individuals died.

Pace et al. (2021) estimated that between 1990 and 2017, only 36 percent of right whale deaths were detected, suggesting the actual number of deaths could be much higher. Effectiveness of the Seasonal Management Area program was reviewed by NMFS in 2020. Results indicated that while it was not possible to determine a direct causal link, the mortality and serious injury incidents on a per-capita basis suggest a downward trend in recent years (NOAA 2020). NARW vessel strike mortalities decreased from 10 prior to the implementation of Seasonal Management Areas to 3, while serious injuries (defined as a 50-percent probability of leading to mortality) increased from 2 to 4 and injuries increased from 8 to 14 (potentially due to increased monitoring levels). Laist et al. (2014) assessed the effectiveness of Seasonal Management Areas 5 years after their initiation by comparing the number of NARW and humpback whale carcasses attributed to ship strikes since 1990 to proximity to the Seasonal Management Areas. Prior to implementation of Seasonal Management Areas, they found that 87 percent of NARW and 46 percent of humpback whale ship-strike deaths were found either inside Seasonal Management Areas or within 52 miles (83 kilometers), and that no ship-struck carcasses were found within the same proximity during the first 5 years of Seasonal Management Areas.

NMFS also recognized that NARW foraging aggregations take place outside of established Seasonal Management Areas; therefore, temporal voluntary Dynamic Management Areas are established when a group of three or more NARWs are sighted within close proximity. Mariners are encouraged to avoid the Dynamic Management Area or reduce speed to less than 10 knots (18.5 km/h) when transiting through the area.

NMFS establishes a Dynamic Management Area boundary around the whales for 15 days and alerts mariners through radio and local notices. Adhering to reduced speed limits within Dynamic Management Areas is voluntary and cooperation has been modest and not at the same levels as achieved with Seasonal Management Areas; however, cooperation does increase during active Dynamic Management Area periods (NOAA 2020). Smaller vessels have also been involved in marine mammal collisions. Minke whales, humpback whales, fin whales, and NARWs have been killed or fatally wounded by whale-watching vessels around the world (Jensen et al. 2003; Pfleger et al. 2021). Strikes have occurred when whale-watching boats were actively watching whales as well as when they were transiting through an area (Laist et al. 2001; Jensen et al. 2003). Small vessels, other than whale watching vessels, are also potential sources of large whale vessel strikes; however, many go unreported and are a source of cryptic mortality (Pace et al. 2021). Vessel traffic in the vicinity of a representative offshore project area from March 2019 to February 2020 was composed of cargo/carriers (22.4 percent), fishing vessels (19.6 percent), pleasure craft (19.1 percent), tugs (11.4 percent), other/undefined (11.1 percent), cruise ships/large ships (10.5 percent), and tanker/oil tanker (5.8 percent) (DNV 2021). Vessels more than 262.5 feet (80 meters) in length or longer, and therefore those more likely to cause lethal or severe injury to large whales (Laist et al. 2001), in this area account for up to 38.7 percent of vessel traffic.

In 2022, NMFS proposed changes to the 2008 NARW vessel speed rule to further reduce the likelihood of mortalities and serious injuries to NARW from vessel collisions (NOAA 2022; 87 FR 46921). The proposed rule, if issued, would: (1) modify the spatial and temporal boundaries of current Seasonal Management Areas, (2) include most vessels greater than or equal to 35 feet (10.7 meters) and less than

65 feet (19.8 meters) in length in the size class subject to speed restriction, (3) create a Dynamic Speed Zone framework to implement mandatory speed restrictions when whales are known to be present outside active Seasonal Management Areas, and (4) update the speed rule's safety deviation provision (NOAA 2022). However, until this rule is formally adopted, this assessment has assumed the current conditions in the analysis of impacts.

In general, large mysticetes are more susceptible to a vessel strike than smaller cetaceans and pinnipeds. While there are rare reports of odontocetes being struck by ships (Van Waerebeek et al. 2007; Wells and Scott 1997), these animals are at relatively low risk due to their speed and agility (Richardson et al. 1995). Pinnipeds are also fast and maneuverable in the water and have sensitive underwater hearing, potentially enabling them to avoid being struck by approaching vessels (Olson et al. 2021). Of the 3,633 stranded harbor seals in the Salish Sea (Canada/U.S.) from 2002 to 2019, 28 exhibited injuries consistent with propeller strike (Olson et al. 2021). There are very few documented cases of seal mortalities as a result of vessel strikes in the literature (Richardson et al. 1995). Large whales are more susceptible to vessel strikes than other marine mammals due to their large size, slower travel and maneuvering speeds, lower avoidance capability, and increased proportion of time they spend near the surface (Laist et al. 2001; Vanderlaan and Taggart 2007). In the marine mammal geographic analysis area, whales at risk of collision include NARW, humpback whales, blue whales, fin whales, sei whales, sperm whales, and, to a lesser extent, minke whales due to their smaller size (Hayes et al. 2020, 2021, 2022). Although the duration of increased vessel traffic for ongoing and planned non-offshore wind activities is long term, the frequency of an individual vessel in any one location throughout the geographic analysis area is short term and localized. Because vessel strikes can result in severe injury to and mortality of individual marine mammals, their intensity can be medium for non-listed species or severe for listed species.

The impacts of traffic (vessel strikes) on mysticetes from ongoing and planned non-offshore wind activities would be moderate because it is likely to result in long-term consequences to individuals or populations that are detectable and measurable, with the exception of NARW. Additionally, impacts of traffic (vessel strikes) on individual mysticetes could have population-level effects, but the population should sufficiently recover. The impacts of traffic (vessel strikes) on NARW from ongoing and planned non-offshore wind activities would be major because impacts on individual NARW could have severe population-level effects and compromise the viability of the species. The impacts of traffic (vessel strikes) on odontocetes and pinnipeds from ongoing and planned non-offshore wind activities would be minor because population-level effects are unlikely although consequences to individuals would be detectable and measurable.

Using the estimated volume of vessel traffic generated by the Proposed Action as a proxy (Section 3.5.6.5), it is assumed that construction of other individual offshore wind projects would generate approximately 20 to 65 simultaneous construction vessels operating in the geographic analysis area per project for marine mammals at any given time. Offshore wind projects on the OCS would be constructed between 2023 and 2030, contributing to increases in vessel traffic within the marine mammal geographic analysis area. Additional information regarding the expected increase in vessel traffic is provided in Section 3.6.7, *Other Uses (Marine Minerals, Military Use, Aviation, Scientific*

Research, and Surveys). Due to the large number of vessels required for offshore wind development, vessel noise could result in impacts on individual marine mammals.

Once projects are operational, they would be serviced by crew transfer vessels making routine trips between the wind farms and port-based O&M facilities several times per week. Increased vessel traffic presents a potential increase in collision-related risks to marine mammals. Unplanned maintenance activities would require the periodic use of larger vessels of the same class used for project construction. Unplanned maintenance would occur infrequently, dictated by equipment failures, accidents, or other events. The number and size of crew transfer vessels and number of trips per week required for unplanned maintenance would vary by project based on the number of WTGs. Vessel requirements for unplanned maintenance would also likely vary based on overall project size. Additionally, vessels required to complete monitoring programs at various stages of project development will add to the number of vessel trips undertaken by other projects. These planned activities would pose the same type of vessel-related collision risks to marine mammals as for planned trips, but the potential extent and number of animals potentially exposed cannot be determined without project-specific information. Impacts from traffic (vessel strikes) from ongoing and planned offshore wind activities (without the Proposed Action) would likely be moderate for mysticetes and odontocetes and are likely to result in long-term consequences to individuals or populations that are detectable and measurable, except for NARW. Impacts from traffic (vessel strikes) from other offshore wind activities would likely be major for NARWs and could result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species. Impacts from traffic (vessel strikes) from other offshore wind activities would likely be minor for pinnipeds and are unlikely to lead to population-level effects.

3.5.6.3.2 Impacts of Alternative A on ESA-Listed Species

As noted in Section 3.5.6.1, two ESA-listed marine mammal species are expected to occur regularly in the Offshore Project area: fin whale and NARW. General impacts of the No Action Alternative on marine mammals were described in the previous subsection. This subsection addresses specific impacts of the No Action Alternative on ESA-listed species for those impacts with species-specific information.

Noise: Noise effects associated with aircraft, G&G surveys, WTGs, pile-driving, and cable laying are not expected to differ between ESA-listed marine mammals and other marine mammal species. Impacts associated with vessel noise could be greater for fin whales and NARWs compared to some other marine mammal species.

As described under the *Future Offshore Wind Activities (without Proposed Action)* subheading in Section 3.5.6.3, the low frequencies produced by vessel noise and the relatively large propagation distances associated with sound at these frequencies put LFC, including fin whales and NARWs, at the greatest risk of impacts associated with vessel noise compared to other marine mammal species. Stress responses to vessel noise may be of particular significance to the critically endangered NARW. In this species, vessel noise is known to increase stress hormone levels, which may contribute to suppressed immunity and reduced reproductive rates and fecundity (Hatch et al. 2012; Rolland et al. 2012). Masking may also be a significant issue for this species as modeling results indicate vessel noise could substantially reduce communication distances for NARWs (Hatch et al. 2012).

Presence of structures: Many effects associated with the presence of structures, including hydrodynamic changes, habitat conversion and prey aggregation, avoidance or displacement, and behavioral disruption are not expected to differ between ESA-listed mammals and other marine mammal species. Impacts associated with increased entanglement risk could be greater for fin whales and NARWs compared to other marine mammal species.

As described under the *Future Offshore Wind Activities (without Proposed Action)* in Section 3.5.6.3, the presence of structures may result in an increase in recreational fishing activity, displacement of commercial fishing activity, and a shift in gear types. An increase in fishing activity or an overall shift to fixed gear types would increase the risk of marine mammal entanglement. Entanglement is a significant threat for NARW. As noted in Section 3.5.6.1, NARW has been experiencing an unusual mortality event since 2017 attributed to vessel strikes and entanglement in fisheries gear; more than 80 percent of NARWs show evidence of past entanglements (King et al. 2021; Knowlton et al. 2012; Johnson et al. 2005), and entanglement in fishing gear is a leading cause of death for this species and may be limiting population recovery (Knowlton et al. 2012). An annual average of 5.7 NARW and 1.5 fin whale incidental fishery interactions per year have been recorded for the period of 2015 through 2019 (Hayes et al. 2022). The increased risk of entanglement associated with the presence of structures could have demographic consequences for the NARW.

Traffic: As described under the *Future Offshore Wind Activities (without Proposed Action)* subheading in Section 3.5.6.3, vessel strikes are a significant concern for mysticetes, including fin whales and NARWs. NARWs are particularly vulnerable to vessel strikes due to their slow swim speeds and the relatively high amount of time they spend at or near the surface, and vessel strikes are a primary cause of death for this species (Kite-Powell et al. 2007; Hayes et al. 2022). As noted in Section 3.5.6.1, NARW has been experiencing an unusual mortality event since 2017 attributed to vessel strikes and entanglement in fisheries gear (NOAA Fisheries 2022a). An annual average of two NARW and 0.4 fin whale vessel strikes per year have been recorded for the period of 2015 through 2019, though this is likely an underestimate of total vessel strikes per annum (Hayes et al. 2022). NARWs are at highest risk for vessel strike when vessels travel in excess of 10 knots (18.5 km/h) (Vanderlaan and Taggart 2007). Average vessel speeds in the geographic analysis area may exceed 10 knots (18.5 km/h), indicating that vessel traffic associated with the No Action Alternative may pose a collision risk for NARW. Vessel strikes may be particularly significant for this species given their relatively high risk and their low population numbers.

3.5.6.3.3 Conclusions

Under the No Action Alternative (i.e., Alternative A), ongoing activities would result in a range of temporary to long-term impacts (disturbance, displacement, injury, mortality, and reduced foraging success) on marine mammals, primarily from exposure to construction-related underwater noise, vessel activity (vessel strike), and changes in habitat from presence of new structures acting as artificial reefs and altering hydrodynamics. Ongoing activities are expected to continue to result in minor impacts on marine mammals. Although impacts on individual marine mammals and their habitat are anticipated, impacts are not likely to lead to population-level effects.

Planned non-offshore wind activities may contribute to impacts on marine mammals. Planned non-offshore wind activities include increasing vessel traffic; new submarine cable and pipeline installation and maintenance; marine surveys; commercial and recreational fishing activities; marine minerals extraction; port expansion; channel-deepening activities; military readiness activities; and the installation of new towers, buoys, and piers. BOEM anticipates planned non-offshore wind activities would result in moderate impacts on marine mammals, primarily driven by ongoing underwater noise impacts, vessel activity (vessel collisions), entanglement, and seafloor disturbance. These effects are often magnified in severity to major impacts for the NARW due to low population numbers and the potential to compromise the viability of the species from the loss of a single individual.

BOEM anticipates the combined ongoing and planned activities would result in moderate impacts on marine mammals primarily because of pile-driving noise, increased vessel traffic, and port utilization.

Additionally, the presence of structures could contribute adverse impacts with potentially beneficial impacts on some marine mammal species, though these effects may be offset by increased interactions with fishing gear associated with the presence of structures. Offshore wind activities would be responsible for most of the impacts associated with pile-driving noise, which could lead to moderate impacts on marine mammals in the geographic analysis area. However, overall, this conclusion assumes mortality of individual marine mammals would not have negative significant consequences at the population level, and that any population-level effects would be recoverable, except for the NARW. As stated earlier, the low population numbers of the NARW result in the potential to compromise the viability of the species due to the loss of a single individual.

Under the No Action Alternative, existing environmental trends and activities would continue, and mysticetes, odontocetes, and pinnipeds would continue to be affected by natural and human caused IPFs. The No Action Alternative (i.e., Alternative A) would result in **minor** impacts on mysticetes, odontocetes, and pinnipeds. BOEM anticipates the overall impacts associated with the No Action Alternative (i.e., Alternative A), when combined with all other planned activities (including offshore wind without the Proposed Action) in the geographic analysis area would result in **moderate** impacts on mysticetes, odontocetes, and pinnipeds, with the exception of the NARW, because the anticipated impact would be notable and measurable, but populations are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken. Impacts on the NARW would be **major**, largely due to pile-driving noise, the presence of structures, and vessel traffic, as population-level impacts cannot be ruled out.

3.5.6.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the following sections. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on marine mammals:

- The number, size, and location of WTGs;
- The number, size, and location of OSSs, including foundations and scour protection;
- The number and location of inter-array cables, OSS cables, and offshore export cables, including landfall and scour protection;

- The number of simultaneous vessels, number of trips, and size of the vessels;
- The number, size, and location of WTGs as they relate to hardened structure; and
- The vessels and gear utilized to sample environmental parameters in the Project area through HRG surveys, fisheries, and biological monitoring plans.

Variability of the Project design exists as outlined in Appendix C. A summary of potential variances in impacts is provided below.

- The number, size, and location of WTGs and OSSs, all installed by pile-driving, which are factors that contribute to the intensity and duration of noise resulting in behavioral and physiological effects (TTS), or cause auditory injury (PTS) to marine mammals;
- The number and location of inter-array cables, OSS cables, and offshore export cables;
- Variability in installation methods of OSSs and cables;
- The number of simultaneous vessels, number of trips, and size of the vessels could affect vessel collision risk to marine mammals due to vessels transiting to and from the Wind Farm Area during construction, operations, and decommissioning, and increased recreational fishing vessels; and
- The number, size, and location of WTGs as it relates to hardened structure, which could cause both beneficial and adverse impacts on marine mammals through localized changes to hydrodynamic disturbance, prey aggregation and associated increase in foraging opportunities, incidental hooking from recreational fishing around foundations, entanglement in lost and discarded fishing gear, migration disturbances, and displacement.

3.5.6.5 Impacts of Alternative B – Proposed Action on Marine Mammals

The following sections summarize the potential impacts of the Proposed Action on marine mammals during the various phases of the Project. Routine activities would include construction, O&M, and decommissioning of the Proposed Action, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on NMFS federally listed species, which found that the Proposed Action may adversely affect marine mammals (BOEM 2023). Consultation with NMFS under Section 7 of the ESA is ongoing.

The analysis of impacts under the No Action Alternative, and references therein, applies to the following discussion of the Proposed Action. The most impactful IPFs associated with the Proposed Action are underwater noise from impact pile-driving, which could cause temporary impacts during WTG construction (126 days over 2 years); the presence of structures, which could lead to increased interactions with fishing gear; and increased vessel traffic, which could lead to injury or mortality from vessel strikes.

3.5.6.5.1 Construction and Installation

3.5.6.5.1.1 Onshore Activities and Facilities

Onshore construction and installation activities for the Proposed Action are not expected to contribute to IPFs for marine mammals.

3.5.6.5.1.2 Offshore Activities and Facilities

Accidental releases: Accidental releases of fuel, fluids, hazardous materials, trash, and debris may increase as a result of the Proposed Action. The risk of any type of accidental release would be increased primarily during construction when additional vessels are present and during the proposed refueling of primary construction vessels at sea. BOEM prohibits the discharge or disposal of solid debris into offshore waters during any activity associated with construction and operation of offshore energy facilities (30 CFR 250.300). The USCG also prohibits dumping of trash or debris capable of posing entanglement or ingestion risk (International Convention for the Prevention of Pollution from Ships, Annex V, Public Law 100–200 [101 Stat. 1458]). The Proposed Action would comply with the federal requirements for the prevention and control of oil and fuel spills and would implement proposed BMPs for waste management and mitigation, as well as marine debris awareness training for Project personnel, reducing the likelihood of an accidental release (COP, Volume I, Appendices A and G; US Wind 2023). The incremental impacts of the Proposed Action from accidental releases of hazardous materials and trash/debris would, therefore, not increase the risk beyond that described under Alternative A. In the unlikely event of an accidental oil spill, impacts would be sublethal due to quick dispersion, evaporation, and weathering, all of which would limit the amount and duration of exposure of marine mammals to hydrocarbons. US Wind would establish and implement an OSRP that would decrease potential impacts from spills. Informational training on proper storage and disposal practices to reduce the likelihood of accidental discharges would further reduce the likelihood of an accidental spill from occurring. The combined regulatory requirements and LPMs would effectively avoid accidental debris releases and avoid and minimize the impacts from accidental spills such that adverse effects on marine mammals are unlikely to occur. The impact of accidental releases and discharges as a result of the Proposed Action would be of low intensity, short term, and localized. Therefore, the effects on mysticetes (including NARW), odontocetes, and pinnipeds from accidental releases and discharges would be negligible.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined accidental release and discharge impacts from other ongoing and planned activities including offshore wind. Impacts, therefore, are expected to be temporary and highly localized due to the likely limited extent and duration of a release, resulting in minor impacts for mysticetes, odontocetes, and pinnipeds.

Cable emplacement and maintenance: The Proposed Action would include temporary seafloor disturbance associated with the installation of the offshore export cable (34 acres [13.76 hectares]) and inter-array cables (29.98 acres [12.13 hectares]), which would result in turbidity effects that could have temporary impacts on some marine mammal prey species (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). Jack-up vessels and vessel anchoring will include an additional 77.8 acres (31.5 hectares) of seafloor disturbance. These effects would be increased primarily during construction and installation activities as cable installation for the offshore export cables and inter-array cables is incrementally added. In general, plumes generated during trenching of offshore areas would be limited to directly above the seafloor and not extend into the water column. The sediment transport model predicts that suspended sediments due to jet plowing will remain localized to the area of disturbance and settle quickly to the seafloor (COP, Volume II, Appendix B2; US Wind 2023). Suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 450 feet (137 meters) during trenching for the offshore export cables and inter-array cables. Concentrations greater than 10 mg/L over ambient conditions are anticipated for a short duration (hours); all sediment plumes are expected to settle out of the water column entirely within 24 hours after the completion of jetting operations (COP, Volume II, Appendix B2; US Wind 2023). The jet plow embedment process for cable installation will, therefore, result in short-term and localized heightened turbidity. Trenching with a jet plow in areas of shallower water depths could cause plumes to nearly reach the surface of the water, and alternate cable emplacement methods may be required for some areas, such as dredging to install cable along sand waves.

Data are not available regarding whales' avoidance of localized turbidity plumes; however, Todd et al. (2015) suggest that because marine mammals often live in turbid waters, significant impacts from turbidity are not likely. If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any negative impacts would be short term and temporary. Increased turbidity effects could affect the prey species of marine mammals, both in offshore and inshore environments. Studies of the effects of turbid water on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute reaction is expected (Wilber and Clark 2001). However, as mentioned previously, sedimentation effects would be temporary and localized, with regions returning to previous levels soon after the activity.

During construction, turbidity reduction measures would be implemented to the extent practical to minimize impacts (Appendix G, *Mitigation and Monitoring*, Table G-1). Therefore, BOEM anticipates short-term and localized water quality impacts from inter-array cable installation and undetectable, negligible impacts on mysticetes, odontocetes, and pinnipeds from turbidity. No current information exists to determine whether the cable laying of other projects in the vicinity would overlap with that of the Proposed Action. Suspended sediment concentrations during activities other than dredging would be within the range of natural variability for this location. Any dredging necessary prior to cable installation could generate additional impacts. However, individual marine mammals, if present, would be expected to successfully forage in nearby areas not affected by increased sedimentation, and only non-measurable, negligible impacts, if any, on individuals would be expected given the localized and temporary nature of the potential impacts.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined cable emplacement impacts on mysticetes, odontocetes, and pinnipeds from ongoing and planned activities including offshore wind, which are expected to be minor, with short-term, localized consequences to individuals that are detectable and measurable but do not lead to population-level effects.

Gear utilization (biological/fisheries monitoring surveys): Pre- and post-construction biological/fisheries monitoring surveys under the Proposed Action will result in an increase the amount of fishing gear in the water. However, specific monitoring plans are not known at this time. It is expected that Project-related fisheries monitoring surveys will be of limited frequency and duration, though any sampling that utilizes in-water gear may pose an entanglement or capture risk to marine mammals. As discussed in the *Presence of Structures* IPF section, entanglement from fishing gear could occur to all marine mammal species, though the impact is particularly pronounced for the NARW. However, given the relatively limited extent and duration of these surveys and the application of monitoring and mitigation measures (e.g., soak time limits, gear marking, and recovery of lost gear requirements; Appendix G, *Mitigation and Monitoring*), entanglement as a result of the Proposed Action is not likely to occur and impacts, if any, would not lead to population-level effects. The impact of gear utilization as a result of the Proposed Action, therefore, is expected to be negligible for mysticetes, odontocetes, and pinnipeds.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined lighting impacts from other ongoing and planned activities including offshore wind, which would likely be negligible for mysticetes, odontocetes, and pinnipeds.

Lighting: The Proposed Action would generate lighting associated with construction vessels, which would increase artificial lighting in the marine environment. Though vessel-related lighting impacts would be localized and temporary, it could attract potential prey species to construction zones, potentially aggregating some marine mammal species (primarily odontocetes), exposing them to greater harm from other IPFs associated with construction, including an increased risk of collision with vessels. Vessels would follow BOEM lighting guidelines. BOEM concluded that the operational lighting effects on marine mammal distribution, behavior, and habitat use were negligible if recommended design and operating practices are implemented. Therefore, BOEM anticipates that lighting effects on mysticetes, odontocetes, and pinnipeds would be negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined lighting impacts from other ongoing and planned activities including offshore wind, which would likely be negligible for mysticetes, odontocetes, and pinnipeds.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on marine mammals are impact pile-driving (installation of WTG and OSS foundations), geophysical surveys (HRG surveys), vessel traffic, aircraft, cable laying, trenching, or dredging, and potential relief drilling during construction. UXO detonations are not included under the Proposed Action and will not be discussed in this section (US Wind 2023). Project construction activities could generate underwater noise and result in auditory injury (i.e., PTS), behavioral disturbance, and other effects on marine mammals such as auditory masking and physiological stress (Section 3.5.6.1).

Assessment of the potential for underwater noise to cause auditory injury or behavioral disturbance to a marine mammal requires acoustic thresholds against which received sound levels can be compared. Sound levels that meet or exceed these thresholds could result in effects to marine mammals exposed to those sound levels. However, sound levels are not the only component that is important in assessing potential impacts; noise with frequencies that are within the hearing sensitivities of an animal are more likely to cause disturbance or auditory injury. Animals exposed to noise with frequencies outside their hearing ranges are unlikely to be affected, even if the noise intensity (i.e., “loudness”) is high. Additionally, the duration of noise exposure can change the potential impacts to marine mammals. In some cases, auditory fatigue can result from low level sound exposures over long periods of time, or conversely, hearing threshold shifts could result from exposure to a short duration, high intensity event.

Acoustic thresholds used for the purpose of predicting the spatial extent of potential noise impacts on marine mammals and subsequent management of these impacts aim to account for the duration of exposure and the differences in hearing acuity among marine mammal hearing groups (Finneran 2016; NMFS 2018). The most widely accepted thresholds are provided by NMFS (2018) and are summarized in Table 3.5.6-5.

Table 3.5.6-5. Acoustic thresholds for marine mammal hearing groups for impulsive and non-impulsive anthropogenic noise sources

Marine Mammal	Impulsive Sources		Non-impulsive Sources	
Hearing Group	PTS	Behavioral Disturbance	PTS	Behavioral Disturbance
Low-frequency cetaceans	SEL_{24h}: 183 dB re 1 μPa^2 s L_{pk}: 219 dB re 1 μPa	SPL: 160 dB re 1 μPa	SEL_{24h}: 199 dB re 1 μPa^2 s	Intermittent Sources: SPL 160 dB re 1 μPa Continuous Sources: SPL 120 dB re 1 μPa
Mid-frequency cetaceans	SEL_{24h}: 185 dB re 1 μPa^2 s L_{pk}: 230 dB re 1 μPa	SPL: 160 dB re 1 μPa	SEL_{24h}: 198 dB re 1 μPa^2 s	Intermittent Sources: SPL 160 dB re 1 μPa Continuous Sources: SPL 120 dB re 1 μPa
High-frequency cetaceans	SEL_{24h}: 155 dB re 1 μPa^2 s L_{pk}: 202 dB re 1 μPa	SPL: 160 dB re 1 μPa	SEL_{24h}: 173 dB re 1 μPa^2 s	Intermittent Sources: SPL 160 dB re 1 μPa Continuous Sources: SPL 120 dB re 1 μPa
Phocid pinnipeds in water	SEL_{24h}: 185 dB re 1 μPa^2 s L_{pk}: 219 dB re 1 μPa	SPL: 160 dB re 1 μPa	SEL_{24h}: 201 dB re 1 μPa^2 s	Intermittent Sources: SPL 160 dB re 1 μPa Continuous Sources: SPL 120 dB re 1 μPa

dB re 1 μPa = decibels referenced to 1 micropascal; dB re 1 μPa^2 s = decibels referenced to 1 micropascal squared second; L_{pk} = peak sound pressure level; PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours; SPL = root-mean-square sound pressure level

The assessment of underwater noise in this Draft EIS uses propagation modeling and noise exposure estimates presented in the Maryland Offshore Wind Project Letter of Authorization (LOA) application (TRC 2023a), revised January 2023.

Impact Pile-driving Noise

Noise from impact pile-driving for the installation of WTG, OSS, and Met Tower foundations would occur intermittently during the installation of offshore structures. Impact pile-driving would be used for all pile types, including the 36.1-foot (11-meter) WTG monopiles, 9.8-foot (3-meter) OSS skirt piles, and 5.9-foot (1.8-meter) Met Tower pin piles. The maximum hammer energy was assumed to be 4,400 kJ for the 36.1-foot (11-meter) monopiles, 1,500 kJ for the 9.8-foot (3-meter) pin piles, and 500 kJ for the 5.9-foot (1.8-meter) pin piles. The acoustic modeling was performed at the maximum strike energy (4,400 kJ), and the modeled sound fields were then adjusted by a broadband sound reduction to represent the lower strike energy levels of 1,100 kJ, 2,200 kJ, and 3,300 kJ that US Wind will likely use for impact piling of the monopiles (COP, Appendix H1; US Wind 2023). The estimated duration is 120 minutes for impact pile-driving of the monopile assuming one pile is installed per day, 480 minutes per day for the skirt piles assuming up to four could be installed per day, and 360 minutes per day for the pin piles assuming up to three piles could be installed per day. US Wind will implement sound attenuation technologies such as double bubble curtains and nearfield attenuation devices to reduce the underwater noise impacts from impact pile-driving. These technologies are expected to achieve at least 10 dB noise reduction from impact pile-driving activities relative to the modeled levels, but US Wind will target 20 dB noise reduction (Appendix G, Table G-1). The modeling report provides ranges with 0, 10, and 20 dB noise mitigation applied, but because 10 dB is considered the most reasonable level of mitigation achievable for this activity (Bellmann et al. 2020) and was carried forward in the exposure assessment in the Project's LOA application (TRC 2023a). Results of the acoustic modeling using the methods described above (i.e., piling schedule, 10 dB noise attenuation) and the threshold criteria provided in Table 3.5.6-5 are summarized in Table 3.5.6-6.

Noise produced by impact pile-driving during installation of WTG and OSS foundations could result in PTS for some species, mainly LFC, and behavioral disturbances for all species. As summarized in Table 3.5.6-6, ranges to the LFC PTS thresholds for impact pile-driving estimated with 10-dB of noise attenuation may extend up to 9,514 ft (2,900 meters) for the installation of one 36.1-foot (11-meter) monopile per day and up to 4,593 feet (1,400 meters) for the installation of four 9.8-foot (3-meter) skirt piles per day. Ranges to the HFC PTS thresholds for impact pile-driving estimated with 10-dB of noise attenuation may extend up to 820.2 feet (250 meters) for the installation of one 36.1-foot (11-meter) monopile per day (Table 3.5.6-6). The low relative abundance of HFC species combined with the small threshold ranges makes PTS exposures unlikely for this group. Ranges for all other hearing groups are equal to or less than 328.1 feet (100 meters) for all pile types, so PTS is not likely to occur for MFC or PPW species. Ranges to the behavioral disturbance threshold for all marine mammal species may extend up to 17,224 feet (5,250 meters) for the 36.1-foot (11-meter) monopile, 1,640.4 feet (500 meters) for the 9.8-foot (3-meter) skirt piles, and 328.1 feet (100 meters) for the 5.9-foot (1.8-meter) pin piles (Table 3.5.6-6).

Table 3.5.6-6. Summary of acoustic ranges (95th percentile) to PTS (SEL_{24} and L_{pk}) and behavioral regulatory threshold levels for marine mammals

Scenario	Distances to PTS Threshold (L_{pk}) (meters)				Distances to PTS Threshold (SEL_{24h}) (meters)				Distance to Behavioral Threshold (SPL) (meters)
	LFC	MFC	HFC	PPW	LFC	MFC	HFC	PPW	All Hearing Groups
Impact pile-driving one 11-meter monopile (10 dB noise attenuation)[1]	<50	<50	200	<50	2,900	<50	250	100	5,250
Impact pile-driving four 3-meter skirt piles (10 dB noise attenuation)[2]	<50	<50	<50	<50	1,400	0	100	50	500
Impact pile-driving three 1.8-meter pin piles (10 dB noise attenuation)[3]	<50	<50	<50	<50	50	0	0	0	100

Source: TRC 2023a

dB = decibel; HFC = high-frequency cetaceans; LFC = low-frequency cetaceans; L_{pk} = peak sound pressure level (in units of decibels referenced to 1 micropascal); MFC = mid-frequency cetaceans; PPW = phocid pinniped in water; PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (in units of decibels referenced to 1 micropascal squared second); SEL_{24} = sound exposure level over 24 hours; SPL= root-mean-square sound pressure level (in units of decibels referenced to 1 micropascal)

[1] Installation of a single 11-meter monopile per day (2 hours pile-driving per day).

[2] Installation of four 3-meter skirt piles per day (8 hours of pile-driving per day).

[3] Installation of three 1.8-meter pin piles per day (6 hours per day).

The proposed mitigation outlined for impact pile-driving, in addition to the sound attenuation technologies, include seasonal restrictions to avoid the period when NARW abundance in the Project area is likely to be greatest; clearance zones; soft-start procedures; no simultaneous pile-driving; daytime-only pile-driving; and shutdown procedures if a species enters their defined shutdown zone and it is safe and technically feasible for the Project to stop pile-driving (Appendix G). The clearance and shutdown zones will be based on the modeled threshold ranges to ensure the risk of PTS is significantly minimized, if not eliminated altogether, and the risk of behavioral disturbance is reduced. Soft-start procedures can also be an effective mechanism to reduce the potential for PTS exposures in certain species by deterring species from the area before the maximum hammer energy, and therefore the maximum sound levels, are reached. They are considered highly effective in deterring HFC (i.e., harbor porpoises) from the area but not as effective in deterring pinnipeds, as described in Southall et al. (2021b). The efficacy of deterring other marine mammal species through pile-driving ramp-up procedures is unknown, but the other mitigation measures described will help to reduce the risk of PTS for other species.

Behavioral and masking effects are more difficult to mitigate and with threshold ranges extending to a maximum of 17,224 feet (5,250 meters) for the 36.1-foot (11-meter) monopile. Behavioral disturbances are therefore considered likely during impact pile-driving. As described in Section 3.5.6.3, the most common behavioral effect of pile-driving on marine mammals is short-term avoidance or displacement from the pile-driving site (Dahne et al. 2013; Brandt et al. 2016; Benhemma-Le Gall et al. 2021). Other effects may include adverse impacts on foraging ability resulting from the increased background noise near the pile-driving site which could decrease odontocete target detection abilities and decrease their catch rate success (Branstetter et al. 2018; Kastelein et al. 2019). However, available studies to date are only available for MFC, HFC, and PPW species, and our knowledge of pile-driving effects on LFC species is primarily based on their responses to other impulsive sources such as airguns (Section 3.5.6.3). Behavioral responses in mysticetes include avoidance of the sound source, cessation of feeding and vocalizing behaviors, and changes in dive behavior (Malme et al. 1986, 1989; Richardson et al. 1986; Johnson 2002; McCauley et al. 1998). However, Dunlop et al. (2017) also indicate that behavioral responses were more likely to occur within 2.48 miles (4 kilometers) of the source, and beyond that the severity of the behavioral changes is likely to decrease.

Based on the result of the acoustic modeling and available studies for pile-driving activities and their effects on marine mammals, there is risk of PTS only for LFC species from impact pile-driving of foundations, as their primary frequency range for listening to their environment and communicating with others overlaps with the dominant frequency of impact pile-driving noise. The Proposed Action includes installation of up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower which would equate to approximately 126 days of impact pile-driving (assuming one WTG monopile, four OSS skirt piles, and three Met Tower pin piles are installed per day). Although the seasonal restriction for pile-driving activities would help reduce exposures for NARW, other LFC species such as fin, humpback, and minke whales are likely to still be present within the Project area during construction and would face the risk of exposure to above-threshold noise. Therefore, even with the proposed mitigation, PTS may occur for some species. If any PTS exposures are realized, impacts would be long-term. Behavioral disturbances in all species may result from impact pile-driving activities given the modeled threshold ranges in

Table 3.5.6-6. However, because pile-driving activities under the Proposed Action would only occur over approximately 126 days, no long-term changes in marine mammal behavior or displacement from the Project area are expected to occur. Therefore, impacts from impact pile-driving are expected to be moderate for all marine mammals due to the potential for PTS in some LFC species, and the detectable, but short-term and localized behavioral disturbances that may occur.

Geophysical Surveys

Under the Proposed Action, geophysical surveys may be conducted prior to one or more construction campaigns to refine the locations of Project elements such as construction footprints, WTG and OSS foundations, and cables, or to meet BOEM or other agency requirements for additional survey. Micro-siting HRG surveys may include use of some or all of the following equipment: MBES, magnetometer, SSS, USB, shallow-penetration SBP (i.e., parametric SBP), and medium-penetration SBP (i.e., boomer, sparker) (TRC 2023a). US Wind assumes HRG surveys would be conducted only during daylight hours, for an average daily distance of 69 miles (111.1 kilometers), and at a survey speed of 4 knots (2.1 m/s). The total HRG survey days during the 2 years of construction would be 28 days (14 survey days per year) (TRC 2023a). Acoustic modeling conducted for the Project indicated that exposure to noise which could result in PTS in marine mammals during the proposed geophysical surveys is not likely to occur, and the maximum range to the behavioral disturbance threshold was estimated to be 164.4 feet (50.1 meters) during operations of the sparker system (TRC 2023a).

Based on the modeled ranges to the behavioral disturbance threshold and available published data discussed in Section 3.5.6.3.1, the likelihood of detectable, biologically notable behavioral disturbances during the proposed geophysical surveys is low (Ruppel et al. 2022; Kates Varghese et al. 2020, 2021). MFC species such as beaked whales may face a higher risk of behavioral disturbance given their dive behavior and estimated hearing range (Cholewiak et al. 2017; Quick et al. 2017); however, given the spatial extent and expected duration of geophysical surveys under the Proposed Action and the low density of beaked whale species expected to occur in the Project area (TRC 2023a), impacts on all marine mammals are expected to be negligible.

Vessels

The number and types of vessels that may be used during Project construction are provided in the COP (Volume I, Table 4-1; US Wind 2023) and include vessel classes ranging from utility boats and offshore supply vessels to general cargo and jack-up crane vessels. As discussed in Section 3.5.6.3, vessel noise is not likely to elicit PTS for any marine mammal species, and behavioral disturbances may include changes in behavior such as altered dive patterns or swim speeds (Finley et al. 1990; Mikkelsen et al. 2019; Williams et al. 2022); stress responses such as increased respiration rate or fecal cortisol levels (Nowacek et al. 2004; Rolland et al. 2012; Sprogis et al. 2020); and changes in acoustic behavior such as altering the number of clicks produced by odontocete species (Castellote et al. 2012; Azzara et al. 2013) or ceasing vocalization completely (Tsujii et al. 2018). However, there is still a lack of understanding of the biological consequences of these behavioral disturbances and how they would affect the viability of given populations. Under the Proposed Action construction vessels would only be present for a relatively short period, and Project vessels would adhere to speed restrictions which are aimed to reduce the risk of vessel strike (see *Traffic* IPF below), but reduced vessel speeds have been shown to reduce the noise level produced by these vessels (ZoBell et al. 2021). With the addition of other vessel strike mitigation such as minimum separation distances (Appendix G, *Mitigation and Monitoring*) that would be expected to reduce exposure of marine mammals to above-threshold noise and because the extent of Project vessel traffic would result in a nominal increase in vessels compared to the existing traffic (Section 3.5.6.3), BOEM anticipates impacts on marine mammals from Project construction vessel noise to be minor for mysticetes, odontocetes, and pinnipeds as effects would be detectable, but short term, localized, and not expected to lead to population-level effects.

Aircraft

Under the Proposed Action, aircraft such as helicopters may be used for crew changes or supply runs. However, these would be intermittent trips occurring irregularly throughout the construction period. As described in Section 3.5.6.3, aircraft noise, though audible to most marine mammals, would only result in temporary behavioral responses such as shortened surface durations or abrupt dives (Patenaude et al. 2002; Richter et al. 2006; Smultea et al. 2008). However, given the physics of sound propagation between air and water (Appendix B, *Supplemental Information*), an animal would need to be directly below the aircraft to hear the sound. With the implementation of the proposed mitigation (Appendix G, *Mitigation and Monitoring*) and BMPs such as approach regulations for NARWs (50 CFR 222.32), and the irregular occurrence of Project aircraft traffic, impacts on all marine mammals would be negligible.

Cable Laying, Trenching, or Dredging

During Project construction, jetting, plowing, or removal of soft sediments may be required prior to installation of the WTG, OSS, and Met Tower foundations, and installation of the inter-array cable and export cable. There is limited information regarding underwater noise generated by cable-laying and burial activities in the literature. Johansson and Andersson (2012) recorded underwater noise levels generated during a comparable operation involving pipe laying and a fleet of nine vessels. Mean noise levels of 130.5 dB re 1 µPa were measured 4,921 feet (1,500 m) from the source. Reported noise levels generated during a jet-trenching operation provided a source level estimate of 178 dB re 1 µPa measured 3.3 feet (1 meter) from the source (Nedwell et al. 2003). As described in Section 3.5.6.3, these activities may result in behavioral disturbances for some marine mammals, though these are expected to be low intensity and localized (Hoffman 2012; Pirotta et al. 2013). LFC species may face a nominally higher risk of behavioral effects or masking given the overlap between their hearing and the frequency of cable-laying noise; however, activities associated with the Proposed Action are expected to be short-term and localized, and impacts on all marine mammals from dredging or trenching activities during cable-laying would therefore be negligible.

Relief Drilling

Drilling activities may be used during installation of the WTG foundations in the unlikely event that pile refusal occurs prior to meeting the target embedment depth for the piles. Relief drilling would be conducted using a trailing suction hopper dredge which would remove soils, boulders, or other obstructions from the pile to ensure the foundation is safely and securely installed in the seabed (COP, Volume I, Section 3.3.2; US Wind 2023). Relief drilling noise is not modeled in the COP and accompanying underwater noise acoustic assessment report (COP, Volume II, Appendix H1; US Wind

2023) but would likely create sound similar to dredging operations (see *Cable Laying, Trenching, or Dredging* above). These events are expected to be short term, which limits the marine mammals potentially present during construction. While behavioral responses may occur from relief drilling, they are expected to be short-term and of low intensity. Impacts from potential relief drilling activities on all marine mammals would therefore be negligible.

Port utilization: US Wind's proposed use of the port facilities located in Ocean City and Baltimore, Maryland, and Portsmouth (Hampton Roads area), Virginia, would increase vessel traffic in the area and potentially require expansion or increased maintenance of port facilities within the marine mammal geographic analysis area. Expansion could result in adverse effects on coastal and estuarine habitats from shoreline noise during construction and disturbance or loss of habitat for prey species. However, the Greater Baltimore area has significant marine infrastructure and port facilities to support offshore wind projects, and extensive port expansions are not considered likely at this time. Additional ports that will serve primarily for support services include Cape Charles, Virginia, Port Norris, New Jersey, and Lewes, Delaware (COP, Volume I, Table 3-1; US Wind 2023). Additionally, WTG, OSS, and foundation components may be supplied and transported to a staging area in Baltimore, Maryland, from ports in Europe or the Gulf of Mexico (Epsilon 2022; COP, Volume I [US Wind 2023]).

Increased maintenance such as dredging could expose marine mammals to increased levels of underwater noise and increase turbidity, affecting individual marine mammals or their prey. Increased port expansion and port maintenance would likely be intermittent but long term. Increased vessel traffic associated with the specified ports is covered in the *Traffic* IPF section. The adverse effects from potential expansion cannot be evaluated because no specific Project proposals were developed as part of the Proposed Action.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute incrementally to the combined impacts of port utilization from other ongoing and planned activities including offshore wind, which would likely be minor, as impacts on marine mammals would be detectable, but highly localized and intermittent; population-level impacts would not be expected for mysticetes, odontocetes, and pinnipeds.

However, any future port expansion and associated increase in vessel traffic would be subject to independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on marine mammals regionwide.

Traffic: Several vessels will be required to support activities carried out during the construction and installation phases of the Project. Specific vessels are required for surveying activities, foundation installation, OSS installation, cable installation, WTG installation, and support activities. Vessels are expected to have conventional propeller- or thruster-based propulsion systems. Smaller vessels designed primarily for crew transfer applications are expected to employ water jet-drive based systems. The COP (Volume I, Table 4-1; US Wind 2023) details the anticipated vessels to be used during construction activities.

Vessel traffic in the immediate vicinity of the Lease Area is mainly composed of deep-draft vessels, with a smaller proportion of fishing vessels, based on AIS data (COP, Volume II, Appendix K1; US Wind 2023).

Cargo/Carrier and Tanker vessels mainly follow the designated TSS when entering and leaving Delaware Bay, which predominantly passes to the north of the Lease Area. However, vessel traffic at the southern terminus of the TSS spread out and pass through the Lease Area, though this traffic is mainly limited to the furthest east, offshore portion of the Lease Area and aligned in a north-south direction (COP, Volume II, Appendix K1; US Wind 2023). Commercial fishing as well as pleasure/recreational vessel activity within the Lease Area is sparce and mainly constitutes transits from Ocean City, Maryland, to fishing grounds east of the Lease Area. Other vessels (with AIS) that utilize the waters of the Lease Area include tug, cruise/ferry, and other non-categorized vessels. In total, 3,547 vessel transits traversed the Lease Area in 2019, with an average of 9.7 transits per day; the highest density of these transits occur in the eastern portion of the Lease Area (COP, Volume II, Appendix K1; US Wind 2023). In comparison, directly north of the Lease Area is the entrance to Delaware Bay, which has an average of 24.5 transits per day (COP, Volume II, Appendix K1; US Wind 2023). When considering vessel traffic in the vicinity of the Lease Area (defined as within 4.3 nautical mile [8 kilometer] of the Lease Area), 8,288 annual transits were recorded in 2019, which is equivalent to approximately 22.7 transits per day (COP, Volume II, Appendix K1; US Wind 2023). These data indicate relatively high levels of regional baseline traffic in the vicinity of the Project area.

Based on information provided by US Wind, construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require up to 39 simultaneous construction vessels. In total, the Proposed Action would generate approximately 2,343 round trip vessel transits during the 3-year construction and installation phase and approximately the same number of vessel trips per year during decommissioning as during construction and installation. The construction vessels that would be used for Project construction are described in the COP (Volume I, Chapter 4.0 and Table 4-1; US Wind 2023). WTG, OSS, and foundation components may be supplied and transported to a staging area in Baltimore, Maryland, from ports in Europe or the Gulf of Mexico; this would be accomplished using a mix of heavy lift and general cargo vessels undergoing up to five round trips per construction year (COP, Volume I, Section 3.0; US Wind 2023).

If a vessel strike does occur, the impact on marine mammals would range from negligible to major, depending on the species and severity of the strike. However, US Wind has committed to a range of LPMs to avoid vessel collisions with marine mammals (Appendix G, Table G-1). These include vessel separation distances and strict adherence to NMFS Regional Viewing Guidelines for vessel strike avoidance as well as specific vessel speed restrictions (NMFS 2020) for all Project vessels moving to and from ports, the Lease Area, and cable lay routes. Vessel operators would monitor the NMFS NARW reporting systems during all Project phases. Additionally, US Wind will implement the following vessel strike avoidance mitigation measures:

- PSOs or trained observers will be present on all Project vessels, including crew transfer vessels.
- US Wind will ensure that from November 1 through April 30, vessel operators monitor NOAA Fisheries NARW reporting systems (e.g., Early Warning System, Sighting Advisory System, Mandatory Ship Reporting System) for the presence of NARWs.
- Vessels 65 feet (19.8 meters) or larger will operate at 10 knots (18.5 km/h) or less in NARW Slow Zones, Special Management Areas (SMAs), and Dynamic Management Areas (DMAs). US Wind will

incorporate the proposed revision to the NARW speed rule for vessels 35 to 65 feet (10.6 to 19.8 meters) in length upon Rule adoption.

- If underway, vessels will maintain a minimum separation distance of 1,640 feet (500 meters) or greater from any sighted NARW, 328.1 feet (100 meters) or greater from any sighted non-delphinid cetacean other than NARW, and 164 feet (50 meters) or greater from any sighted delphinid cetacean and pinniped except if the animal approaches the vessel.
- US Wind will continue to evaluate technologies that may increase the ability to detect marine mammals from vessels, such as thermal detection technologies.

The LPMs to reduce marine mammal injury or mortality from potential Project-related vessel strikes are expected to be effective. In the rare event of a marine mammal strike at the proposed vessel speeds identified in the LPMs (Appendix G, Table G-1), the consequence would likely be a non-lethal injury (laceration from a propeller or blunt-force injury) rather than direct mortality. Most odontocetes (e.g., harbor porpoises) and pinnipeds (e.g., harbor seals) are considered to be at low risk for vessel strikes due to their swimming speed and agility in the water.

The potential effect of a vessel strike on marine mammal populations is considered severe in intensity because potential receptors include listed species (e.g., NARWs) and because the Offshore Project area and vessel transit routes seasonally or annually support mysticetes (e.g., humpback whales), which have a higher susceptibility to vessel strikes compared to certain odontocetes (except sperm whales) and pinnipeds. The geographic extent is considered localized to the vessel transit routes and the Offshore Project area. As Project vessels would operate throughout the construction, O&M, and decommissioning phases, the potential for a vessel to strike a marine mammal is considered continuous (life of Project). Effects from vessel strikes range from short term in duration for minor injuries to permanent in the case of death of an animal. Proposed measures to mitigate vessel-marine mammal strikes (e.g., vessel speeds) are expected to be highly effective and reduce the likelihood of occurrence to low.

With implementation of known and highly effective measures such as reduced vessel speeds and ships maintaining minimum distances from marine mammals, this impact is considered negligible for pinnipeds and odontocetes as impacts would be barely detectable and minor for non-listed mysticetes because impacts would be detectable, but not lead to population-level consequences. As the death of a single NARW could lead to population-level consequences and the application of mitigation cannot rule out the potential for this effect to occur, this impact is considered major for NARW and moderate for all other listed mysticetes, whose populations would be expected to sufficiently recover.

The area around the Offshore Project area (including Project vessel transit routes) is used by many different vessels, including large, deep-draft vessels; fishing vessels; recreational vessels; and tugs operating to and from ports in Maryland, Delaware, New Jersey, and abroad (COP, Volume II, Appendix K1; US Wind 2023). The contribution of the Proposed Action would be relatively small when compared to the number of vessel trips associated with ongoing and planned non-offshore activities and offshore wind activities (without the Proposed Action) throughout the marine mammal geographic analysis area and would represent only a small portion of the overall annual increases in vessel traffic in the region. In the context of reasonably foreseeable environmental trends, the Proposed Action would inclemently contribute to the combined impacts from ongoing activities and planned activities including offshore wind, which would be negligible for pinnipeds and odontocetes as impacts would be barely detectable; minor for non-listed mysticetes because impacts would be detectable, but not lead to population-level consequences; major for NARW as the death of a single NARW could lead to population-level consequences; and moderate for all other listed mysticetes, whose populations would be expected to sufficiently recover.

3.5.6.5.2 Operations and Maintenance

3.5.6.5.2.1 Onshore Activities and Facilities

Onshore construction and installation, O&M, and decommissioning activities for the Proposed Action are not expected to contribute to IPFs for marine mammals.

3.5.6.5.2.2 Offshore Activities and Facilities

Accidental releases: The incremental impacts of the Proposed Action during O&M from accidental releases of hazardous materials and trash/debris would be the same, though slightly reduced, as that described earlier for construction and installation of the Proposed Action. During O&M of the Proposed Action, at-sea refueling for construction vessels would not likely occur, thereby reducing overall risk for an accidental spill. All other impacts of accidental releases during O&M would be the same as during construction and installation and would therefore remain negligible for mysticetes, odontocetes, and pinnipeds.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined accidental release and discharge impacts from other ongoing and planned activities including offshore wind during O&M. Impacts, therefore, are expected to be temporary and highly localized due to the likely limited extent and duration of a release, resulting in minor impacts for mysticetes, odontocetes, and pinnipeds.

Cable emplacement and maintenance: Only intermittent, localized cable maintenance is predicted during the O&M phase of the Proposed Action. Routine procedures will include cable surveys, typically required to check the cable burial depths, especially in those locations with sand waves or a high fishing activity that can have impacts on buried cables. Cable surveys are anticipated in year 1, year 3, and then every 5 years after. In case of insufficient burial or cable exposure, whether attributable to natural or human caused issues, appropriate remedial measures will be taken including reburial or placement of additional protective measures. If a cable failure occurs, an appropriate cable repair spread will be mobilized. During these remedial activities, if they occur, sediment plumes would be limited to directly above the seafloor and not extend into the water column. The sediment transport model predicts that suspended sediments due to jet plowing will remain localized to the area of disturbance and settle quickly to the seafloor (COP, Volume II, Appendix B2; US Wind 2023). Elevated turbidity levels would be short term, highly localized, and temporary. Therefore, effects to marine mammals would be similar to that described for the construction and installation phase and impacts would be non-measurable and negligible for mysticetes, odontocetes, and pinnipeds.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined cable emplacement impacts on mysticetes, odontocetes, and pinnipeds from ongoing and planned activities including offshore wind, which are expected to be minor, with short-term, localized consequences to individuals that are detectable and measurable but do not lead to population-level effects.

EMFs and cable heat: Normandeau et al. (2011) reviewed the potential effects of EMFs from offshore wind energy projects on marine mammals and other species. They concluded that marine mammals are unlikely to detect magnetic field intensities below 50 milligauss, suggesting that these species would be insensitive to EMF effects from Project electrical cables. The areas with potentially detectable EMFs, if any, would be small, extending only a few feet from the cable. Both offshore export and inter-array cable arrays are high-voltage AC, which would be buried at a depth of approximately 3.3 to 6.6 feet (1 to 2 meters) and installed with appropriate cable shielding and scour protection (where needed). These factors will effectively limit marine mammal exposure to both EMF and heat originating from the Proposed Action's HVAC cables.

These factors indicate that the likelihood of marine mammals encountering detectable EMF and heat effects is low, and any exposure would be below levels associated with measurable biological effects. Therefore, EMF effects on marine mammals (mysticetes, odontocetes, and pinnipeds) would be negligible.

In the context of reasonably foreseeable environmental trends, the undetectable incremental impact contributed by the Proposed Action would result in a noticeable increase in EMF in the geographic analysis area beyond that described under the No Action Alternative. However, the combined impacts from EMF on mysticetes, odontocetes, and pinnipeds would likely still be negligible, localized, and long term.

Lighting: The Proposed Action would introduce stationary artificial light sources in the form of navigation, safety, and work lighting. The Project is proposing to use an ADLS, which if implemented would only activate WTG lighting when aircraft enter a predefined airspace, which would minimize the amount of artificial lighting associated with the Proposed Action. Vessel lighting during operations will be greatly reduced compared to that during construction activities (see Traffic IPF). The WTGs, OSSs, and vessels would be lighted and marked in accordance with FAA, USCG, and BOEM guidelines to aid safe navigation within the Project area. Orr et al. (2013) summarized available research on potential operational lighting effects from offshore wind energy facilities and developed design guidance for avoiding and minimizing lighting impacts on aquatic life, including marine mammals. BOEM concluded that the operational lighting effects on marine mammal distribution, behavior, and habitat use were negligible if recommended design and operating practices are implemented. Therefore, BOEM anticipates that operational lighting effects on mysticetes, odontocetes, and pinnipeds would be negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined lighting impacts from other ongoing and planned activities including offshore wind, which would likely be negligible for mysticetes, odontocetes, and pinnipeds.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on marine mammals are WTG operations, geophysical surveys, and vessel traffic during O&M. Project O&M

activities could generate underwater noise and result in behavioral disturbance and masking effects on marine mammals.

WTG Operations

As discussed in Section 3.5.6.3, operations of the WTG would result in long-term, low-level, continuous noise in the Project area which could result in behavioral disturbances and auditory masking at close distances (Lucke et al. 2007; Tougaard et al. 2005, 2020; Thomsen and Stober 2022). Noise produced by operational WTG is within the auditory hearing range for all marine mammals, but the potential for impacts is not likely to occur outside a relatively small radius surrounding the Project foundations and the audibility of the WTGs may be further limited by the ambient noise conditions of the Project area (Jansen and de Jong 2016, as an example). Furthermore, WTG operations are not expected to exceed noise produced by vessel traffic out to 0.6 miles (1 kilometer; Tougaard et al. 2020). Therefore, impacts would be similar to those described for vessel noise in Section 3.5.6.3 and expected to be negligible to minor. Minor impacts, such as masking in low ambient noise conditions, may be more likely for LFC, due to the low-frequency nature of operational noise and this group's hearing sensitivity.

Geophysical Surveys

Geophysical surveys may occur irregularly throughout the O&M phase of the Proposed Action to check the integrity of the scour protection around the foundations and ensure the inter-array and export cables have not become exposed. The scope of geophysical surveys during O&M would be similar to that described for Project construction, and impacts on all marine mammals would similarly be negligible.

Vessels

Vessel traffic during the O&M phase of the Proposed Action is expected to be infrequent and limited to the use of smaller vessels which would limit the level of noise produced during the maintenance trips and geophysical surveys. Given the lower volume of vessel traffic expected during O&M and the smaller size of the vessels expected, impacts on all marine mammals are expected to be negligible.

Port utilization: US Wind's planned O&M Facility in Ocean City, Maryland, is intended to serve as the primary port for Project maintenance activities and routine inspections. This site will serve as the primary point for the loading of maintenance crews, replacement components, and consumables onto crew transfer vessels. Additional O&M ports include Portsmouth, Virginia, for major maintenance activities requiring deep draft or jack-up vessels; Baltimore, Maryland, for major maintenance activities requiring deep draft vessels; and Lewes, Delaware, for maintenance activities and routine inspections. The crew transfer vessels will transport the maintenance crews to the offshore site on an as needed basis dependent on weather conditions. Port activities beyond routine maintenance of the facilities are not predicted at this time. Therefore, port utilization during the O&M phase of the Proposed Action is likely to have negligible impacts on mysticetes, odontocetes, and pinnipeds as there would be no perceptible consequences to individuals or populations. Vessel traffic in and out of the ports is considered in the *Traffic* IPF.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute to the combined impacts of port utilization from other ongoing and planned activities including offshore wind, which would likely be moderate, as impacts on marine mammals would be detectable, but highly localized and intermittent; population-level impacts would not be expected for mysticetes, odontocetes, and pinnipeds.

Presence of structures: Under the Proposed Action, US Wind proposes to install up to 121 WTGs (PDE), up to 4 OSSs, 1 Met Tower, as well as scour and cable protection materials. The structures and scour/cable protection, and the potential consequential impacts, would remain at least until decommissioning of each facility is complete. The long-term presence of Project structures could displace marine mammals from preferred habitats or alter movement patterns. The 121 WTG monopile foundations would be placed in a grid-like pattern with approximate spacing of 0.77 and 1.02 nautical mile (1.43 and 1.89 kilometer) between WTGs. Based on documented lengths (Wynne and Schwartz 1999), the largest NARW (59 feet [18 meters]), fin whale (79 feet [24 meters]), sei whale (59 feet [18 meters]), and sperm whale (59 feet [18 meters]) would fit end to end between two foundations spaced at 1 nautical mile (1.9 kilometer) 100 times over. This simple assessment of spacing relative to animal size indicates that the physical presence of the monopile foundations is unlikely to pose a barrier to the movement of large marine mammals, and even less likely to impede the movement of smaller marine mammals. On this basis, BOEM concludes that the presence of the Project's WTG foundations would pose a negligible risk of impeding the movements of marine mammals, though altered movement patterns to avoid developed areas cannot be ruled out; the likelihood and impact of this remains unknown for marine mammals. Localized displacement may result in higher encounter rates with fishing gear (see the entanglement discussion below) and vessel traffic (see *Traffic* IPF).

Long-term reef and hydrodynamic effects resulting from the Proposed Action (detailed in Section 3.5.6.3.1) could result in beneficial effects on fish-eating odontocetes and pinnipeds that benefit from increased prey abundance around the structures, though these effects may be offset by increased interactions with fishing gear associated with the presence of structures. Conversely, minor adverse effects due to disruption in hydrodynamics from the Proposed Action could result in impacts on mysticetes that forage on plankton and forage fish. Long-term impacts could occur as a result of increased interaction with active or abandoned fishing gear. This impact is considered minor for pinnipeds, odontocetes, and mysticetes except for the NARW.

Entanglement is a significant threat for NARW, which has been experiencing an unusual mortality event since 2017 attributed to vessel strikes and entanglement in fisheries gear. Most NARWs show evidence of past entanglements (Johnson et al. 2005), and entanglement in fishing gear is a leading cause of death for this species and may be limiting population recovery (Knowlton et al. 2012). Therefore, the increased risk of entanglement is more significant for this species. As the death of a single NARW could lead to population-level consequences and the potential for this effect to occur cannot be ruled out, this impact is considered major for the NARW. In the context of reasonably foreseeable environmental trends, the appreciable incremental impact contributed by the Proposed Action would slightly increase the presence of structures in the marine mammal geographic analysis area beyond that described under the No Action Alternative. However, the combined impacts from the presence of structures, which would be localized and long term, would likely be minor for pinnipeds, odontocetes, and mysticetes except the NARW as impacts, primarily to the increased risk for fishing gear entanglement, would be detectable and measurable, but would not lead to population-level effects. Impacts to the NARW would be elevated to major due to the potential for population-level impacts associated with fishing gear entanglement risk for the species.

In the context of reasonably foreseeable environmental trends, the incremental impact contributed by the Proposed Action would result in a noticeable increase in the presence of structures in the geographic analysis area beyond that described under the No Action Alternative. However, the combined impacts from the presence of structures would likely still be minor for odontocetes and pinnipeds and minor for mysticetes, except the NARW, as population-level impacts are not expected. Impacts to the NARW could be elevated to major due primarily to the increased risk for fishing gear entanglement that could result in population-level consequences.

Traffic: The O&M phase of the Proposed Action would result in approximately 822 vessel roundtrip transits per year originating from O&M facilities in Ocean City and Baltimore, Maryland, to the Wind Farm Area. Crew transfer vessels would be the most common vessel type used during O&M, followed by service operation vessels and other as-needed vessels (i.e., heavy lift vessels for non-routine procedures). Crew transfer vessels operating out of Ocean City, Maryland, would conduct daily vessel round trip transits from May through August and two to three roundtrip transits per week for the remainder of the year throughout the duration of the O&M phase; less than one service operation vessel roundtrip transit is expected per year.

US Wind has committed to specific LPMs as summarized in Appendix G, Table G-1. Those relevant to the assessment of vessel strikes include vessel speed restrictions; vessel strike avoidance measures; monitor NMFS NARW reporting systems; use of qualified observers; and minimum separation distances. In addition, US Wind has committed to mitigation measures as outlined in the MMPA Letter of Authorization Application (TRC 2023a) and NMFS BA (BOEM 2023) including protected species observer/passive acoustic monitoring training and requirements, general vessel strike avoidance measures, vessel separation distances, vessel speed restrictions, reporting of observed impacts on species, and BOEM Project Design Criteria and BMPs.

The LPMs to reduce marine mammal injury or mortality from potential Project-related vessel strikes are expected to be effective. In the rare event of a marine mammal strike at the proposed vessel speeds identified in the LPMs (Appendix G, Table G-1), the consequence would likely be a non-lethal injury (laceration from a propeller or blunt force injury) rather than direct mortality. Most odontocetes (e.g., harbor porpoises) and pinnipeds (e.g., harbor seals) are considered to be at low risk for vessel strikes due to their swimming speed and agility in the water.

The potential effect of a vessel strike on marine mammal populations Is considered severe in intensity because potential receptors include listed species (e.g., NARWs) and because the Offshore Project area and vessel transit routes seasonally or annually support mysticetes (e.g., humpback whales), which have a higher susceptibility to vessel strikes compared to certain odontocetes (except sperm whales) and pinnipeds. The geographic extent is considered localized to the vessel transit routes and the Offshore Project area. As Project vessels would operate throughout the construction, O&M, and decommissioning phases, the potential for a vessel to strike a marine mammal is considered continuous (life of Project). Effects from vessel strikes range from short term in duration for minor injuries to permanent in the case of death of an animal. Proposed measures to mitigate vessel-marine mammal strikes (e.g., vessel speeds) are expected to be highly effective and reduce the likelihood of occurrence to low.

With implementation of known and highly effective measures such as reduced vessel speeds and ships maintaining minimum distances from marine mammals, this impact is considered negligible for pinnipeds and odontocetes as impacts would be barely detectable and minor for non-listed mysticetes because impacts would be detectable, but not lead to population-level consequences. As the death of a single NARW could lead to population-level consequences and the application of mitigation cannot rule out the potential for this effect to occur, this impact is considered major for NARW and moderate for all other listed mysticetes, whose populations would be expected to sufficiently recover.

The area around the Offshore Project area (including Project vessel transit routes) is used by many different vessels, including tugs, fishing vessels, and large, deep-draft vessels operating to and from ports in Virginia, Delaware, New Jersey, and abroad. The contribution of the Proposed Action would be relatively small when compared to the number of vessel trips associated with ongoing and planned non-offshore activities and offshore wind activities (without the Proposed Action) throughout the marine mammal geographic analysis area and would represent only a small portion of the overall annual increases in vessel traffic in the region. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts from ongoing activities and planned activities including offshore wind, which would be negligible for pinnipeds and odontocetes as impacts would be barely detectable; minor for non-listed mysticetes because impacts would be detectable, but not lead to population-level consequences; major for NARW as the death of a single NARW could lead to population-level consequences; and moderate for all other listed mysticetes, whose populations would be expected to sufficiently recover.

3.5.6.5.3 Conceptual Decommissioning

3.5.6.5.3.1 Onshore Activities and Facilities

Onshore decommissioning activities for the Proposed Action are not expected to contribute to IPFs for marine mammals.

3.5.6.5.3.2 Offshore Activities and Facilities

The decommissioning process for the WTGs and ESPs is anticipated to be the same sequence and time frame, but in reverse of construction and installation.

The first stage will require Project components to be drained of all fluids and chemicals, transported to an appropriate disposal or recycling facility. All foundations will be removed to a level below the mudline of the seabed in accordance with the conditions of the lease, potentially to 15 feet (4.6 meters). Cables and scour protection around each foundation may be left in place to provide seafloor habitat, although this is not certain and may be removed entirely to return the seafloor to pre-project conditions if required. It is anticipated that the equipment and vessels used during decommissioning will be similar to those used during construction and installation and would likely include heavy lift vessels, jack-up vessels, larger support vessels, tugboats, crew transport vessels, and possibly vessels specifically built for installing WTGs.

Decommissioning impacts include underwater noise emitted from underwater acetylene cutting torches, mechanical cutting, high-pressure water jet, and vacuum pump. SPLs are not available for these types of equipment, but are not expected to be higher than construction vessel noise. US Wind would return the sediments previously removed from the inner space of the pile to the depression left after the pile is removed. In addition, US Wind would likely use a vacuum pump and diver or ROV-assisted hoses to minimize sediment disturbance and turbidity. US Wind may abandon the offshore export cables in place to minimize environmental impact, in which case there would be no impacts from their decommissioning. If required, US Wind would remove the cables from their embedded position in the seabed. Where necessary, US Wind would jet plow the cable trench to remove the sandy sediments covering the cables and reel the cables onto barges. A physical description of underwater potential methods that could be used for decommissioning, can be found in Appendix B, *Supplemental Information*. The impacts from noise generated during decommissioning activities are likely be similar to those outlined for construction activities. Risks from removing the cables would be short-term, localized to the Proposed Action area, and similar to those experienced during cable installation. Although some of the decommissioning activities (e.g., acoustic impacts, increased levels of turbidity) may cause marine mammals, including listed species, to avoid or leave the Proposed Action area, this disturbance would be short term and temporary. The increased vessel traffic associated with decommissioning could also cause a temporary increase in potential effects. Details regarding potential impacts on listed species are found in the BA (BOEM 2023).

When compared to the construction of the Proposed Action, impact determinations for IPFs either will not change or will be greatly reduced for marine mammals during decommissioning activities. Impacts from accidental releases, lighting, new cable emplacement/maintenance, port utilization, and climate change will not change from the determinations discussed in the construction phase. Impacts from EMF will be less than or entirely gone in comparison to construction and operation phases due to the removal of cables. The impact from vessel traffic and noise related to vessels is expected to be the same as construction but noise levels will be reduced in relation to HRG surveys; no pile-driving operations will be utilized during decommissioning. Impacts from the presence of structures related to fishing gear entanglement risk would be less than during construction and operations. However, decommissioning activities would reverse the artificial reef effect, converting hard-bottom habitat back to soft-bottom habitat. Benefits some marine mammal species experienced due to the presence of the artificial reef effect would likely be reduced following the decommissioning process.

In the context of reasonably foreseeable environmental trends considering, all the IPFs combined on marine mammals from ongoing, future offshore non-wind activities, and planned action, including decommissioning of the Proposed Action, are anticipated to range from negligible to moderate impacts for most mysticetes (except the NARW), odontocetes, and pinnipeds as population-level effects would not be expected. The NARW may experience major impacts as population-level effects could be realized primarily due to vessel strike risk and entanglement risk resulting from the presence of structures. The decommissioning phase of the Proposed Action would contribute to, but would not change, the overall impact rating.

3.5.6.5.4 Impacts of Alternative B on ESA-Listed Species

General impacts of the Proposed Action on marine mammals were described in the previous subsection. This subsection addresses specific impacts of the Proposed Action on ESA-listed species (i.e., fin whale and NARW) for those impacts with species-specific information.

Noise: As noted for the No Action Alternative, noise effects associated with aircraft, G&G surveys, WTGs, and cable laying for the Proposed Action are not expected to differ between ESA-listed marine mammals and non-ESA-listed marine mammal species. Impacts associated with pile-driving noise may be reduced for NARW compared to other marine mammal species, whereas impacts associated with vessel noise could be greater for fin whales and NARWs, both LFCs, compared to some other marine mammal species. As described for offshore activities and facilities in the construction and installation phase of the Proposed Action, pile-driving can result in physiological and behavioral effects on marine mammals, and LFC are expected to have the largest exposure ranges for injury. However, as previously noted, US Wind has proposed seasonal pile-driving restrictions with pile-driving occurring between April 1 and November 30 to minimize risks to NARW. Additional mitigation measures such as larger clearance or exclusion zones may be implemented, if necessary, during April and November. Given this measure, pile-driving noise impacts on NARW are expected to be minor for NARW compared to moderate impacts for other species.

As described in Section 3.5.6.3, the low frequencies produced by vessel noise and the relatively large propagation distances associated with sound at these frequencies put LFC at the greatest risk of impacts associated with vessel noise. Vessel noise is known to increase stress hormone levels in NARW, which may contribute to suppressed immunity and reduced reproductive rates and fecundity (Hatch et al. 2012; Rolland et al. 2012). Masking may also be a significant issue for this species as modeling results indicate vessel noise could substantially reduce communication distances for NARWs (Hatch et al. 2012).

Presence of structures: As noted for the No Action Alternative, many effects associated with the presence of structures, including hydrodynamic changes, habitat conversion and prey aggregation, avoidance or displacement, and behavioral disruption are not expected to differ between ESA-listed mammals and other marine mammal species. Impacts associated with increased entanglement risk could be greater for NARWs compared to other marine mammal species.

As described in Section 3.5.6.3, the presence of structures may result in an increase in the risk of marine mammal entanglement due to increased fishing activity or a shift to fixed gear types. Entanglement is a significant threat for NARW, which has been experiencing an unusual mortality event since 2017 attributed to vessel strikes and entanglement in fisheries gear. Most NARWs show evidence of past entanglements (Johnson et al. 2005), and entanglement in fishing gear is a leading cause of death for this species and may be limiting population recovery (King et al. 2021; Knowlton et al. 2012; Johnson et al. 2005). Therefore, the increased risk of entanglement is more significant for this species. However, the incremental contributions of the Proposed Action to the combined impacts due to the presence of structures associated with ongoing and planned activities would be negligible, and the Proposed Action is not expected to result in stock- or population-level effects for this species.

Traffic: As described in Section 3.5.6.3, vessel strikes are a significant concern for mysticetes, including fin whales and NARWs. NARWs are particularly vulnerable to vessel strikes, and vessel strikes are a primary cause of death for this species (Hayes et al. 2022; Kite-Powell et al. 2007). As noted for the presence of structures IPF, NARW has been experiencing an unusual mortality event since 2017 attributed to vessel strikes and entanglement in fisheries gear (NOAA Fisheries 2022a). Vessel strikes may be particularly significant for this species given their relatively high risk and their low population numbers. However, the incremental contributions of the Proposed Action to the combined impacts due to vessel traffic associated with ongoing and planned activities would be negligible. Given its minor incremental contribution and US Wind's proposed vessel strike avoidance measures, the Proposed Action is not expected to result in stock- or population-level effects for this species.

3.5.6.5.5 Conclusions

Project construction and installation, O&M, and conceptual decommissioning would result in habitat disturbance (presence of structures, lighting, and new cable emplacement), habitat conversion (presence of structures), underwater and airborne noise, vessel traffic (strikes and noise), entanglement risk (presence of structures and gear utilization), and potential discharges/spills and trash. BOEM expects individual impacts ranging from **negligible** to **moderate** for mysticetes because impacts would be noticeable and measurable, but would not result in population-level effects, except for the NARW. BOEM expects individual impacts ranging from **negligible** to **major** for the NARW because population-level effects may occur, primarily due to vessel traffic and entanglement risk associated with the presence of structures. BOEM further expects individual impacts ranging from **negligible** to **moderate** for odontocetes and pinnipeds and could include **minor beneficial** impacts because impacts would be noticeable and measurable, but would not result in population-level effects. Adverse impacts are expected to result mainly from pile-driving noise, increased vessel traffic, and the presence of structures related to fishing gear entanglement. Beneficial impacts for odontocetes and pinnipeds are expected to result from the presence of structures, though these effects may be offset by increased interactions with fishing gear associated with the presence of structures.

In the context of other reasonably foreseeable environmental trends, incremental impacts contributed by the Proposed Action to the overall impact on marine mammals would range from undetectable to appreciable. BOEM anticipates the overall impacts for mysticetes, odontocetes, and pinnipeds in the geographic analysis area from the Proposed Action when combined with ongoing and planned activities would be **moderate**, except for the NARW, impacts would be **major**. BOEM made this determination because the anticipated impact would be notable and measurable, but marine mammals are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken, except for the NARW, as population level impacts cannot be ruled out. The main drivers for this impact rating are impact pile-driving noise, vessel noise, the presence of structures, and vessel traffic. The Proposed Action would contribute to the overall impact rating primarily through impact pile-driving noise, vessel traffic, and the presence of structures.

3.5.6.6 Impacts of Alternatives C, D, and E on Marine Mammals

Alternatives C, D, and E would result in the same impacts on marine mammals from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, with some impacts being minimally decreased in duration and geographic extent. Alternative C, the Landfall and Onshore Export Cable Route Alternative ("Landfall Alternative" inclusive of Alternatives C-1 and C-2), would result in onshore export cable routing that avoids Indian River Bay and the Indian River, which would not have any significant differences in the potential effects on marine mammals compared to Alternative B; all other Project components including construction, operations, and decommissioning would be identical to those of Alternative B. Alternative D, the Viewshed Alternative, would result in the exclusion of 32 WTG positions and 1 OSS within 14 miles (22.5 kilometers) from shore associated with the future development phase, and Alternative E, the Habitat Impact Minimization Alternative, would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), or repositioning the export cable route. Micrositing of WTGs and cables may also be necessary under Alternative E to avoid AOCs. The removal of WTG and OSS positions under Alternatives D and E would decrease the overall duration of impact pile-driving noise present during project construction, the overall number of structures present during operations, and the overall area of seafloor disturbance resulting from Project construction. All other Project components including construction, operations, and decommissioning would be identical to those of Alternative B.

Reductions in the WTGs would reduce the number of monopiles required. As a result, the number of hours of impact pile-driving required to install the WTGs would be reduced. The length of inter-array cables to be installed would also be reduced if fewer WTGs are installed. IPFs that could change as a result include presence of structures, underwater noise from pile-driving and vessels during construction activities, habitat alteration, vessel strikes, and cable emplacement and maintenance. The changes in the number of monopiles and associated Project construction vessels between the Proposed Action (PDE of up to 121 WTG) and each alternative (up to 82 under Alternative D and 103 under Alternative E) would be nominal in the context of the complete assessment of effects on marine mammals. As a result, a reduction in the duration of the effects would occur; however, the magnitude of the effects would remain unchanged from that of the Proposed Action. Similarly, the volume of Project vessels and area of seafloor disturbance and the overall reduction in the number of Project structures present during operations would not differ significantly between Alternative B and Alternatives D and E, so the relative risk of impacts on marine mammals would be expected to remain as described in Section 3.5.6.5 for those IPFs. Alternatives C-1, C-2, D, and E may change the duration for the IPFs in comparison to that described for the Proposed Action in Section 3.5.6.5.

3.5.6.7 Impacts of Alternatives C, D, and E on ESA-Listed Species

Impacts of Alternatives C, D, and E on ESA-listed marine mammals would not differ from the impacts as described for the Proposed Action.

3.5.6.7.1.1 Conclusions

Although Alternatives C, D, and E would result in a decreased construction and operational footprint and avoidance of particular habitat areas, BOEM anticipates the impacts resulting from these action alternatives would be similar to those of the Proposed Action and range from **negligible** to **major**. BOEM expects individual impacts ranging from **negligible** to **moderate** for mysticetes because impacts would be noticeable and measurable, but would not result in population-level effects, except for the NARW. BOEM expects individual impacts ranging from **negligible** to **major** for the NARW because population-level effects may occur, primarily due to vessel traffic and entanglement risk associated with the presence of structures. BOEM further expects individual impacts ranging from **negligible** to **moderate** for odontocetes and pinnipeds and could include **minor beneficial** impacts because impacts would be noticeable and measurable but would not result in population-level effects. Adverse impacts are expected to result mainly from pile-driving noise, increased vessel traffic, and the presence of structures related to fishing gear entanglement. Beneficial impacts for odontocetes and pinnipeds are expected to result from the presence of structures, though these effects may be offset by increased interactions with fishing gear associated with the presence of structures.

In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives C, D, and E to the overall impacts on marine mammals would be similar to those of the Proposed Action and would range from undetectable to noticeable. BOEM anticipates the overall impacts of Alternatives C, D, and E when combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: **moderate** as the anticipated impact would be notable and measurable, but marine mammals are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken, except for the NARW. Impacts for NARWs would be **major** as population level impacts cannot be ruled out. The main drivers for this impact rating are impact pile-driving noise, vessel noise, the presence of structures, and vessel traffic.

3.5.6.8 Comparison of Alternatives

As discussed earlier, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Alternative D would result in slightly less effects on marine mammals due to the potential removal of up to 32 WTG and 1 OSS positions whereas Alternative E could result in the removal of up to 11 WTG positions. Alternative C would have minimal difference of impacts on marine mammals since this alternative includes Onshore Export Cable Routes that avoids Indian River Bay and the avoidance of sand burrow resource areas, respectively. Although the number of WTGs and their associated inter-array cables varies slightly for Alternatives D and E, the impacts to marine mammals from any action alternative would not differ from the Proposed Action. Therefore, construction and installation, O&M, and decommissioning of Alternatives C, D, and E would result in **negligible** to **moderate** impacts for mysticetes because impacts would be noticeable and measurable, but would not result in population-level effects, except for the NARW; **negligible** to **major** for the NARW because population-level effects may occur, primarily due to vessel traffic and entanglement risk associated with the presence of structures; and **negligible** to **moderate** for odontocetes and pinnipeds that could include **minor beneficial** impacts because impacts would be noticeable and measurable, but would not result in population-level effects. Adverse impacts are expected to result mainly from pile-driving noise, increased vessel traffic, and the presence of structures as related to fishing gear entanglement. Beneficial impacts for odontocetes and pinnipeds are expected to result from the presence of structures.

In the context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur under the same scenario (Appendix D). Therefore, impacts would only vary if the alternative's incremental contributions differ. BOEM expects individual impacts ranging from **negligible** to **moderate** for mysticetes because impacts would be noticeable and measurable, but would not result in population-level effects, except for the NARW. BOEM expects individual impacts ranging from **negligible** to **major** for the NARW because population-level effects may occur, primarily due to vessel traffic and entanglement risk associated with the presence of structures. BOEM further expects individual impacts ranging from **negligible** to **moderate** for odontocetes and pinnipeds and could include **minor beneficial** impacts because impacts would be noticeable and measurable but would not result in population-level effects. The overall impact of any action alternative on marine mammals when combined with past, present, and reasonably foreseeable activities would be **moderate** because the anticipated impact would be notable and measurable, but marine mammals are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken, except for the NARW, impacts would be **major** as population level impacts cannot be ruled out. The main drivers for this impact rating are impact pile-driving noise, vessel noise, the presence of structures, and vessel traffic. The action alternatives would contribute to the overall impact rating primarily through impact pile-driving noise, vessel traffic, and the presence of structures.

3.5.7 Sea Turtles

The reader is referred to Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts* for a discussion of current conditions and potential impacts on sea turtles from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.5.8 Wetlands and Other Waters of the United States

This section discusses potential impacts on wetlands and other waters of the U.S. from the Project, action alternatives, and ongoing and planned actions in the geographic analysis area. The wetlands geographic analysis area (Figure 3.5.8-1) includes all subwatersheds that intersect the Onshore Project area, which encompasses all wetlands and surface waters that are most likely to experience impacts from the Project. Under Section 404 of the CWA, the USACE considers fill impacts that permanently convert a wetland to an upland as a permanent impact. Conversion of a wetland type may also be considered a permanent impact. Temporary impacts occur when fill is placed in wetlands, but they are restored to preconstruction contours when construction activities are complete (e.g., stockpiling, temporary access). The limits of USACE jurisdiction in non-tidal waters (33 CFR 328.4) are as follows:

- In the absence of adjacent wetlands, the jurisdiction extends to the ordinary high-water mark; or when adjacent wetlands are present, the jurisdiction extends beyond the ordinary high-water mark to the limit of the adjacent wetlands.
- When the water of the U.S. consists only of wetlands, the jurisdiction extends to the limit of the wetland.

Section 3.4.2 (*Water Quality*) addresses impacts on tidal waters (other than tidal wetlands) from mean high water to the edge of the U.S. Exclusive Economic Zone.

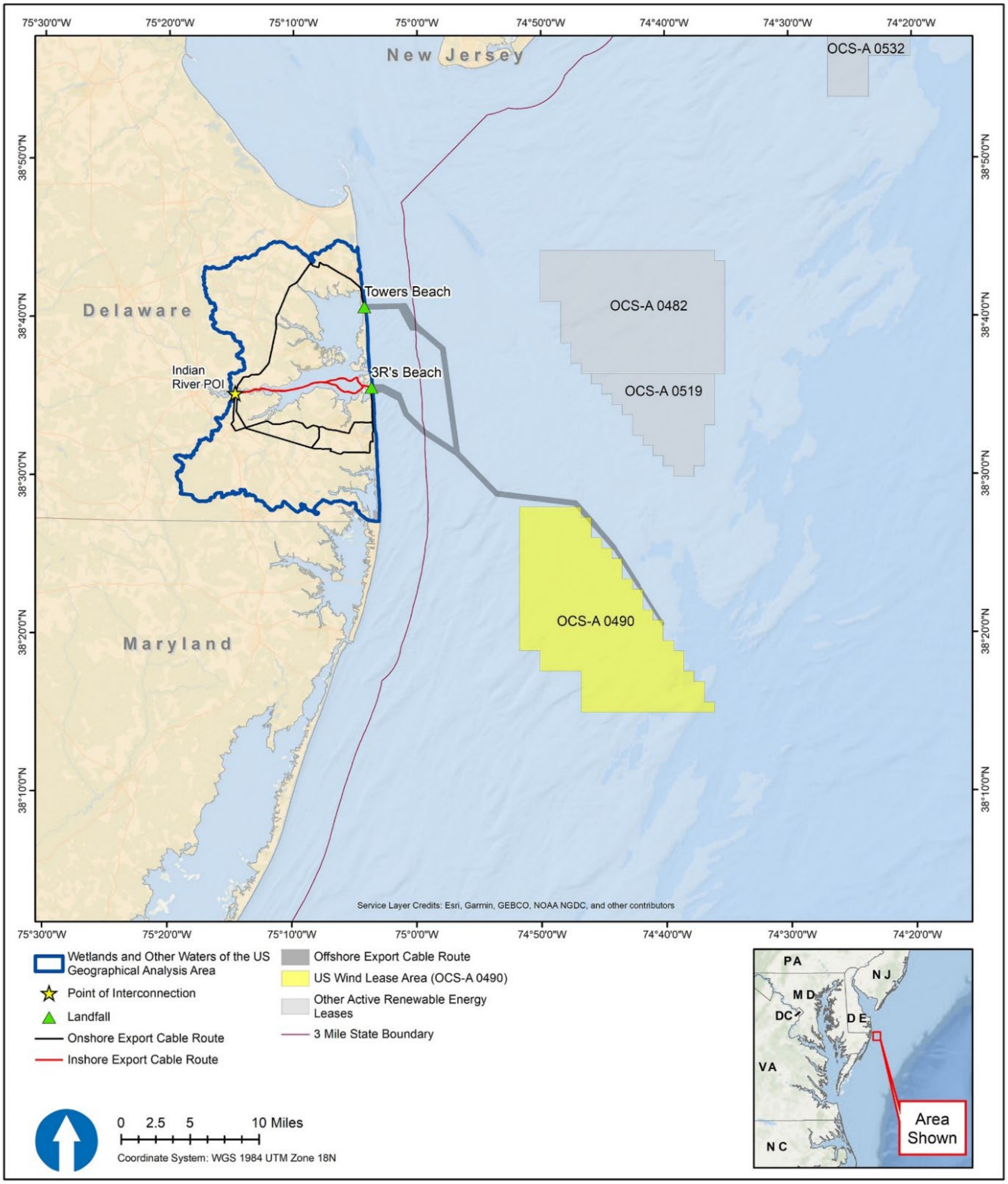


Figure 3.5.8-1. Wetlands and other waters of the United States geographic analysis area

3.5.8.1 Description of the Affected Environment and Future Baseline Conditions

The National Wetlands Inventory (NWI) wetland data were used to determine the potential presence of wetlands. Tidal wetlands are areas where the Atlantic Ocean and estuaries meet land, are found below the spring high tide line, and are subject to regular flooding by the tides. Tidal wetlands are typically categorized into two zones: high marsh and low marsh. The former occurs at a higher elevation, where it is subject to shorter tidal inundation, while the latter is flooded for extended periods during daily tidal cycles (COP, Volume II, Section 6.1.1.3; US Wind 2023). Non-tidal wetlands, otherwise referred to as freshwater wetlands, are not influenced directly by tides and are typically categorized based on their hydrology and predominant vegetation.

Wetlands are important features in the landscape that provide numerous beneficial services or functions. Some of these include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, providing aesthetic value, ensuring biological productivity, filtering pollutant loads, and maintaining surface water flow during dry periods. Most wetlands in the geographic analysis area are tidally influenced saline marshes, which provide shelter, food, and nursery grounds for coastal fisheries species including shrimp, crab, and many finfish. Saline marshes also protect shorelines from erosion by creating a buffer against wave action and by trapping soils. In flood-prone areas, saline marshes reduce the flow of flood waters and absorb rainwater. Tidal wetlands also serve as carbon sinks, holding carbon that would otherwise be released into the atmosphere and contribute to climate change. Other wetlands in the geographic analysis area include estuarine and marine deepwater (marine and estuarine subtidal unconsolidated bottom), freshwater emergent wetland (non-tidal freshwater marsh), and freshwater forested/scrub-shrub (non-tidal freshwater scrub-shrub wetland).

Table 3.5.8-1 provides information about the wetland communities within the geographic analysis area based on NWI data. Figure 3.5.8-2 shows wetlands near the onshore substation site. These are also included in the COP (Volume II, Appendix G1; US Wind 2023):

- a large emergent tidal wetland with a non-tidal wetland fringe along the border with the Indian River;
- an emergent forested non-tidal wetland north of the existing substation that may be of conservation concern; and
- an emergent scrub/shrub tidal wetland with a non-tidal wetland fringe to the west of the substation site.

Figure 3.5.8-3 shows wetlands near the 3R's Beach landfall site. These are also included in the COP (Volume II, Section 6.1; US Wind 2023):

- Tidal salt marsh along the eastern edge of Indian River Bay, across Delaware State Route (SR) 1 from the landfall site;
- A non-tidal freshwater scrub-shrub wetland between the tidal salt marsh and the western edge of SR 1; and
- A non-tidal freshwater marsh wetland immediately south of the 3R's Beach parking lot.

- Although not shown on Figure 3.5.8-2, according to correspondence from DNREC there is also an interdunal swale located directly north of the 3R's parking lot. The low-lying swales within the dune landforms in this area create wetland habitat in the depressions between sand dunes.

Other wetlands in the geographic analysis area are predominantly found along the shores and tributaries of Indian River Bay and the Indian River.

Table 3.5.8-1. Wetland communities in the geographic analysis area

Wetland Community	Area (acres)	Percent of Total
Non-tidal		
Freshwater emergent wetland	1,493.319	2.2%
Freshwater forested/scrub-shrub wetland	17,757.257	26.2%
Freshwater pond	1,469.136	2.2%
Riverine	1,073.327	1.6%
Lake	502.476	0.7%
Other	115.694	0.2%
Total Non-tidal	22,401.210	33.1%
Tidal		
Estuarine and marine wetland	20,126.306	29.7%
Estuarine marine subtidal unconsolidated bottom (deep water)	25,225.837	37.2%
Total Tidal	45,352.143	66.9%
Total Wetlands	67,753.353	100.0%

Source: USFWS 2022. National Wetland Inventory GIS data. Available: https://www.fws.gov/wetlands/Data/State-Downloads.html. Accessed: December 1, 2022.

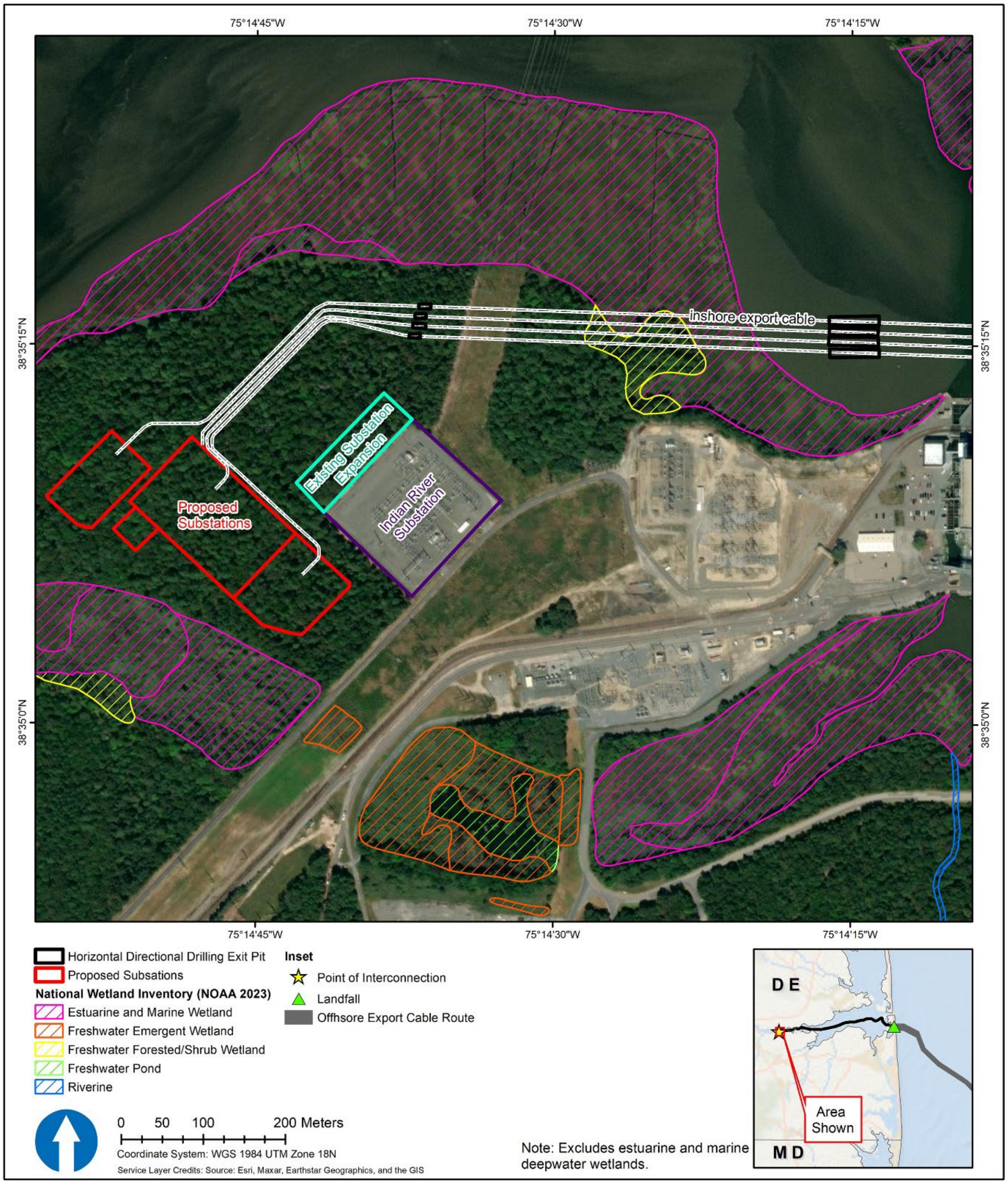


Figure 3.5.8-3. National Wetland Inventory wetlands and Proposed Action onshore substation site

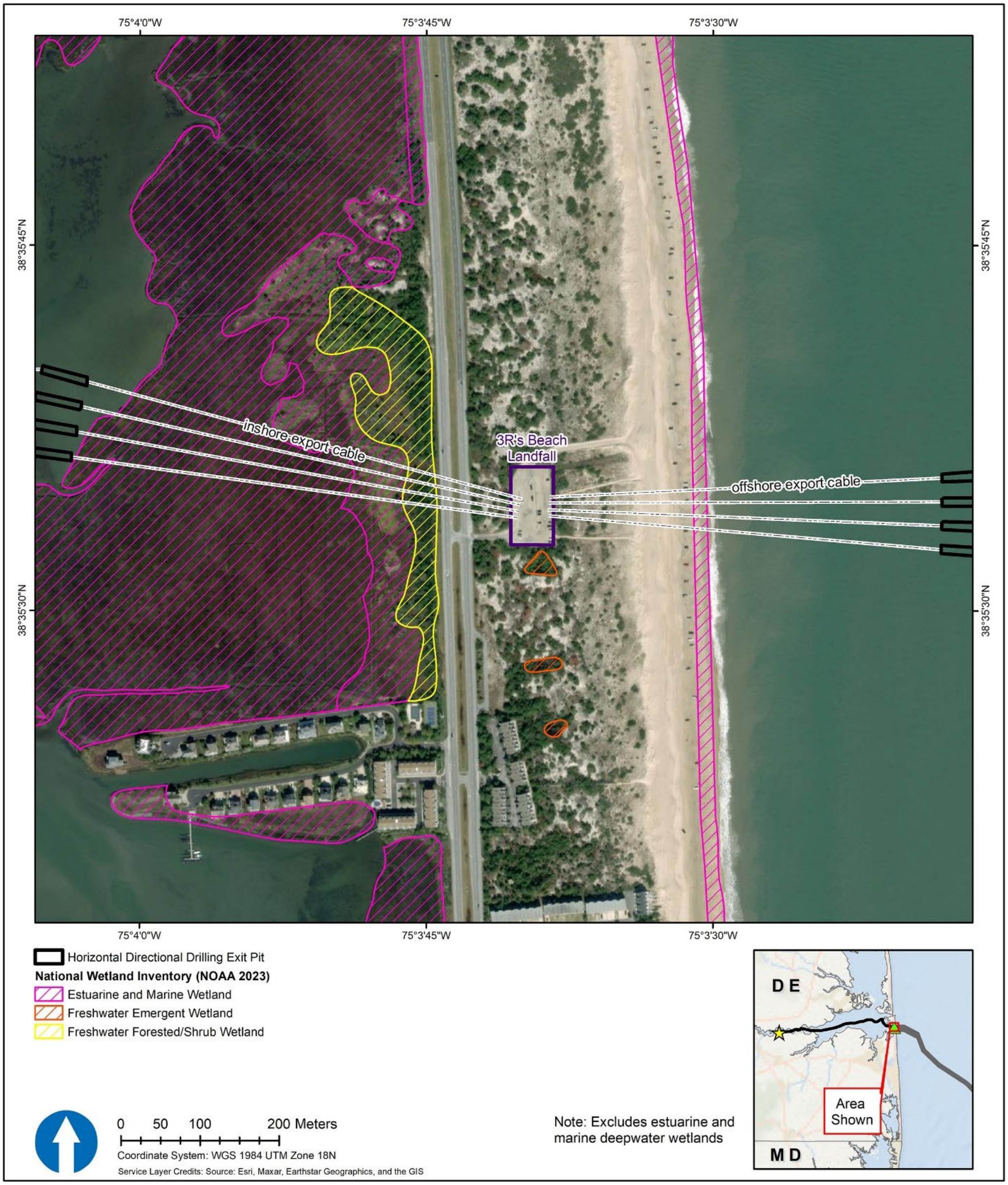


Figure 3.5.8-4. National Wetland Inventory wetlands and Proposed Action landfall site

3.5.8.2 Impact Level Definitions for Wetlands and Other Waters of the United States

Definitions of impact levels are provided in Table 3.5.8-2. Table F-10 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts to wetlands and other waters of the U.S.

Table 3.5.8-2. Impact level definitions for wetlands

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on wetlands would be so small as to be unmeasurable and impacts would not result in a detectable change in wetland quality and function.
Minor	Adverse	Impacts on wetlands would be minimized and would be relatively small and localized. If impacts occur, wetlands would completely recover.
Moderate	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be unavoidable. Compensatory mitigation required to offset impacts on wetland functions and values and would have a high probability of success.
Major	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be regionally detectable. Extensive compensatory mitigation required to offset impacts on wetland functions and values would have a marginal or unknown probability of success.

All disturbances from construction activities would be conducted in compliance with the approved Stormwater Pollution Prevention Plan (SWPPP) for the Project. Any work in wetlands would require a CWA Section 404 permit from the USACE; for unavoidable impacts, compensatory mitigation may be required to replace the loss of wetlands and associated functions. In addition, a project-specific application for Water Quality Certification from the State of Delaware will be required, as well as the appropriate wetlands and subaqueous lands permits and leases.

3.5.8.3 Impacts of Alternative A – No Action on Wetlands and Other Waters of the United States

When analyzing the impacts of the No Action Alternative on wetlands and waters of the U.S., BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, baseline conditions for wetlands and waters of the U.S. would continue to follow regional current trends and respond to IPFs introduced by other ongoing and planned actions. Ongoing activities within the geographic analysis area that contribute to impacts on wetlands and waters of the U.S. are generally associated with land disturbance (i.e., for construction of structures, roads, and other infrastructure), accidental releases of pollutants and debris from land or water sources such as vehicles and vessels, and climate change. Impacts from these activities increase sedimentation and contamination of wetlands and waters of the U.S. Planned non-offshore wind activities that may affect wetlands and waters of the U.S. in the geographic analysis area include additional land disturbance and dredging projects (Appendix D, Section D.2 contains a description of ongoing and planned actions).

3.5.8.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind activities to affect wetlands and waters of the U.S. through the following primary IPFs.

Accidental releases: During onshore construction of offshore wind projects in the geographic analysis area, oil leaks and accidental spills from construction equipment are potential sources of wetland water contamination. While many wetlands act to filter out contaminants, any significant increase in contaminant loading could exceed the capacity of a wetland to perform its normal water quality functions. Although degradation of water quality in wetlands could occur during construction, decommissioning, and, to a lesser extent, O&M, due to the small volumes of spilled material anticipated these impacts would all be short term until the source of the contamination is removed. Compliance with applicable state and federal regulations related to oil spills and waste handling would minimize potential impacts from accidental releases. These include the Resource Conservation and Recovery Act, U.S. Department of Transportation (USDOT) Hazardous Material regulations, and implementation of an SPCC Plan for each project. Impacts from accidental releases on wetlands would be minor because accidental releases would be small and localized, and compliance with state and federal regulations would avoid or minimize potential impacts on wetland quality or functions.

Cable emplacement and maintenance: To the degree that Onshore Export Cable Routes for other offshore wind projects are installed in the geographic analysis area, construction would require clearing, excavating, trenching, fill, and grading, which could result in the loss or alteration of wetlands, causing adverse effects on wetland habitat, water quality, and flood and storage capacity functions. Fill material permanently placed in wetlands during construction would result in the permanent loss of wetlands, including any habitat, flood and storage capacity, and water quality functions that the wetlands may provide. If a wetland were partially filled and fragmented or if wetland vegetation were trimmed, cleared, or converted to a different vegetation type (e.g., forest to herbaceous), habitat would be altered and degraded (affecting wildlife use) and water quality and flood and storage capacity functions would be reduced by changing natural hydrologic flows and reducing the wetland’s ability to impede and retain stormwater and floodwater.

On a watershed level, any permanent wetland loss or alteration could reduce the capacity of regional wetlands to provide wetland functions. Short-term wetland impacts may occur from construction activity that crosses or is adjacent to wetlands, such as rutting, compaction, and mixing of topsoil and subsoil. Where construction leads to unvegetated or otherwise unstable soils, precipitation events could erode soils, resulting in sedimentation that could affect water quality in nearby wetlands, as well as alter wetland functions if sediment loads are high (e.g., adverse habitat impacts from burying vegetation). The extent of wetland impacts would depend on specific construction activities and their proximity to wetlands. These impacts would occur primarily during construction and decommissioning; impacts during O&M would only occur if new ground disturbance was required, such as to repair a buried component. BOEM anticipates Onshore Export Cable Routes from other offshore wind projects would likely be sited in along existing roadways or utility ROWs, which would avoid and minimize wetland impacts. In addition, BOEM expects the offshore wind projects would be designed to avoid wetlands to the extent feasible, including through the use of trenchless cable installation methods such as HDD to avoid and minimize impacts. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Impacts from cable emplacement and maintenance on wetlands would be minor because wetland impacts are anticipated to be short term and would not require compensatory mitigation.

Land disturbance: The wetland impact types and mechanisms associated with land disturbance for onshore substations would be similar to those described for the cable emplacement and maintenance IPF, and impacts on wetland functions (i.e., water quality, habitat, and hydrology) would be similar. Land disturbance would be unlikely to cause permanent wetland impacts because it would be unlikely that a substation or other permanent facility would be constructed in tidal wetlands. Affected wetlands would be restored to pre-existing conditions per permitting requirements. BOEM also anticipates the offshore wind projects would be designed to avoid wetlands (including tidal wetlands) to the extent feasible. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Impacts from land disturbance on wetlands would be moderate because permanent wetland impacts would likely occur and compensatory mitigation would be required.

3.5.8.3.2 Conclusions

Under the No Action Alternative, wetlands would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned actions. Land disturbance from onshore construction periodically would cause short-term and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided or minimized, mitigation would be anticipated for projects to compensate for lost wetlands. Ongoing activities, especially land disturbance, would likely result in **moderate** impacts on wetlands. Planned actions other than offshore wind may also contribute to **moderate** impacts on wetlands, due to the potential for activities that could result in permanent wetland impacts that require compensatory mitigation. BOEM expects the combination of ongoing activities and planned actions other than offshore wind to result in **moderate** impacts on wetlands, primarily driven by land disturbance.

Other offshore wind activities could cause impacts that would be similar to the impacts of the Project. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands, thereby avoiding or minimizing impacts. If impacts would not be entirely avoided, compensatory mitigation would be anticipated for projects that result in permanent impacts, resulting in overall **moderate** impacts.

Under the No Action Alternative, existing environmental trends and activities would continue, and wetlands would continue to be affected by natural and human caused IPFs. The No Action Alternative would result in **moderate** impacts on wetlands. Considering the IPFs and regulatory requirements for avoiding, minimizing, and mitigating impacts on wetlands, BOEM anticipates the No Action Alternative combined with all planned actions (including other offshore wind activities) would result in **moderate** impacts, primarily through land disturbance. Offshore wind activities are expected to contribute to the impacts through land disturbance, accidental releases, and cable emplacement and maintenance, although most of these IPFs would be attributable to ongoing activities.

3.5.8.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in similar or lesser impacts than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenarios*) would influence the magnitude of the impacts on wetlands:

- The Inshore and Onshore export cable routing variants within the Onshore Project area

An Onshore Export Cable Route with less wetlands within or adjacent to the ROW would have less potential for direct and indirect impacts on wetlands.

The US Wind has committed to measures to minimize impacts on wetland resources, as described in Appendix G, Table G-1. These measures include use of HDD at the landfall site, establishment of buffers around wetland areas and preparation and enforcement of a Project-specific SPCC Plan and SWPPP.

3.5.8.5 Impacts of Alternative B – Proposed Action on Wetlands and Other Waters of the United States

BOEM expects the proposed offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs. The land disturbance IPF discusses impacts on freshwater/non-tidal wetlands landward of the mean high water line. The cable emplacement and maintenance IPF discusses impacts on tidally influenced wetlands below the mean high water line.

As discussed in Section 3.5.8.1, the evaluation of wetlands and other waters of the U.S. focuses on tidal and non-tidal wetlands. For simplicity of analysis, these are considered “onshore” resources. The IPFs related to wetlands are therefore discussed as Onshore Activities and Facilities. Open waters other than tidal wetlands are discussed in Section 3.5.2, *Benthic Resources*, and are considered offshore activities and facilities.

3.5.8.5.1 Construction and Installation

Accidental releases: Onshore construction activities would require heavy equipment use and HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. Frac-outs also have the potential to occur during HDD activities. A drilling fluid fracture contingency plan will be in place prior to the start of HDD activities. The US Wind would enforce its Project-specific SPCC Plan and SWPPP to minimize impacts on wetlands. In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and USDOT Hazardous Material regulations. Therefore, the Proposed Action would result in minor and temporary impacts on wetlands as a result of releases from heavy equipment during onshore construction.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined accidental release impacts on wetlands from ongoing and planned activities including offshore wind. Impacts would likely be short term and minor due to the low risk and localized nature of the most likely spills, the use of SPCC Plans and SWPPPs for projects, and regulatory requirements for the protection of wetlands.

Cable emplacement and maintenance: Offshore export cable transition would occur at proposed 3R's Beach landfall site. When the offshore cables reach the landfall, they will be installed via HDD, which would avoid disturbance of tidal areas. Construction at the landfall site could affect wetlands through sedimentation or other runoff from the work site (i.e., the 3R's Beach parking lot).

The Bethany Beach firefly (*Photuris bethaniensis*) is on Delaware's Endangered Species List and is restricted to the interdunal wetlands along Atlantic Ocean beaches near Bethany. There is a strong habitat association between the Bethany Beach firefly and the rare interdunal swale wetland habitat found along oceanfront beaches (DEDFW 2015). By avoiding direct alteration of interdunal swale wetlands effect on critical habitat for Bethany Beach firefly would be minimized.

In addition to the proposed Inshore Export Cable Route will traverse Indian River Bay. Similar to the landfall transition the inshore export cable installed between 3R's Beach landfall and Indian River Bay (Old Basin Cove) and between Indian River (Deep Hole) the Indian River substation will in Indian River) will be installed using HDD thus avoiding impacts to estuarine and freshwater wetlands bordering the Indian River. Implementation of US Wind's Project-specific SPCC Plan, SWPPP, and other sediment control measures and BMPs (Appendix G, Table G-1), cable emplacement and maintenance from Proposed Action construction would have short-term, negligible impacts on wetlands.

Impacts to non-tidal wetlands will be minimized to the extent practicable and temporary in nature. Buffers will be established and maintained, and BMP's will be used to minimize impact.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal incremental impact on the cable emplacement and maintenance impacts from ongoing and planned activities including offshore wind. Impacts of the Proposed Action and other ongoing or planned activities from cable emplacement and maintenance would be long-term, localized, and negligible.

Land disturbance: Impacts on wetlands and related functions from construction of the Proposed Action's onshore substation would be similar to those described in Section 3.5.8.3. Substation construction would result in vegetation clearing, excavation, rutting, compaction, and mixing of topsoil and subsoil. The Inshore Export Cable Route between the Indian River and the substation site would be accomplished via HDD (COP, Volume I, Section 2.6.2; US Wind 2023) and thus would not affect wetlands (except in the case of accidental release of HDD materials). The construction associated with the substation expansion, proposed substations, temporary workspace and access roads adjacent to the Indian River Power Plant would avoid alternation to adjacent estuarine and freshwater wetlands.

Use of HDD for the export cable landfall would avoid permanent impacts on wetlands near the 3R's Beach parking lot landfall site.

Wetlands adjacent to the substation site, HDD sites, and other workspaces may also be affected by sedimentation from nearby exposed soils. US Wind would use erosion and sedimentation controls and BMPs and would develop and implement a Project-specific SWPPP to avoid and minimize impacts during onshore construction (Appendix G, Table G-1).

In summary, Proposed Action construction would have localized, minor impacts on wetlands. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal increment to the land disturbance impacts from ongoing and planned actions including offshore wind. Impacts due to onshore land use changes are expected to include a gradually increasing amount of wetland alteration and loss. Based on regional trends, land disturbance due to onshore residential, nonresidential, and infrastructure development other than offshore wind is anticipated to be substantially greater than that of the Proposed Action (Section 3.6.5, *Land Use and Coastal Infrastructure*). Impacts on land use and coastal infrastructure would be additive only if onshore structures (e.g., substations) associated with one or more other projects occurs in close spatial and temporal proximity. Impacts of the Proposed Action and other ongoing or planned actions from land disturbance would be long-term, localized, and moderate.

3.5.8.5.2 Operations and Maintenance

Accidental releases: Onshore O&M activities would require periodic maintenance at the onshore substation site, landfall site, and along the Inshore Export Cable Route. Use of heavy equipment during these activities could result in potential spills. The impacts of these spills would be similar to those described for this IPF in Construction and Installation. Therefore, the Proposed Action would result in negligible and temporary impacts on wetlands as a result of releases from heavy equipment during onshore O&M. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined accidental release impacts on wetlands from ongoing and planned actions including offshore wind. Impacts would likely be short term and negligible.

Cable emplacement and maintenance: Onshore O&M activities would require periodic maintenance of the Inshore Export Cable Route. These activities could impact wetlands through sedimentation or other runoff from work sites. With continued implementation of US Wind's Project-specific SPCC Plan, SWPPP, and other sediment control measures and BMPs (Appendix G, Table G-1), cable emplacement and maintenance from Proposed Action O&M would have short-term, negligible impacts on wetlands. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal increment to the cable emplacement and maintenance impacts from ongoing and planned actions including offshore wind. Impacts of the Proposed Action and other ongoing or planned actions from cable emplacement and maintenance during O&M would be long-term, localized, and negligible.

3.5.8.5.3 Conceptual Decommissioning

The impacts of onshore and Offshore Project decommissioning on wetlands and waters of the U.S. would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Impacts from cable removal could be negligible to minor if some offshore or inshore export cables are retired in place rather than removed.

3.5.8.5.4 Conclusions

The Proposed Action may affect wetlands through short-term or temporary disturbance from activities within or adjacent to these resources. These impacts would be minimized to the extent practicable and temporary in nature. HDD, buffers, and BMP's will be used to minimize impacts to wetlands. Considering the avoidance, minimization, and mitigation measures required under federal and state statutes (e.g., CWA Section 404), construction of the Proposed Action would likely have **minor** impacts on wetlands, due to the potential need for compensatory mitigation resulting from temporary wetland impacts.

In the context of other reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal increment to the overall impacts on wetlands from ongoing and planned actions, including offshore wind. BOEM anticipates the overall impacts associated with the Proposed Action when combined with the impacts on wetlands from ongoing and planned actions including offshore wind would likely be **moderate**. The Proposed Action would contribute to the overall impact rating primarily through temporary impacts on wetlands from onshore land disturbance that requires compensatory mitigation.

3.5.8.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Wetlands and Other Waters of the United States

Alternative C-1 would use the Towers Beach landfall instead of the 3R's Beach landfall, and a terrestrial-based Onshore Export Cable Route (route 2) from the Towers Beach landfall to the Indian River substation (Figure 2-6 in Section 2.1.3, *Alternative C – Landfall and Onshore Export Cable Routes Alternative*). The substation site is located in a previously developed area. US Wind would install the Towers Beach landfall using HDD. Alternative C-2 would use the same 3R's Beach landfall and Indian River substation site as Alternative B but would select from three different terrestrial-based Onshore Export Cable Routes (routes 1a, 1b, or 1c) to reach the substation site (Figure 2-7). Table 3.5.8-3 summarizes wetland impacts of each Onshore Export Cable Route under Alternatives C-1 and C-2.

While the extent of impacts under each Onshore Export Cable Route would differ, the types of impacts would be the same as described for Alternative B. Alternatives C-1 and C-2 would avoid impacts on wetlands within and adjacent to Indian River Bay and the Indian River, but would have additional wetland impacts along each Onshore Export Cable Route (Figure 3.5.8-4 and Figure 3.5.8-5). Impacts on wetlands were calculated by assuming a maximum worst-case scenario of a 50-foot (15.2-meter) construction corridor centered on the route alignment. Total impacts would be less than described below.

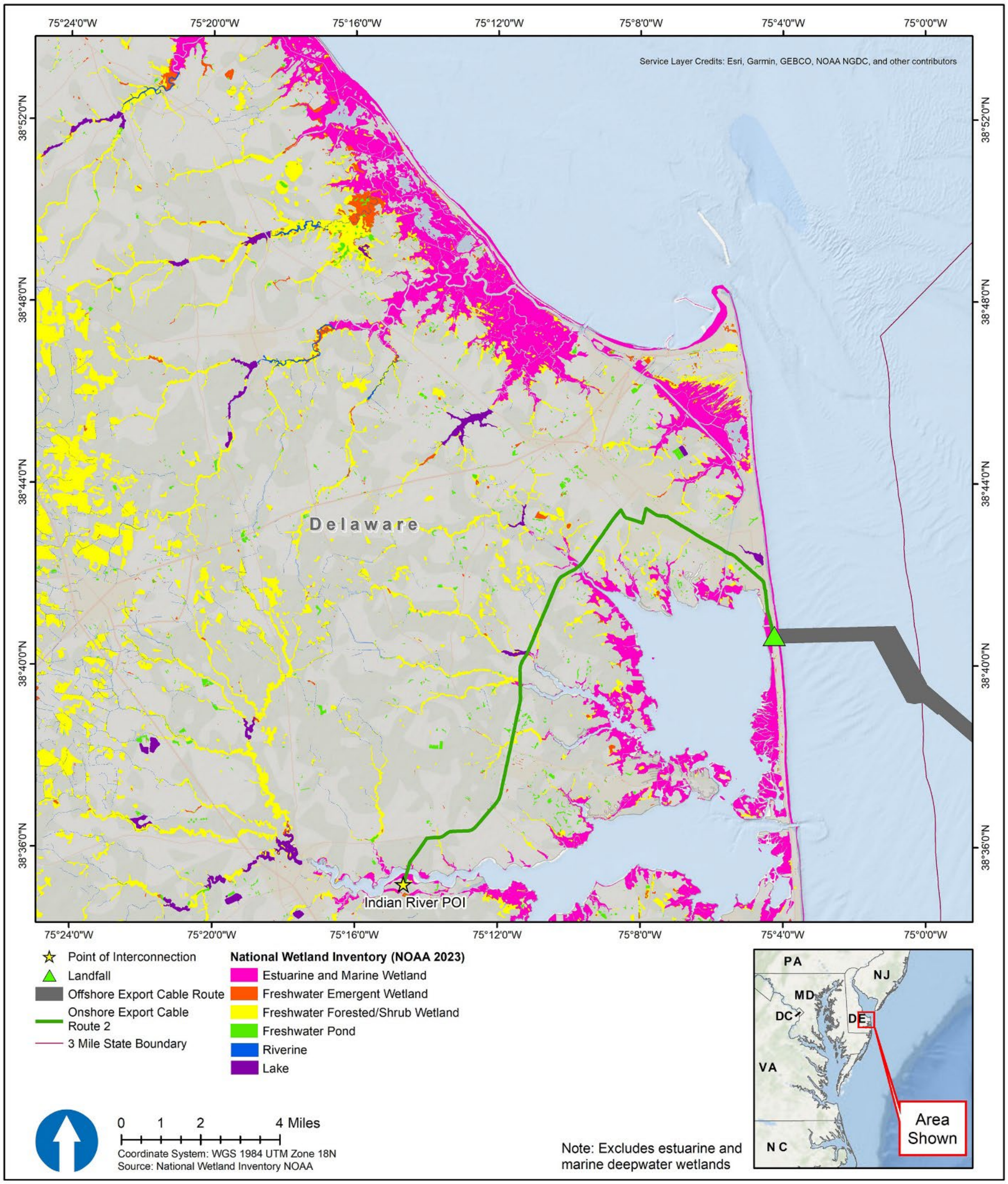


Figure 3.5.8-5. National wetland inventory wetlands along the Onshore Export Cable Routes associated with Alternative C-1

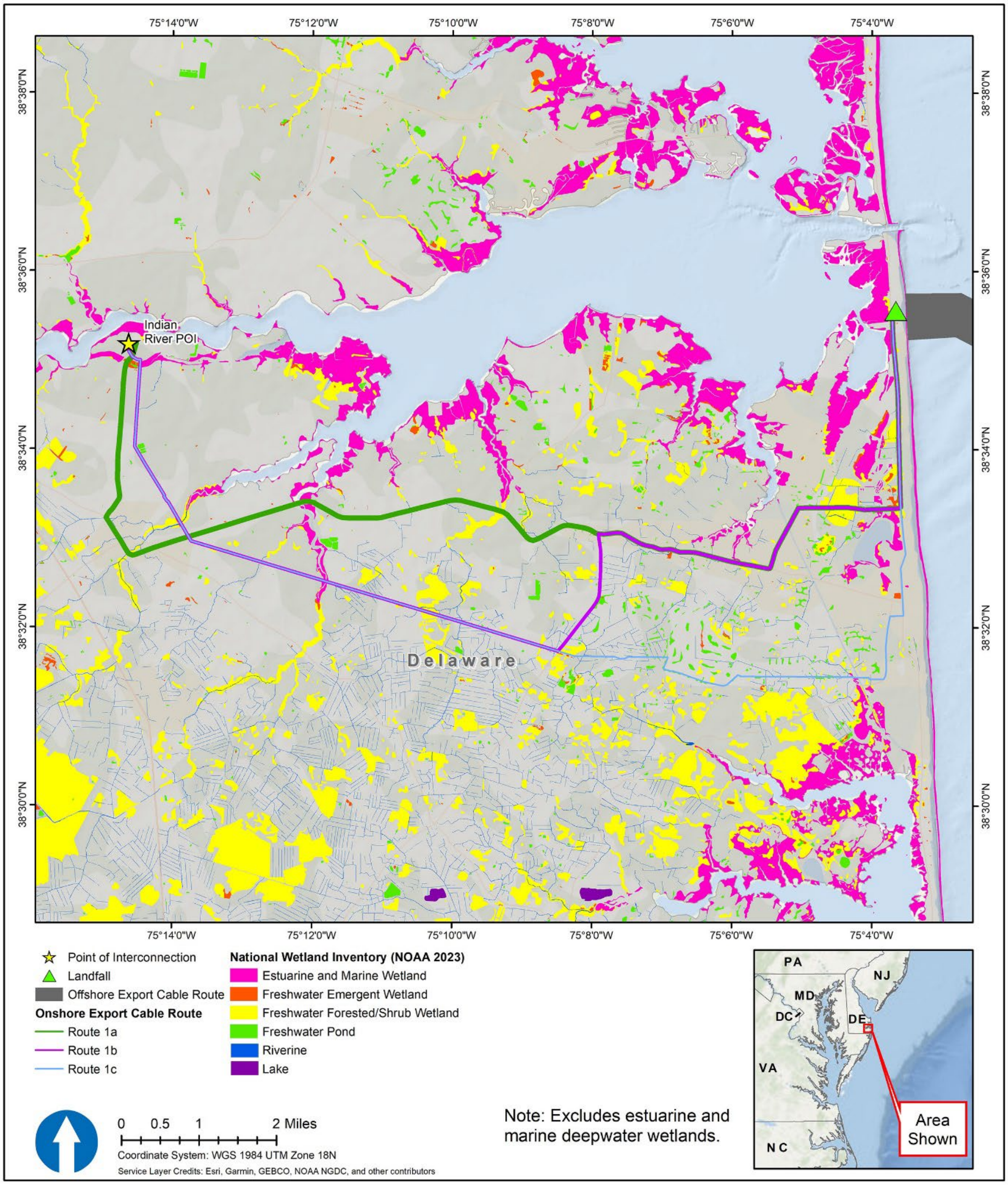


Figure 3.5.8-6. National wetland inventory wetlands along the Onshore Export Cable Routes associated with Alternative C-2

Table 3.5.8-3. Wetland impacts (acres) from Alternatives C-1 and C-2 Onshore Export Cable Routes

Wetland Community	Alternative C-1 Onshore Export Cable Route	Alternative C-2 Onshore Export Cable Route		
	2	1a	1b	1c
Non-tidal				
Freshwater emergent wetland	0.0	0.0	0.260	0.342
Freshwater forested/scrub-shrub wetland	0.082	0.138	1.846	2.468
Riverine	0.108	0.200	0.693	1.084
Lake	0.0	0.0	0.0	0.0
Freshwater pond	0.0	0.0	0.0	2.528
Total non-tidal wetlands	0.190	0.338	2.799	6.422
Tidal				
Emergent scrub-shrub tidal wetland	1.715	0.291	0.542	0.816
Total tidal wetlands	3.007	0.739	0.903	1.005
Total wetlands	3.197	1.077	3.702	7.427

3.5.8.6.1 Conclusions

Based on the acres of impacted wetlands in Tables 3.5.8-3, while Alternatives C-1 and C-2 would have marginally different impacts, they would have the same impact rating as Alternative B: **minor**. In the context of reasonably foreseeable environmental trends and planned actions, Alternatives C-1 and C-2 would occur under the same scenario (Appendix D) as Alternative B. As a result, the overall impact of Alternatives C-1 and C-2 on wetlands when combined with past, present, and reasonably foreseeable activities would therefore be **moderate**.

3.5.8.7 Impacts of Alternatives D and E on Wetlands and Other Waters of the United States

Alternatives D and E would not impact any onshore component of the Proposed Action; therefore, the impacts associated with the Proposed Action (as described in Section 3.5.8.5) would not change under Alternatives D and E.

3.5.8.7.1 Conclusions

Alternatives D and E would have the same impact rating as Alternative B: **minor**. In the context of reasonably foreseeable environmental trends and planned actions, Alternatives D and E would occur under the same scenario (Appendix D) as Alternative B. The overall impact of Alternatives D and E on wetlands and waters of the U.S. when combined with past, present, and reasonably foreseeable activities would therefore be **moderate**.

3.5.8.8 Comparison of Alternatives

As described in Section 3.5.8.5, the impacts of the Proposed Action in combination with ongoing and planned actions would likely be similar to the impacts expected under the No Action Alternative. The Proposed Action would impact wetlands and waters of the U.S. primarily through land disturbance. Under the No Action Alternative, these impacts would not occur.

As stated in Section 3.5.8.6, compared to Alternative B, Alternatives C-1 and C-2 would have incrementally different impacts on wetlands (**moderate**), while Alternatives D and E would have the same impacts as the Proposed Action (**minor**). In the context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternatives on wetlands and waters of the U.S. when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **moderate**.

If BOEM requires the mitigation measures beyond the design features described in Section 3.5.8.4, then adverse Project impacts on wetlands and waters of the U.S. could be further reduced; however, overall impact ratings would remain the same as described in this section.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.1 Commercial Fisheries and For-Hire Recreational Fishing

This section discusses potential impacts on commercial fisheries and for-hire recreational fishing from the Project, action alternatives, and ongoing and planned activities in the commercial fisheries and for--hire recreational fishing geographic analysis area. The commercial fisheries and for-hire recreational fishing geographic analysis area (Figure 3.6.1-1) includes the waters managed by the New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC), HMS, and Atlantic States Marine Fisheries Commission (ASMFC) for federal fisheries within the U.S. Exclusive Economic Zone (from 3 to 200 nautical miles [5.6 to 370.4 kilometers] from the coastline, plus the state waters (out to 3 nautical miles [5.6 kilometers] from the coastline) of North Carolina to Maine. The boundaries for the geographic analysis area were developed to consider impacts on federally permitted vessels operating in all fisheries in state and U.S. Exclusive Economic Zone waters surrounding the Project, vessels from the Project area that may transit to fishing grounds in other Atlantic regions, as well as potential impacts on federally managed species of commercial importance that have ranges which overlap with the Project area.

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

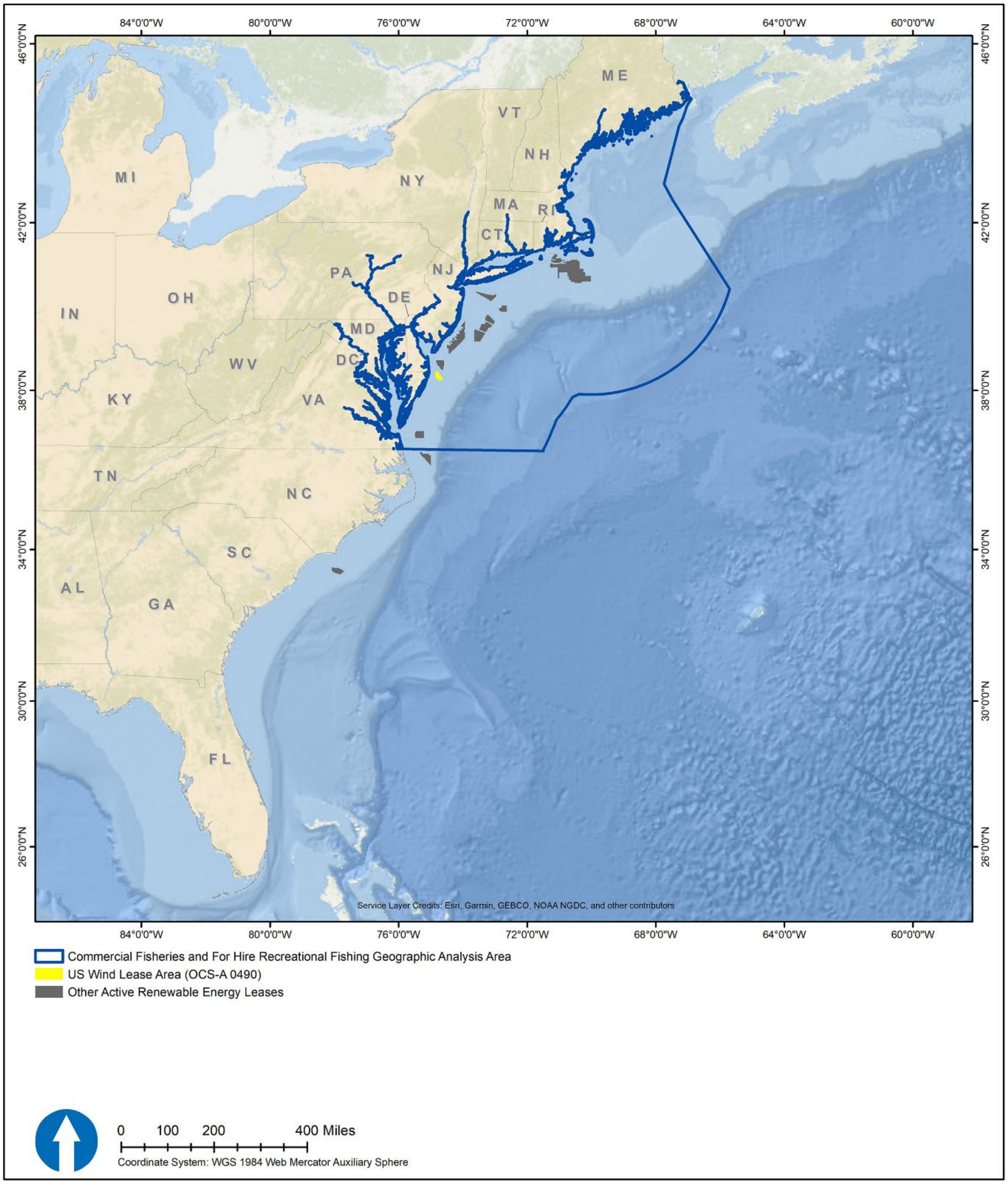


Figure 3.6.1-1. Commercial fisheries and for-hire recreational fishing geographic analysis area

3.6.1.1 Description of the Affected Environment and Future Baseline Conditions

3.6.1.1.1 Commercial Fisheries

This section provides an overview of commercial fisheries management and the economic value of fisheries in the region and Project area. The primary source for regional fisheries data (Mid-Atlantic and New England regions) was commercial fisheries landings data (landings and revenue) provided by NMFS (2021a), which is based on Vessel Trip Report data drawn from commercial fisheries data dealer reports. The primary source of fisheries data within the Lease Area was the Project's Fisheries Assessment Report (COP, Volume II, Appendix F2; US Wind 2023) and NMFS's *Socioeconomic Impacts of Atlantic Offshore Wind Development* website (NMFS 2021b), which summarizes commercial fisheries data for each proposed WEA along the U.S. Atlantic coast.

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

3.6.1.1.1.1 Regional Setting

Commercial fisheries in the geographic analysis area are managed at the federal, state, and regional level. At the federal level, there are three councils designated by the Magnuson Fishery Conservation and Management Act of 1976 (later renamed the Magnuson-Stevens Fishery Conservation and Management Act): the NEFMC for Connecticut, Massachusetts, Maine, New Hampshire, and Rhode Island; the MAFMC for Delaware, Maryland, New Jersey, New York, Pennsylvania. Species managed at the federal level include Atlantic salmon (*Salmo salar*), groundfish (flounders, Atlantic cod [*Gadus morhua*], white hake [*Urophycis tenuis*], haddock [*Melanogrammus aeglefinus*], Atlantic pollock [*Pollachius virens*], Acadian redfish [*Sebastes fasciatus*], Atlantic halibut [*Hippoglossus hippoglossus*], Atlantic wolffish [*Anarhichas lupus*], and ocean pout [*Zoarces americanus*]), sea scallop (*Placopecten magellanicus*), skates (Rajidae), herring (*Clupea harengus*), whiting (*Merlangius merlangus*), and red crab (*Chaceon quinquedens*) by the NEFMC; summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), black seabass (*Centropristis striata*), mackerel (Scombridae), squid (*Illex* sp.), butterfish (*Peprilus triacanthus*), bluefish (*Pomatomus saltatrix*), surfclam (*Spisula solidissima*), ocean quahog (*Arctica islandica*), and tilefish (Malacanthidae) by the MAFMC. The NEFMC and MAFMC jointly manage monkfish (*Lophius americanus*) and spiny dogfish (*Squalus acanthias*). At the regional level, the ASMFC manages American lobster (*Homarus americanus*), Jonah crab (*Cancer borealis*), black drum (*Pogonias cromis*), red drum (*Sciaenops ocellatus*), tautog (*Tautoga onitis*), and weakfish (*Cynoscion regalis*). Black sea bass, spiny dogfish, scup, and summer flounder are managed at both the federal and regional level.

Commercial fisheries species managed in state waters include the American eel (*Anguilla rostrata*), Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*), American shad (*Alosa sapidissima*) and river herring (Alosa *pseudoharengus*), red drum (*Sciaenops ocellatus*), horseshoe crab (*Limulus polyphemus*), and northern shrimp (*Pandalus borealis*).

NOAA has management authority for certain tunas (Thunnini), sharks (Selachimorpha), swordfish (*Xiphias gladius*), and billfish (Istiophoridae) (Table 3.6.1-1).

Within the Maryland and Delaware state waters of the Lease Area, commercial and recreational fisheries are further managed by state regulatory agencies under various ocean management plans developed at the state level or at the regional level (MAFMC). Each coastal state has its own structure of agencies and plans that govern fisheries resources. In Maryland, the Maryland Department of Natural Resources Fishing and Boating Services is responsible for managing commercial and recreational fishing which include estuarine and migratory fish stocks. In Delaware, the DNREC Fisheries section is responsible for managing commercial and recreational fishing. Both state agencies are responsible for the development and enforcement of state and federal regulations pertaining to marine fish and fisheries, and also coordinate with the ASMFC and the MAMFC to ensure proper management of migratory species and other coastal resources.

Table 3.6.1-1 presents a summary of the managed species and associated agencies within the Geographic Analysis Area.

Table 3.6.1-1. Managed species and associated managing agency within the geographic analysis area

Managed Species	HMS	Regional/ State Waters	Managing Agency	
			NEFMC	MAFMC
Acadian redfish (*Sebastes fasciatus*)			X	
American lobster (*Homarus americanus*)		X		
Atlantic halibut (*Hippoglossus hippoglossus*)			X	
Atlantic mackerel (*Scomber scombrus*)				X
Atlantic pollock (*Pollachius virens*)			X	
Atlantic salmon (*Salmo salar)*			X	
Atlantic wolffish (*Anarhichas lupus*)			X	
Billfish (Istiophoridae)*	X			
Black drum (*Pogonias cromis*)		X		
Black seabass (*Centropristis striata*)				X
Blue crab (*Callinectes sapidus*)		X		
Bluefish (*Pomatomus saltatrix*)				X
Butterfish (*Peprilus triacanthus*)				X
Cobia (*Rachycentron canadum*)				
Dolphinfish (*Coryphaena hippurus*)				
Groundfish (flounders, Atlantic cod [*Gadus morhua*])			X	

Managed Species	HMS	Regional/ State Waters	Managing Agency	
			NEFMC	MAFMC
Haddock (*Melanogrammus aeglefinus*)			X	
Herring (*Clupea harengus*)			X	
Longfin squid (*Doryteuthis pealeii*)				X
Monkfish (*Lophius americanus*)				X
Ocean pout (*Zoarces americanus*)			X	
Ocean quahog (*Arctica islandica*)				X
Red crab (*Chaceon quinquedens*)			X	
Red drum (*Sciaenops ocellatus*)		X		
Scup (*Stenotomus chrysops*)				X
Sea scallop (*Placopecten magellanicus*)			X	
Sharks (Selachimorpha)*	X			
Shortfin squid (*Illex* sp.)				X
Skates (Rajidae)			X	
Spiny dogfish (*Squalus acanth*ias)			X	X
Summer flounder (P*aralichthys dentat*us)				X
Surfclam (*Spisula solidissima*)				X
Swordfish (*Xiphias gladius*)*	X			
Tautog (*Tautoga onitis*)		X		
Tilefish (Malacanthidae)			X	
Tunas (Thunnini)*	X			
Wahoo (*Acanthocybium solandri*)				
Weakfish (*Cynoscion regalis*)		X		
White hake (*Urophycis tenuis*)			X	
Whiting (*Merlangius merlangus*)			X	

HMS = Office of Highly Migratory Species; MAFMC = Mid-Atlantic Fishery Management Council; NEFMC = New England Fishery Management Council

*NOAA has management authority for certain tunas (Thunnini), sharks (Selachimorpha), swordfish (*Xiphias gladius*), and billfish (Istiophoridae).

Within the Maryland state waters of the Lease Area, commercial and recreational fisheries are further managed by state regulatory agencies under various ocean management plans developed at the state level or at the regional level. Each coastal state has its own structure of agencies and plans that govern fisheries resources. In Maryland, the Department of Natural Resources' Fisheries Service is responsible for regulating commercial and recreational fishing within Maryland state waters.

Regional Fisheries Economic Value and Landings

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

Commercial fishing fleets contribute to the overall economy in the region through direct employment, income, and gross revenues, as well as through products and services to maintain and operate vessels, seafood processors, wholesalers/distributors, and retailers. In 2021, four ports in the geographic analysis area ranked in the top 20 U.S. ports for commercial landings by weight (Reedville, Virginia; New Bedford, Massachusetts; Cape May-Wildwood, New Jersey; and Gloucester, Massachusetts), and five ports ranked in the top 20 U.S. ports in commercial landings value (New Bedford, Massachusetts; Cape May-Wildwood, New Jersey; Gloucester, Massachusetts; Stonington, Maine, and Point Judith, Rhode Island in 2021 (NMFS 2021c).

The value of commercial landings in the geographic analysis area (New England and Mid-Atlantic NMFS regions) has been generally increasing since 2000, reaching a revenue of $2.45 billion in 2021 (NMFS 2021a). Commercial landings in the Mid-Atlantic are dominated by menhaden, a high-volume, low value fishery that typically accounts for 50 to 65 percent of the region's landings by weight, but less than 10 percent by value. An analysis of the landings of economically important species in the Mid-Atlantic other than menhaden showed a marked decline in landed weight, but an increase in ex-vessel landed value between 2002 and 2015 (King 2017).

Table 3.6.1-2 shows commercial fishing landings and revenue by state for the New England and Mid-Atlantic regions for 2012 to 2021 which were derived from NMFS (2021a). While most of the revenue is derived from areas outside of the Lease Area, it is important to note that the geographic analysis area does include the entire area under the jurisdiction of the NEFMC and MAFMC.
Table 3.6.1-3 shows commercial fishing landings and revenue for the top 10 species by landings for the states in the geographic analysis area for 2021. American lobster and sea scallops were the largest sources of revenue, with 2021 revenues of approximately $925 million and $671 million, respectively, while menhadens had the highest landings (188,252 metric tons) (Table 3.6.1-3).

Table 3.6.1-2. Commercial fishing landings and revenues for states in the geographic analysis area between 2012 and 2021

State	Peak Annual Landings (metric tons)	Average Annual Landings (metric tons)	Peak Annual Revenue ($1,000s)	Average Annual Revenue ($1,000s)
Maine	131,498	107,420	$894,882	$626,562
New Hampshire	5,999	4,844	$48,669	$32,161
Massachusetts	133,834	112,721	$839,293	$610,599
Rhode Island	41,632	36,987	$109,879	$93,532
Connecticut	5,510	4,186	$21,128	$16,324
New York	16,678	12,517	$69,171	$49,840
New Jersey	89,626	72,734	$223,698	$177,101
Pennsylvania	47	26	$251	$164
Delaware	2,719	2,270	$16,294	$9,996
Maryland	35,047	22,679	$92,262	$80,631
Virginia	209,766	170,966	$222,030	$190,000

Source: Developed using data from NMFS (2021a). Data current as of November 15, 2022.

Table 3.6.1-3. Commercial fishing landings of the top ten species by landings in the geographic analysis area in 2021

Species	2021 Landings (metric tons)	2021 Revenue (2019 U.S. dollars)
Menhadens	188,252	$140,520,957
American lobster	61,093	$924,740,140
Species confidential	29,169	$82,589,495
Sea scallop	19,608	$670,574,366
Blue crab	18,271	$91,830,704
Shortfin squid	17,707	$19,608,775
Atlantic surfclam	11,338	$21,821,430
Longfin squid	10,633	$33,384,431
Ocean quahog	10,365	$22,801,146
Haddock	7,307	$19,920,369

Source: Developed using data from NMFS (2021a). Data current as of November 15, 2022.

3.6.1.1.2 Commercial Fisheries in the US Wind Lease Area

This section summarizes the US Wind Lease Area (OCS-A 0490) specific commercial fish landings and associated revenue by FMP fishery, gear type, and port of landing based on NMFS-prepared planning-level assessment which describes selected fishery landings and estimates of commercial revenue from each was Atlantic Wind Energy Area (NMFS 2023). These reports modeled results using Vessel Trip Report (VTR) and vessel logbook data to estimate catch and landings based on the percentage of a trip that overlapped with each lease area. It should be noted, however, that not all vessels are required to provide federal VTRs, including, for example, federal lobster vessels with only lobster permits or Atlantic HMS permitted vessels (NMFS 2023).

NMFS (2023) described the most impacted FMPs from the lease area, with "most impacted" meaning the FMP which provided the most revenue during the 14-year period from 2008 to 2021. The most impacted FMPs for the US Wind Lease Area are listed in Table 3.6.1-4 by landings (pounds) and revenue (2021 U.S. dollars). ASMFC FMP had the highest landings from 2008 to 2021 with 1,986,000 pounds (900,834 kilograms) (Table 3.6.1-4). ASMFC FMP includes American Lobster, cobia, Atlantic croaker, black drum, red drum, menhaden, NK sea bass, NK seatrout, spot, striped bass, tautog, Jonah cab, and Pandalid shrimp. "No Federal FMP" refers to all species that are not federally regulated, including smooth and chain dogfish and whelk (NMFS 2023). NMFS (2023) estimated that up to 72 species may be caught in the US Wind Lease Area that are not regulated under an FMP.

Sea scallops were the most valuable (revenue) federally managed species in the US Wind Lease Area between 2008 and 2021, with a revenue of $1239,000. Other federally managed species producing substantial revenue included summer flounder, scup, black sea bass ($814,000), species with no federal FMP ($636,000) and species part of the ASMFC FPM ($517,000) (Table 3.6.1-4). Figures 3.6.1-2 and 3.6.1-3 depict overall landings and revenue, respectively, for the most impacted FMPs in the US Wind Lease for each year from 2008 to 2021.

Table 3.6.1-4. Commercial fishing landings and revenue of the most impacted FMPs from 2008 to 2021 for the US Wind Lease Area

Fishery Management Plan	14-Year Landings (2008–2021; pounds)	14-Year Revenue (2021 U.S. dollars)
Sea scallop	119,000	$1,239,000
Summer flounder, scup, black sea bass	291,000	814,000
No federal FMP	207,000	$636,000
Atlantic States Marine Fishery Commission FMP	1,986,000	$517,000
Surfclam, ocean quahog	366,000	$276,000

Adapted from: NMFS 2023

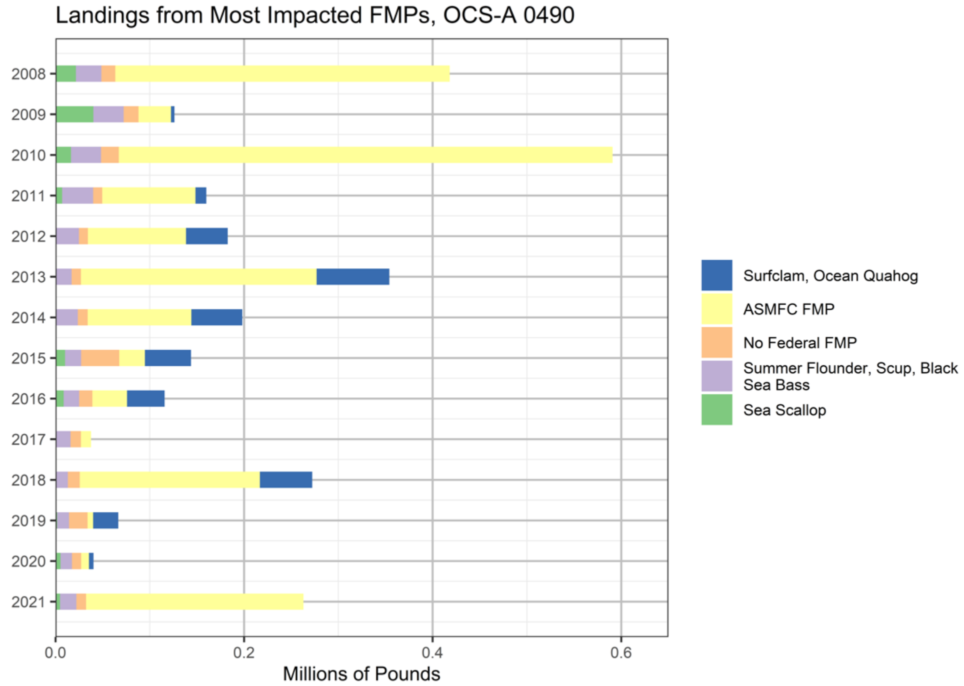


Figure 3.6.1-2. Commercial fishing landings of the most impacted FMPs for the US Wind Lease Area from 2008 to 2021

From: NMFS 2023

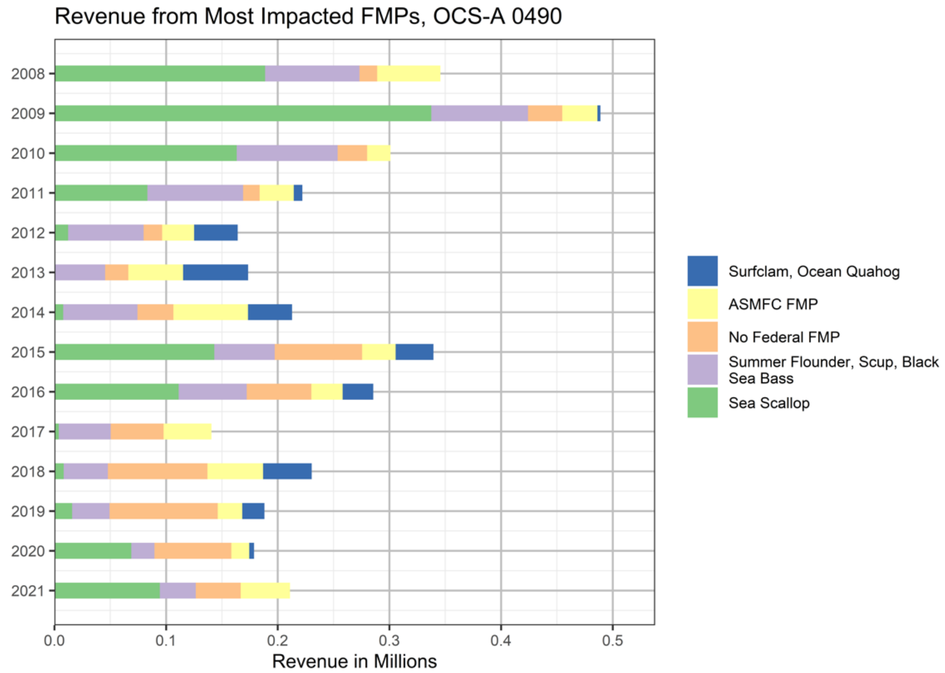


Figure 3.6.1-3. Commercial fishing revenue (2021 U.S. dollars) from the most impacted FMPs for the US Wind Lease Area from 2008 to 2021

From: NMFS 2023

NMFS (2023) further analyzed the most impacted species in the Lease Area and separated them from combined FMPs. Table 3.6.1-5 presents cumulative landings and revenue for the most impacted species from 2008 to 2021. Landings by weight were dominated by menhaden, the overall revenue over the 14-year period from 2008 to 2021 was dominated by sea scallops ($1,239,000). Overall, the Lease Area had 10 species that produced more than $100,000 in revenue from 2008 to 2021. Figures 3.6.1-4 and 3.6.1-5 depict overall landings and revenue, respectively, for the most impacted species in the US Wind Lease Area for each year from 2008 to 2021.

Table 3.6.1-5. Commercial fishing landings and revenue of the most impacted species from 2008 to 2021 for the US Wind Lease Area

Species	14-Year Landings (2008–2021; pounds)	14-Year Revenue (2021 U.S. dollars)
Sea scallop	119,000	$1,239,000
Black sea bass	181,000	$548,000
Channeled whelk	57,000	$457,000
Summer flounder	101,000	$261,000
All others	446,000	$235,000
Surf clam	310,000	$232,000
American lobster	40,000	$228,000
Spiny dogfish	838,000	$170,000
Menhaden	,1,615,000	$127,000
Longfin squid	79,000	$105,000

Adapted from: NMFS 2023

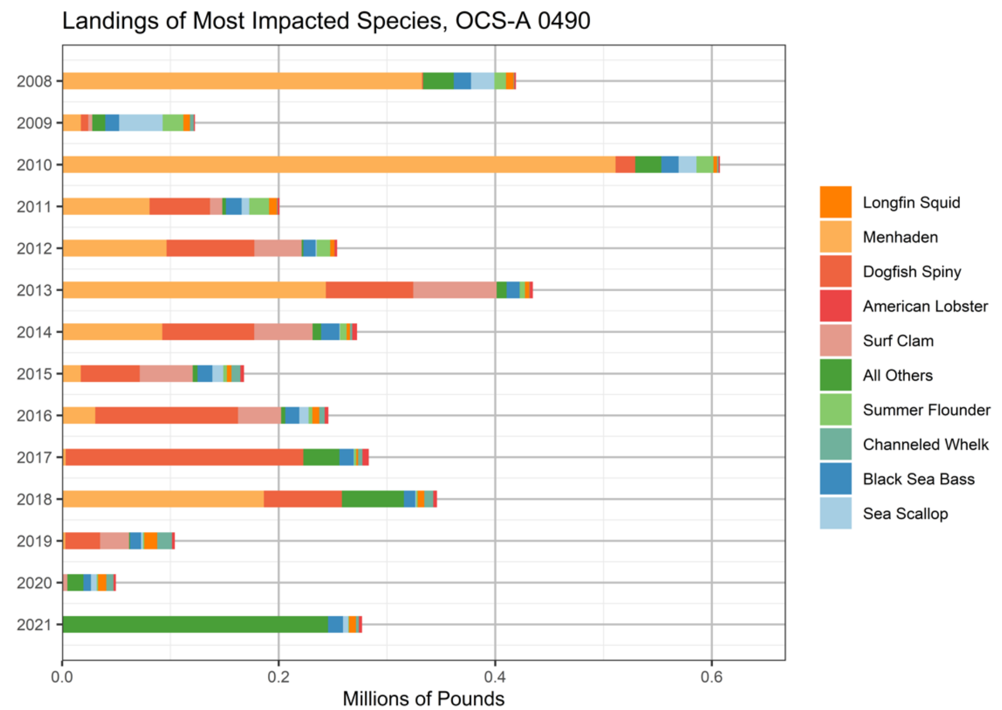


Figure 3.6.1-4. Commercial fishing landings from the most impacted species for the US Wind Lease Area from 2008 to 2021
From: NMFS 2023

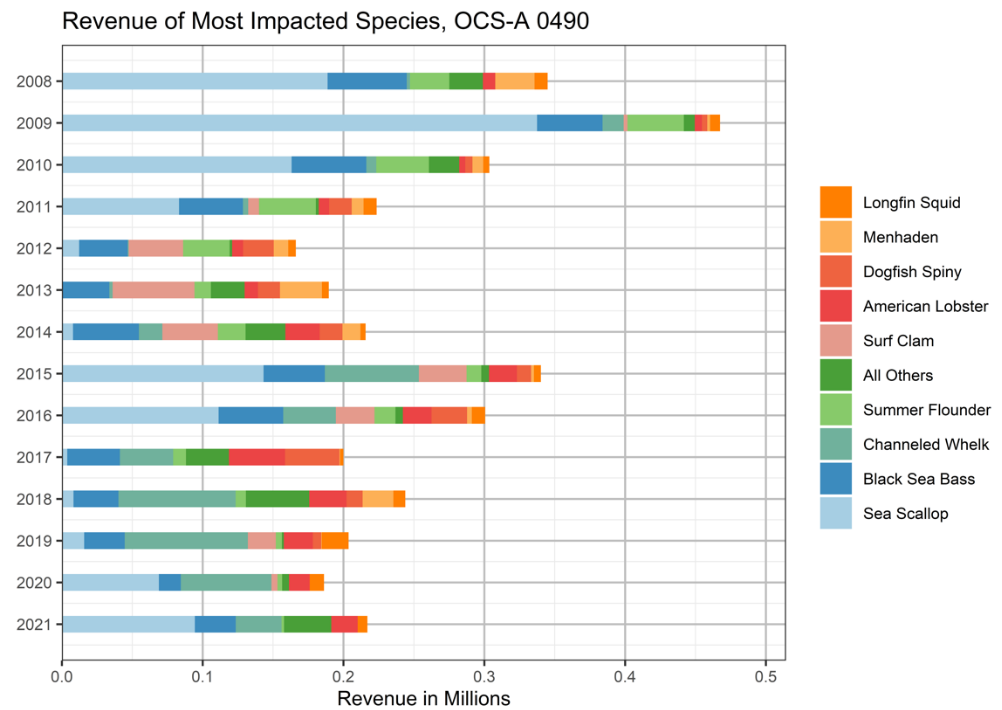


Figure 3.6.1-5. Commercial fishing revenue (2021 U.S. dollars) from the most impacted species for the US Wind Lease Area from 2008 to 2021
From: NMFS 2023

NMFS (2023) also analyzed fishing gear types and their associated revenue for commercial fishing occurring in the US Wind Lease Area. From 2008 to 2021, revenue was highest for scallop dredges ($1,213,000), while landings were highest for All Others (1,920,000 pounds) and sink gillnets (1,025,000). The category "All others" refers to landings of species of less than three federal permits or dealers impacted to protect data confidentiality. A total of six individual gear types (scallop dredge, pot-other, bottom trawl, lobster pot, clam dredge, and sink gillnet) totaled more than 100,000 pounds (45,359 kilograms) of total landings from 2008 to 2021 (Table 3.6.1-6).

Table 3.6.1-6. Commercial fishing landings and revenue by fishing gear type from 2008 to 2021 for the US Wind Lease Area

Gear Type	14-Year Landings (2008–2021; pounds)	14-Year Revenue (2021 U.S. dollars)
Scallop dredge	117,000	$1,213,000
Pot-other	243,000	$900,000
Bottom trawl	548,000	$702,000
All others	1,920,000	$370,000
Lobster pot	101,000	$351,000
Clam dredge	327,000	$249,000
Gillnet-sink	1,025,000	$234,000
Handline	4,000	$16,000
Bottom longline	22,000	$11,000
Gillnet-other	20,000	$6,000

Adapted from: NMFS 2023

The total number of commercial fishing trips and vessels have decreased in recent years, dipping to a low of 872 vessel trips in 2020, a result likely due to closures caused by the COVID-19 pandemic (Table 3.6.1-7). For 2021, knobbed whelk was the most targeted species by vessel trips (322) and sea scallop was the most targeted species by number of vessels (42) (Table 3.6.1-8).

Table 3.6.1-7. Number of commercial fishing vessel trips and number of vessels from 2008 to 2021 in the US Wind Lease Area

Year	Number of Vessel Trips	Number of Vessels
2021	967	115
2020	872	125
2019	1,080	115
2018	957	95
2017	892	72
2016	1,270	190
2015	1,119	177
2014	1,183	119
2013	1,196	100
2012	1,339	132
2011	1,607	226
2010	1,577	307
2009	1,534	313
2008	1,536	254

Source: NMFS 2023

Table 3.6.1-8. Number of commercial fishing vessel trips and number of vessels by target species (top ten) for 2021 in the US Wind Lease Area

Species	Number of Vessel Trips	Number of Vessels
Knobbed whelk	322	11
Channeled whelk	261	117
Black sea bass	218	15
Summer flounder	202	30
American lobster	200	10
Longfin squid	65	24
Jonah crab	61	6
Conger eel	53	6
Scup	52	20
Sea scallop	51	42

Source: NMFS 2021d, e

The ports in Table 3.6.1-9 were estimated by NMFS (2023) as being the topmost impacted from commercial fishing that occurs in the US Wind Lease Area. The port with the highest 14-year (2008 to 2021) revenue was Ocean City, Maryland, with a total landings revenue of $1,558,000.

Table 3.6.1-9. Most impacted ports and revenue for commercial fishing in the US Wind Lease Area

Port	2008–2021 Revenue (2021 U.S. dollars)
Ocean City, Maryland	$1,558,000
Cape May, New Jersey	$640,000
New Bedford, Massachusetts	$454,000
Indian River, Delaware	$450,000
Newport News, Virginia	$203,000
Atlantic City, New Jersey	$159,000
Hampton, Virginia	$94,000
North Kingstown, Rhode Island	$64,000
Other Cape May, New Jersey	$57,000
All Others	$145,000

Source: NMFS 2023

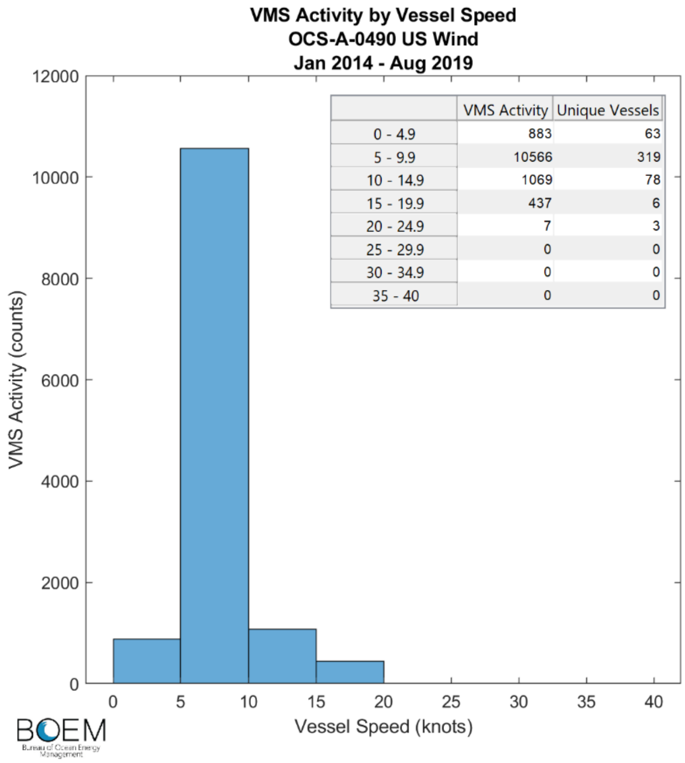
NMFS (2023) also analyzed the total number and revenue generated from small and large commercial fishing businesses[19] that have been active in the Northeast region and have historically fished within the US Wind Lease Area. From 2019 to 2021, there was roughly ten times more small commercial fishing businesses operating in the northeast region than large commercial fishing businesses, which generated two to three times more revenue than large commercial fishing businesses (Table 3.6.1-10). The number of large commercial fishing businesses operating in the US Wind Lease Area between 2019 and 2021 was between seven and eight, generating between $24,000 and $64,000 of revenue from within the US Wind Lease Area. Small commercial fishing businesses for the same time frame consisted of 73 to 83 businesses generating between $139,000 and $208,000 of revenue from the US Wind Lease Area. From 2019 to 2021, the percentage of revenue exposure from the US Wind Lease Area was slightly larger for small commercial fishing businesses (0.08 to 0.11 percent) compared to large commercial fishing businesses (0.01 to 0.05 percent).

[19] A small commercial fishing business is characterized as being independently owned and operated, is not dominant in its field of operation (including its affiliates) and has combined annual receipts not in excess of $11 million (NMFS 2021e).

Table 3.6.1-10. Total number and revenue generated by small and large commercial fishing businesses within the northeast region and the US Wind Lease Area

		Northeast Region		US Wind Lease Area			
Year	Business Type	# of entities	Revenue	# of entities	Revenue	Total Revenue	Percent
2019	Large	11	$247,928,000	7	$27,000	$137,872,000	.02
	Small	1,130	$799,249,000	73	$173,000	$153,800,000	.11
2020	Large	11	$200,342,000	7	$64,000	$134,792,000	.05
	Small	1,144	$684,526,000	83	$139,000	$185,195,000	.08
2021	Large	11	$248,437,000	8	$24,000	$170,725,000	.01
	Small	1,190	$849,039,000	78	$208,000	$200,341,000	.10

NMFS uses Vessel Monitoring System (VMS) data to monitor some fisheries under its jurisdiction. VMS data are useful for characterizing the spatial distribution of fishing activity in the Lease Area. Using VMS data conveyed in individual position reports (pings) from January 2014 to August 2019, BOEM compiled information about fishing activities within the Lease Area. BOEM assumes that vessels with speeds less than 5 knots (2.6 m/s) (as reported in VMS data) are actively engaged in fishing, although some vessels may also be using slower speeds while transiting or engaging in other activities such as processing at sea. Vessels traveling faster than 5 knots (2.6 m/s) are generally interpreted to be transiting. Of the 469 unique vessels operating in the Lease Area during the above-referenced period, 63 vessels or 13 percent were actively fishing (Figure 3.6.1-6).



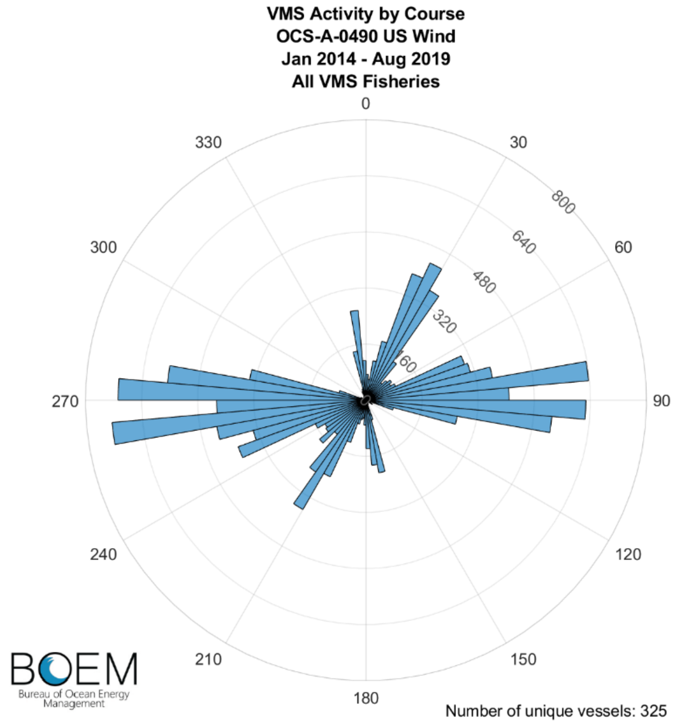
	VMS Activity	Unique Vessels
0 - 4.9	883	63
5 - 9.9	10566	319
10 - 14.9	1069	78
15 - 19.9	437	6
20 - 24.9	7	3
25 - 29.9	0	0
30 - 34.9	0	0
35 - 40	0	0

Figure 3.6.1-6. VMS Activity and Unique Vessels Operating in the Lease Area, January 2014 to August 2019

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

BOEM also developed polar histograms using the VMS data that show the directionality of VMS-enabled vessels operating in the Project area and the targeted FMP fishery (Figures 3.6.1-7 through Figure 3.6.1-11). The larger bars in the polar histograms represent a greater number of position reports showing fishing vessels moving in a certain direction within the Project area.

Figure 3.6.1-7 shows that for all activities (transiting and fishing combined), most of the 325 unique vessels participating in a VMS fishery generally operated in an east-west pattern with a secondary pattern of northeast-southwest. Non-VMS fishery vessels almost exclusively operated in a northeast-southwest pattern. Figure 3.6.1-8 shows that VMS fishery vessels transiting the Lease Area also primarily followed an east-west pattern and non-VMS fishery vessels primarily followed a northeast-southwest pattern. Figure 3.6.1-9 shows that most of the unique VMS fishery vessels followed an east-west pattern while non-VMS vessels actively fishing in the Lease Area showed no discernable pattern of orientation.



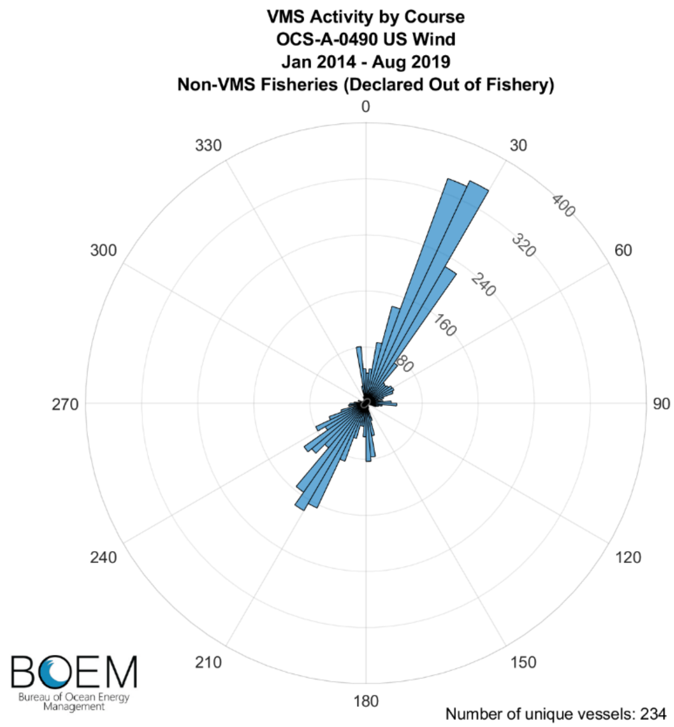


Figure 3.6.1-7. VMS Bearings for All Activity of VMS and Non-VMS Fisheries in the Lease Area, January 2014 to August 2019

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

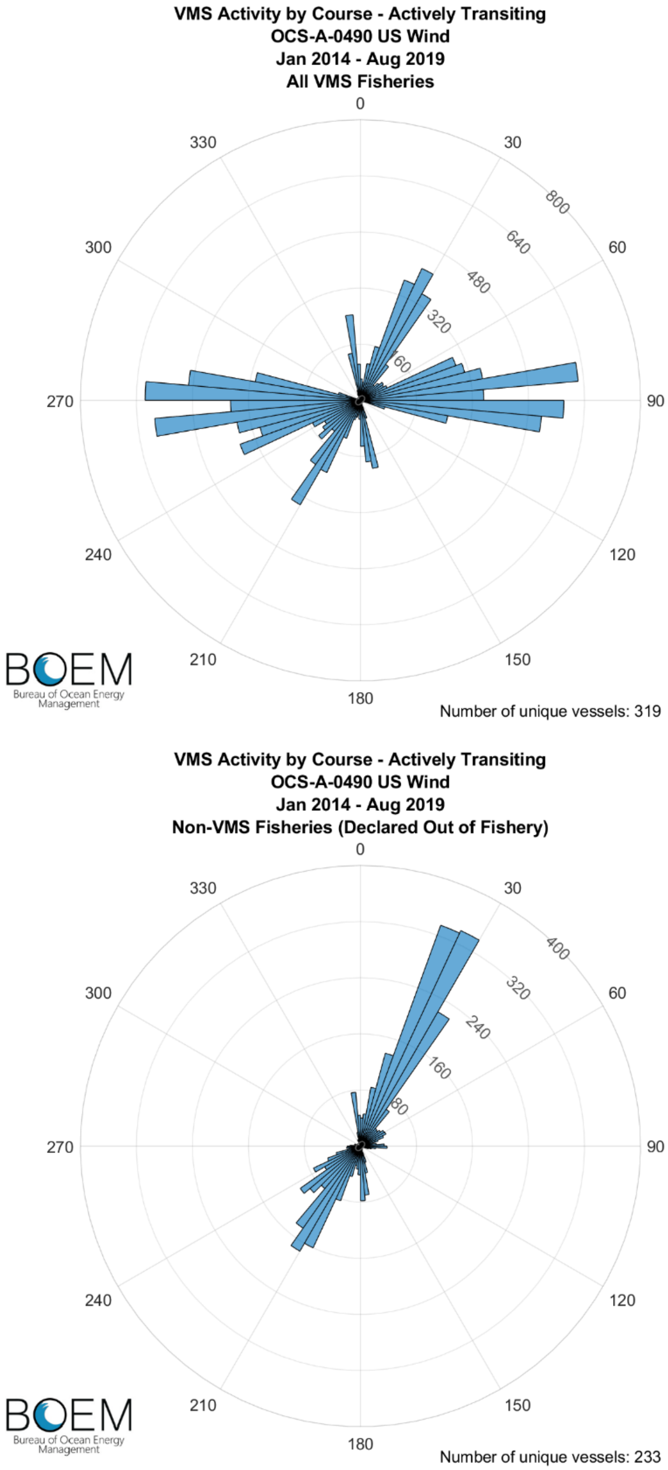
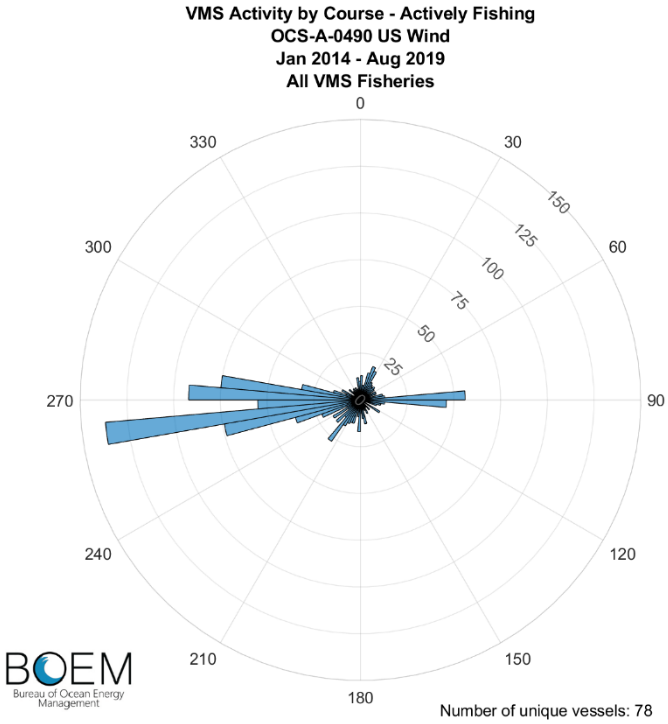


Figure 3.6.1-8. VMS Bearings for Transiting Vessels of VMS and Non-VMS Fisheries in the Lease Area, January 2014 to August 2019

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



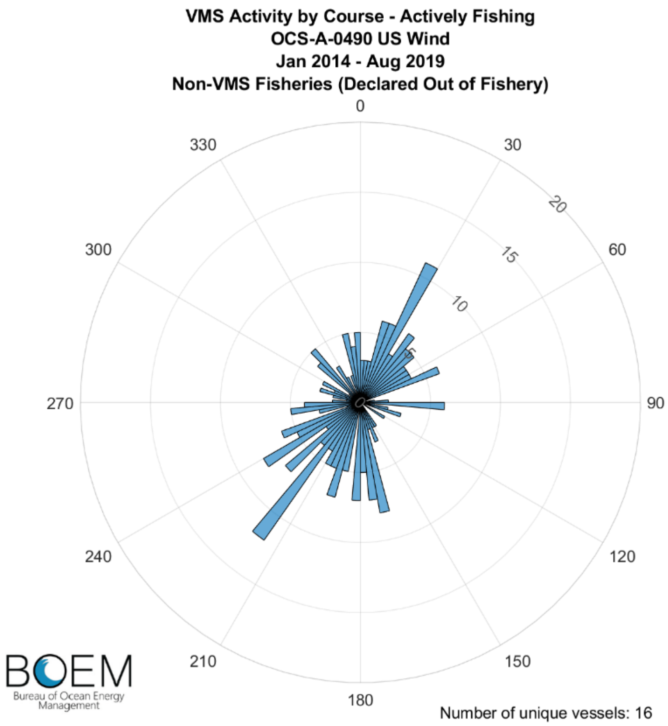


Figure 3.6.1-9. VMS Bearings for Actively Fishing Vessels of VMS and Non-VMS Fisheries in the Lease Area, January 2014 to August 2019

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

For individual FMP fisheries, Figures 3.6.1-10 and 3.6.1-11 show that the orientation of vessels transiting and actively fishing the Lease Area respectively had various orientations. Six or fewer unique vessels were logged actively fishing in most FMP fisheries in the Lease Area, with only the sea scallop FMP fishery having additional vessels (30). Vessels actively fishing in the Lease Area in the sea scallop FMP fishery were generally oriented in an east-west pattern.

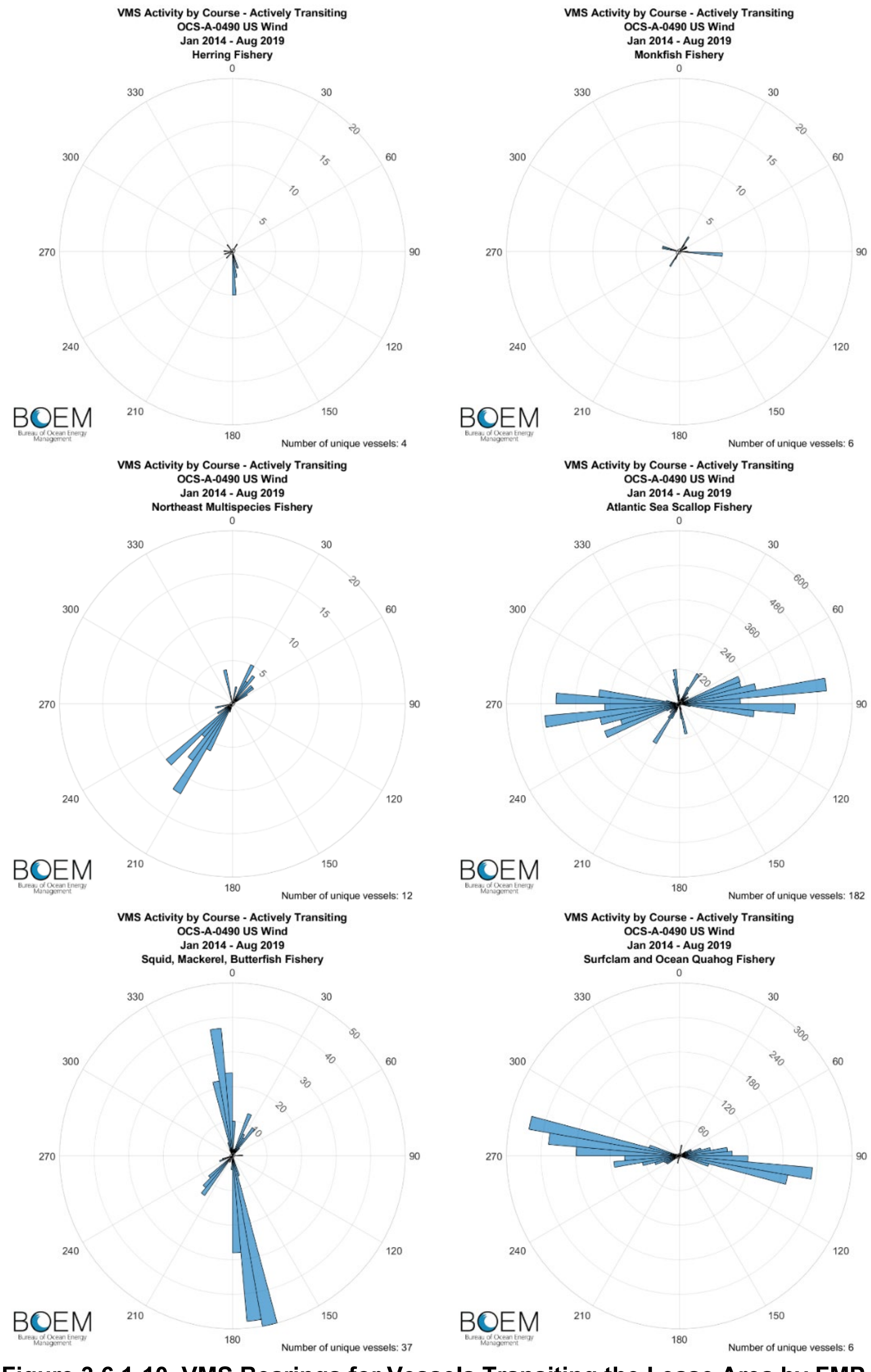


Figure 3.6.1-10. VMS Bearings for Vessels Transiting the Lease Area by FMP Fishery, January 2014 to August 2019

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

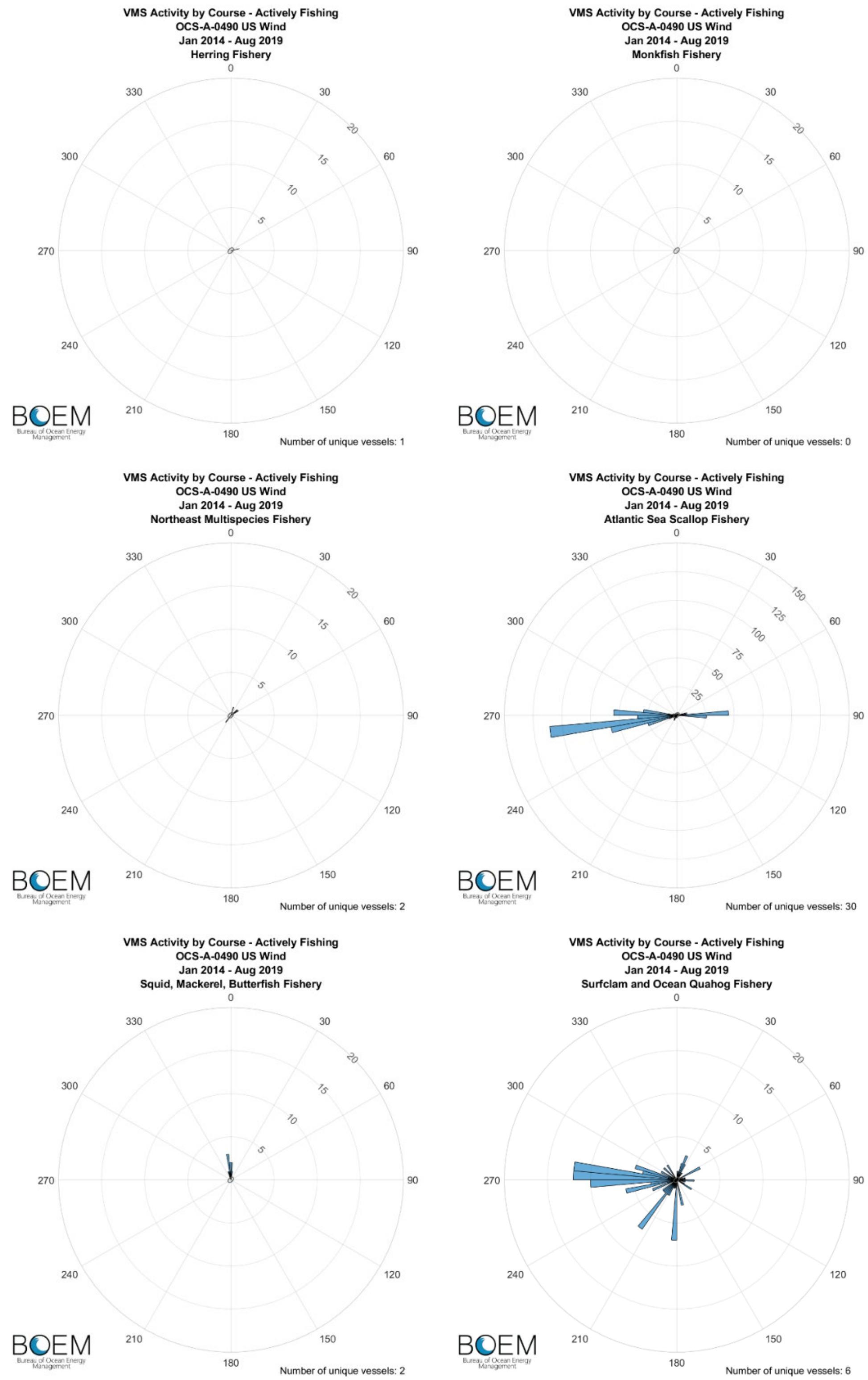


Figure 3.6.1-11. VMS Bearings for Vessels Actively Fishing in the Lease Area by FMP Fishery, January 2014 to August 2019

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

3.6.1.1.3 For-Hire Recreational Fishing in the US Wind Lease Area

Recreational fishing in and around the US Wind Lease Area may occur year-round, with most charter trips occurring from April through October. The for-hire recreational fishing industry offshore Maryland is primarily made up of small to medium sized (i.e., 25- to 50-foot [7.6- to 15.2-meters]) vessels that are chartered for half-day or full-day trips. Most chartered fishing vessels that may utilize the US Wind Lease Area likely originate from various ports on the coasts of Maryland or Delaware and therefore the affected environment for for-hire recreational fishing will focus on those two states.

Most recreational fishing in Maryland and Delaware occurs in inland waters such as rivers, lakes, and inland bays (COP, Volume II, Section 17.5; US Wind 2023), but in 2021, there were approximately 422,000 angler trips in Maryland and approximately 1 million angler trips in Delaware that occurred in ocean waters (NMFS 2022a). Figure 3.6.1-12 shows recreational angler trips in ocean waters broken down by trip type from 2012 to 2021 for Maryland (top) and Delaware (bottom). In both states, shore-based fishing was the most popular trip type in 2020 and 2021, although trips on private/rental boats have historically been more popular in Maryland (Figure 3.6.1-12).

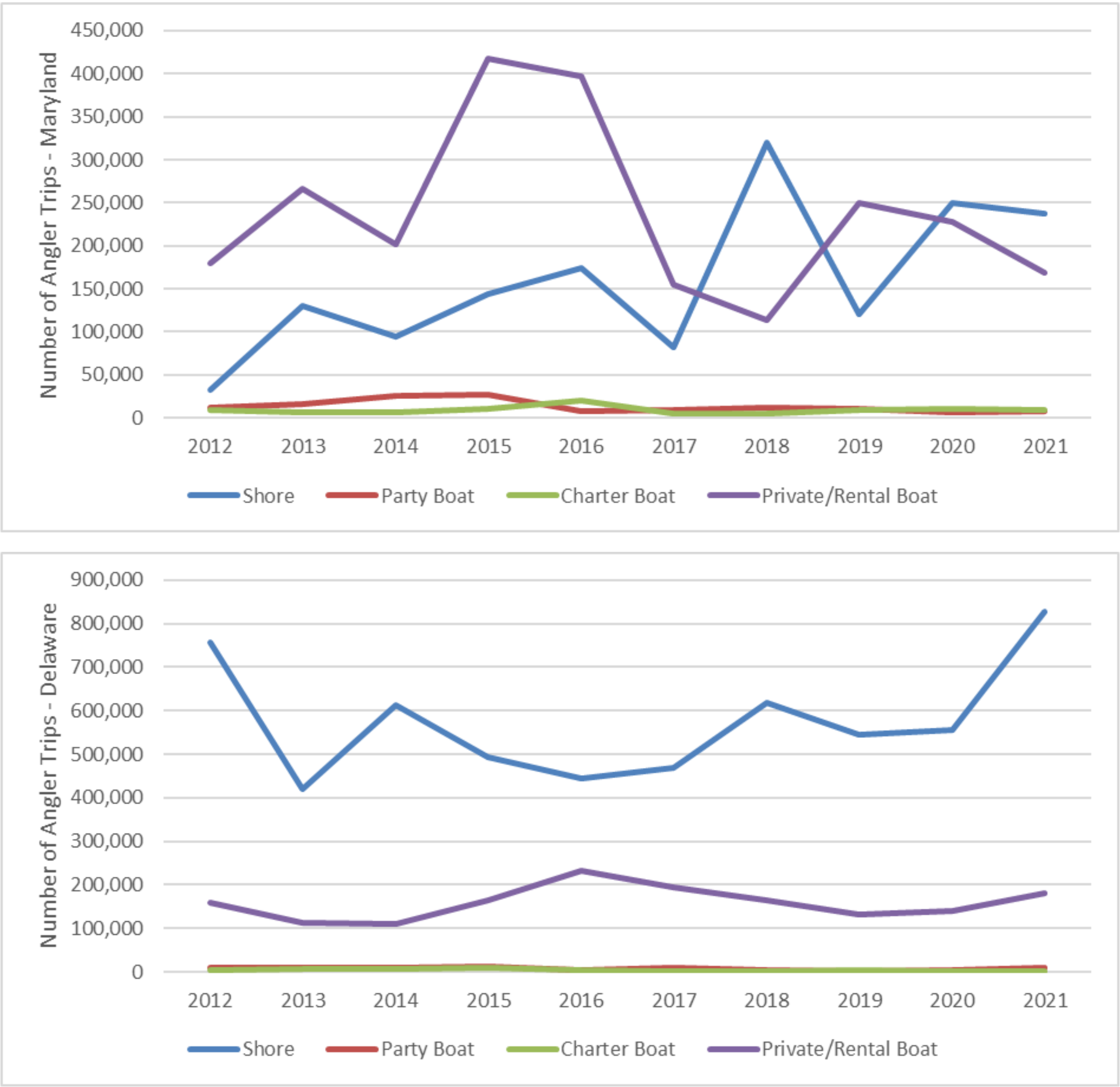


Figure 3.6.1-12. Number of for-hire recreational angler trips in ocean waters by trip type in Maryland (top) and Delaware (bottom) from 2012 to 2021
Data source: NMFS 2022a

Target species for recreational anglers in marine and brackish waters of Maryland and Delaware vary by location and fishing type, but they include striped bass, tautog, black sea bass, summer flounder, and many others; Table 3.6.1-11 presents the top species by landings weight for Maryland and Delaware for 2021. Striped bass and channel catfish were the top species in Maryland with approximately 2.7 million and 2.0 million pounds (1.2 million and 907,184 kilograms), respectively, while tautog and black sea bass were the top species in Delaware with approximately 479,000 pounds (217,271 kilograms) each (NMFS 2022b).

Table3.6.1-11. Recreational fish catch (pounds) of marine or brackish species from Maryland and Delaware in 2021

Species	2021 Total Catch (Pounds)	Species	2021 Total Catch (Pounds)
Maryland		**Delaware**	
Striped bass	2,681,573	Tautog	479,076
Yellowfin tuna	1,509,617	Black sea bass	478,946
Spot	1,071,983	Summer flounder	272,110
Bigeye tuna	370,895	Yellowfin tuna	133,236
Dolphinfish	349,281	Striped bass	109,244
Black sea bass	278,680	Spiny dogfish	108,902
Bluefin tuna	267,200	White perch	105,505
Spanish mackerel	251,276	Spot	54,022
Summer flounder	192,799	Atlantic croaker	35,746

Source: NMFS 2022b; data current as of November 15, 2022

A significant recreational fishing area is located just north of the Lease Area and is termed the Old Grounds. This is an area composed of rocky bottom that is heavily used by recreational fishermen and for-hire charter fishing trips (COP, Volume II, Section 17.5.1; US Wind 2023). Located approximately 18 miles south of Cape May, New Jersey, the Old Grounds are known for summer flounder and black sea bass (The Fisherman 2018) but is also known for an area for anglers to target winter flounder, tautog, and red hake (COP, Volume II, Section 17.5.1; US Wind 2023).

NMFS (2022c) prepared a planning-level assessment estimating landings and recreational party and charter vessel revenue from the US Wind Lease Area. Between 2008 and 2021, NMFS estimated the number of fish kept after recreational party and charter vessel trips were dominated by black sea bass (12,013 individuals), followed by summer flounder (818 individuals) and bluefish (717 individuals). Other species constituted less than 6 percent of the total number of individuals kept (14,369).

Annual revenues from recreational party and charter vessel trips in the US Wind Lease Area between 2008 and 2021 ranged from $15,000 to $106,000, with a total revenue over the 14-year period of $602,000 (Table 3.6.1-12) (NMFS 2022c). Revenue in recent years has been relatively stable, with a reduction noted in 2020 likely due to the COVID-19 pandemic.

Table 3.6.1-12. Annual revenue from 2008 to 2021 from recreational party and charter vessel trips in the US Wind Lease Area

Year	Annual Revenue (2021 U.S. dollars)
2021	$37,000
2020	$15,000
2019	$42,000
2018	$61,000
2017	$32,000
2016	$54,000
2015	$32,000
2014	$12,000
2013	$37,000
2012	$30,000
2011	$77,000
2010	$106,000
2009	$32,000
2008	$34,000

Source: NMFS 2022c

NMFS (2022c) also analyzed the total number and revenue generated from small for-hire and recreational fishing business[20] that have been active in the Northeast region and have historically fished within the US Wind Lease Area. The number of small for-hire recreational fishing businesses within the northeast region has grown from 289 businesses generating $1,769,000 of revenue in 2019 to 402 businesses generating $4,368,000 of revenue in 2021. The number of small for-hire recreational fishing businesses operating within the US Wind Lease Area between 2019 to 2021 was between four and six, generating between $58,000 and $104,000 of revenue from the US Wind Lease Area. The percentage of revenue exposure from the US Wind Lease Area for small and for-hire recreational fishing businesses ranged from 0.48 to 0.86 percent between 2019 and 2021 (Table 3.6.1-13).

[20] A small for-hire recreational fishing business is characterized as being independently owned and operated, is not dominant in its field of operation (including its affiliates) and has combined annual receipts not in excess of $8 million (NMFS 2022c).

Table 3.6.1-13. Total number and revenue generated by small for-hire recreational fishing businesses within the northeast region and the US Wind Lease Area

Year	Business Type	Northeast Region		US Wind Lease Area			
		Number of Entities	Revenue	Number of Entities	Revenue	Total Revenue	Percent of Revenue Exposure
2019	Small	289	$1,769,000	4	<$500	$99,000	0.50
2020	Small	323	$2,362,000	4	<$500	$58,000	0.86
2021	Small	402	$4,368,000	6	<$500	$104,000	0.48

There are numerous saltwater fishing tournaments held annuals offshore of Maryland and Delaware that attract anglers from around the country. Typically held between the months of May and October, targeted species are often tournament-specific, but are known to include blue and white marlin, flounder, striped bass and others. Artificial reefs are often key locations for anglers during tournaments, as well as during regular non-tournament charter trips. While there are no known artificial reefs in any of the US Wind Lease Area, the State of Maryland has designated 11 artificial reefs in offshore waters (there are additional reefs located in Maryland waters within Chesapeake Bay) (Ocean City Reef Foundation n.d.). Delaware has designed 14 artificial reefs within Delaware Bay and along the Atlantic coast. The reefs are known havens for a variety of fish species, including tautog, black sea bass, scup, spadefish, and triggerfish (Delaware Division of Fish and Wildlife 2015). Figure 3.6.1-13 presents the location of the Maryland (offshore only) and Delaware artificial reefs relative to the US Wind Lease Area and popular recreational fishing areas based on NMFS (2022d) vessel trip report (VTR) data from 2011 to 2015 (NMFS 2022d). Based on NMFS (2022d) data, there is no substantial recreational fishing effort in the US Wind Lease Area (Figure 3.6.1-13).

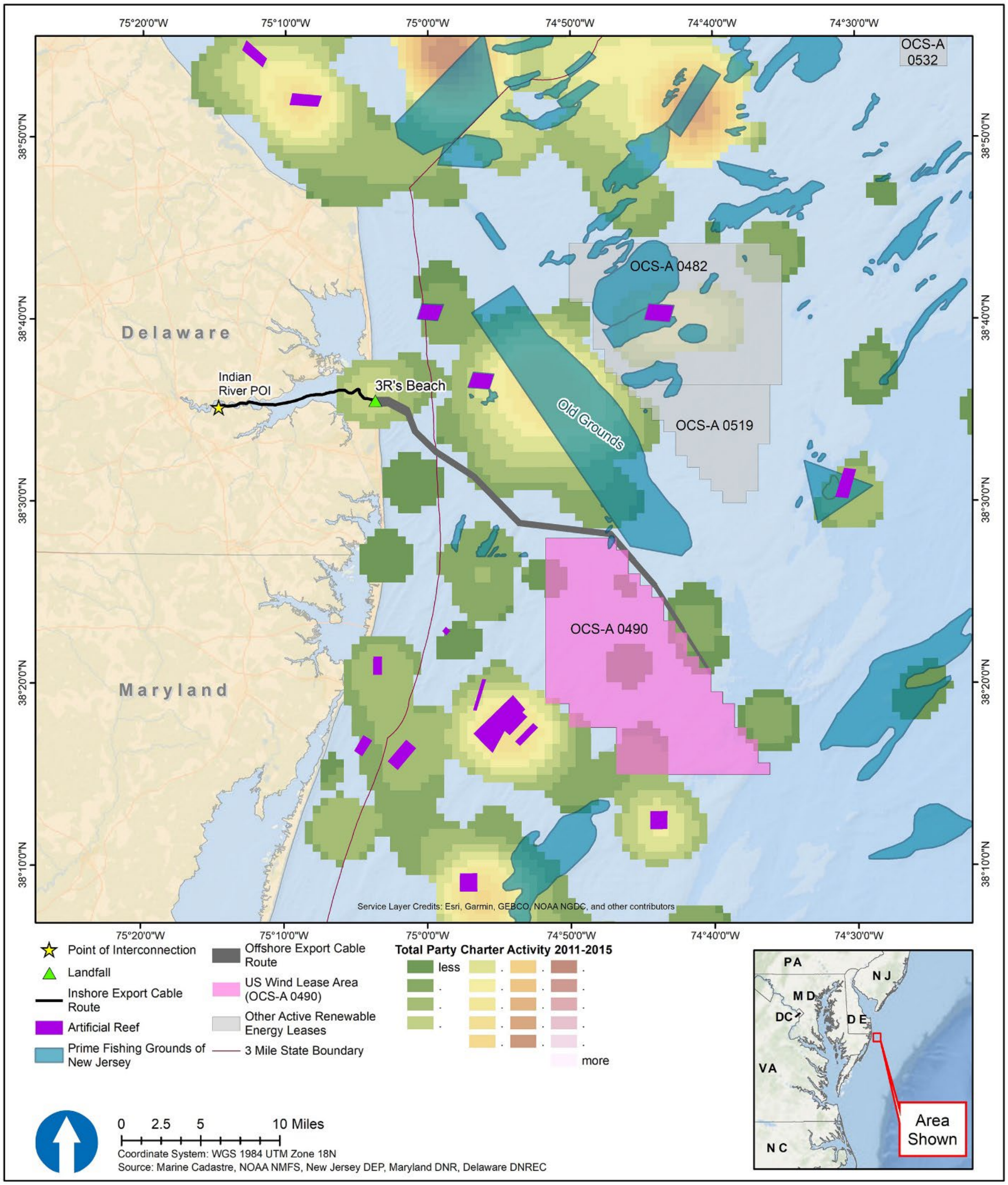


Figure 3.6.1-13. Recreation party/charter fishing vessel intensity (2011 to 2015) and location of artificial reefs offshore Maryland and Delaware relative to the US Wind Lease Area

There are no known data regarding historical fishing methods for for-hire recreational fishing trips in the vicinity of the US Wind Lease Area. However, most recreational fishing in saltwater involves rod and reel fishing either from shore (e.g., jetties, piers) or from a boat. Rod and reel fishing techniques include bait fishing, bottom jigging, casting lures, fly fishing, and trolling. Other common recreational fishing methods include spearfishing or by-hand shellfishing.

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

Definitions of impact levels for commercial fisheries and for-hire recreational fishing are provided in Table 3.6.1-14. Table F-11 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on commercial fisheries and for-hire recreational fishing.

Table 3.6.1-14. Impact level definitions for commercial fisheries and for-hire recreational fishing

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

3.6.1.3 Impacts of Alternative A – No Action on Commercial Fisheries and For-Hire Recreational Fishing

Under the No Action Alternative, the Project would not be built. If the Project is not approved, baseline conditions for commercial fisheries and for-hire recreational fishing would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. When analyzing the impacts of the No Action Alternative on commercial fisheries and for-hire recreational fishing, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore wind activities.

Ongoing non-offshore wind activities within the geographic analysis area that are contributing or may contribute to impacts on commercial fisheries and for-hire recreational fishing resources are generally associated with activities that limit the aerial extent of where fishing can occur such as tidal energy projects, military use, dredge material disposal, and sand borrowing operations; increased vessel congestion that can pose a risk for collisions or allisions; dredging and port improvements, marine transportation, and oil and gas activities; or activities that pose a risk for gear entanglement such as undersea transmission lines, gas pipelines, and other submarine cables. Existing undersea transmission lines, gas pipelines, and other submarine cables are generally indicated on nautical charts and may also cause commercial fishermen to avoid the areas to prevent the risk of gear entanglement. Some of these activities may also result in bottom disturbance or habitat conversion that may alter the distribution of fishery-targeted species and increase individual mortality, resulting in a less-productive fishery or causing some vessel operators to seek alternate fishing grounds, target a different species, or switch gear types.

Activities of NMFS and fishery management councils could affect commercial and for-hire recreational fisheries through stock assessments, setting quotas, and implementing fishery management plans to ensure the continued existence of species at levels that will allow commercial and for-hire recreational fisheries to occur. Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by state, regional, or federal agencies may affect commercial fisheries and for-hire recreational fishing by modifying the nature, distribution, and intensity of fishing-related impacts.

Ongoing commercial and for-hire recreational fisheries would also be affected by climate change primarily through ocean acidification, ocean warming, sea level rise, and increases in both the frequency and magnitude of storms, which could lead to altered habitats, altered fish migration patterns, increases in disease frequency, and safety issues for conducting fishing operations.

Commercial and for-hire recreational fisheries would also be affected by climate change, primarily through ocean acidification, ocean warming, sea level rise, and increases in both the frequency and magnitude of storms, which could lead to altered habitats, altered fish migration patterns, increases in disease frequency, and safety issues for conducting fishing operations. Over the next 35 years, greenhouse gas (GHG) emissions are expected to continue and to gradually warm ocean waters, affecting the distribution and abundance of finfish and invertebrates and their food sources.
Ocean acidification driven by climate change is contributing to reduced growth and, in some cases, decline of invertebrate species with calcareous shells. Increased freshwater input into nearshore estuarine habitats can also result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016). Risks to fisheries associated with these events include the ability to safely conduct fishing operations (e.g., because of storms) and climate-related habitat or distribution shifts in targeted species. Fish and shellfish species are expected to exhibit variation in their responses to climate change, with some species benefiting from climate change and others being adversely affected (Hare et al. 2016). To the extent that impacts of climate change on targeted species result in a decrease

in catch or increase in fishing costs, the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected. Ongoing activities of NMFS and fishery management councils affect commercial and for-hire recreational fisheries through stock assessments, setting quotas, and implementing FMPs to ensure the continued existence of species at levels that will allow commercial and for-hire recreational fisheries to occur. To the extent that impacts on targeted species results in a decrease in catch or an increase in fishing costs (e.g., transit costs to other fishing grounds, need to switch to different fishing gear to target a different species), the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be affected. The economies of communities reliant on marine species vulnerable to the effects of climate change would also be affected. Climate change could affect the location of commercial and for-hire recreational fisheries by altering the distribution of important fish stocks changes. Coastal communities with fishing-related infrastructure near the shore could be adversely affected by sea level rise (Colburn et al. 2016; Rogers et al. 2019).

Other planned non-offshore wind activities, described in Appendix D, which may affect commercial fisheries and for-hire recreational fishing include tidal energy projects, dredge material disposal and sand borrowing operations, increased vessel congestion, dredging and port improvements, marine transportation, and oil and gas activities. Similar to ongoing activities, other planned non-offshore wind activities could limit the geographic extent of where fishing can occur, pose a risk for collisions or allisions, pose a risk for gear entanglement, and result in bottom disturbance or habitat conversion that may alter the distribution of fishery-targeted species and increase individual mortality.

3.6.1.3.1 Future Offshore Wind Activities (without Proposed Action)

Under the No Action Alternative, baseline conditions for commercial fisheries and for-hire recreational fishing would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned non-offshore wind activities (Appendix D, Section D.2 contains a description of ongoing and planned activities).

Offshore wind development along the U.S. Atlantic coast is expected to result in approximately 3,081 foundations (WTG, OSS, and Met Tower) over the next 10 years (Appendix D, Table D-3). BOEM expects offshore wind activities to affect commercial fisheries and for-hire recreational fishing through the following primary IPFs: anchoring, cable emplacement and maintenance, noise, port utilization, presence of structures, increased vessel traffic, and climate change.

Offshore wind activities could produce impacts from site characterization studies, site assessment data collection activities that involve installation of the Met Tower or buoys, and installation and operation of turbine structures. The IPFs deemed to have impacts on commercial fisheries and for-hire recreational fishing are summarized in this section for offshore wind activities without the Proposed Action. This section provides a general description of these mechanisms, recognizing that the extent and significance of potential effects on conditions cannot be fully quantified for projects that are in the conceptual or proposal stage and have not been fully designed. Where appropriate, certain potential effects resulting from these future activities can be generally characterized by comparison to effects resulting from the Proposed Action that are likely to be similar in nature and significance. The intent of this section is to provide a general overview of how reasonably foreseeable future activities might influence future environmental conditions. Should any or all of the future activities proceed, each would be subject to independent NEPA analyses and regulatory approvals, and their environmental effects would be fully considered therein.

Anchoring: Anchoring could pose a localized (within a few hundred feet of anchored vessels), temporary (hours to days) navigational hazard to fishing vessels. There would be an increase in vessel anchoring during survey activities and during the construction and installation of offshore components as a result of offshore wind activities over the next 10 years. However, the location and level of these impacts would depend on specific locations and duration of activity, and the use of dynamic positioning vessels would lessen this impact. As specified in Appendix D, *Planned Activities Scenario*, Table D2-2, BOEM assumes up to 5,019 acres (2,031 hectares) of seafloor could be disturbed within the geographic analysis area as a result of anchoring during construction activities over the next 10 years. In addition, there could be increased anchoring associated with the installation of the Met Tower.

Cable emplacement and maintenance: Cable emplacement could cause localized, short-term impacts including disrupting fishing activities during active installation and maintenance or periods during which the cable is exposed on the seafloor prior to burial (if simultaneous lay and burial techniques are not used). As specified in Appendix D, Table D2-2, BOEM assumes more than 108,425 acres (43,878 hectares) of seafloor could be disturbed within the geographic analysis area as a result of inter-array and export cable emplacement. Although the offshore wind projects listed in Appendix D are currently at various stages in the process, BOEM does anticipate some simultaneous emplacement activities. This will result in an actual disturbed footprint that will vary in scale and location over the course of the 10-year period. Fishing vessels may not have access to affected areas, in whole or in part, over various durations during the installation and operation period, which could lead to reduced revenue, displacement, or increased conflict over other fishing grounds. Because most construction activities would likely take place in more favorable conditions (i.e., late spring through early fall), fisheries and fishery resources most active during that time period would likely be affected more than those in the winter (e.g., the longfin squid fishery). The localized commercial and for-hire recreational fishing industries proximal to the landfall sites would also be disproportionately affected by emplacement activities.

Noise: Noise from offshore construction, site assessment and monitoring geological and geophysical (G&G) survey activities, O&M, pile-driving, trenching, and vessels could cause localized, temporary impacts on commercial fisheries and for-hire recreational fishing through direct effects on species (Popper and Hastings 2009). The most impactful noise on commercial fisheries and for-hire recreational fishing is expected to result from pile-driving, which can cause behavioral changes, injury, and mortality (Popper et al. 2014). Noise impacts are also anticipated from operational WTGs; however, these are anticipated to occur at relatively short distances from the WTG foundations and there is no available information to suggest that such noise would negatively affect fishery resources on a broad scale (English et al. 2017); therefore, fishery-level impacts are unlikely in this context.

Port utilization: Ports are largely privately owned or managed businesses that are expected to compete against each other for offshore wind business. Major fishing ports in the geographic analysis area that could support offshore wind energy construction and operations include Portsmouth (Hampton Roads area), Virginia; New Bedford, Massachusetts; Atlantic City, Cape May-Wildwood, and Point Pleasant, New Jersey; Montauk, New York; New London, Connecticut; and Portland, Maine, among others. Other non-major fishing ports could also be used for O&M support. Port expansion and modification could have local, temporary impacts on commercial and for-hire fishing vessels in ports used for both fishing and offshore wind and other projects, and some displacement of available dockage may occur.

Presence of Structures: The presence of structures can lead to impacts on commercial fisheries and for-hire recreational fishing through fish aggregation, habitat conversion, allisions, displacement of certain vessels/gear types, entanglement or gear loss/damage, navigation hazards (including transmission cable infrastructure), alterations on fisheries management mechanisms, space use conflicts, and safety-related issues (e.g., hindering search and rescue). These impacts may arise from buoys, the Met Tower, WTG foundations, OSSs, scour/cable protection, and transmission cable infrastructure. Using the assumptions in Appendix D, Table D2-2, the expanded planned activities scenario would include more than 3,215 foundations, 6,011 acres (2,433 hectares) of foundation footprint and scour protection, and 2,880 acres (1,165 hectares) of new hard protection atop export and inter-array cables. Projects may also install additional buoys and Met Towers. BOEM anticipates structures would be added intermittently over an assumed 6- to 10-year period and that they would remain until conceptual decommissioning of each facility is complete.

The presence of foundations and associated scour protection may alter the availability of targeted fish species in the immediate vicinity of the structures for commercial and for-hire recreational fishers. Structure-oriented fish such as black sea bass, striped bass, lobster, and cod may increase in areas where there was no previous structure (natural or artificial) (Claisse et al. 2014; Linley et al. 2007; Smith et al. 2016; Stevens et al. 2019).

The presence of the WTG foundations and associated scour protection would convert existing sand or sand with mobile gravel habitat to hard bottom, which, in turn, would reduce the habitat for target species that prefer soft-bottom habitat (e.g., surfclams, sea scallops, squid, summer flounder) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, cod). Where WTG foundations and associated scour protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species (Kirkpatrick et al. 2017). Although species that rely on soft-bottom habitat would experience a reduction in favorable conditions, the impacts from structures are not expected to result in population-level impacts (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). Decommissioning of each wind farm would then have the opposite impact, wherein the species dependent on hard-bottom or reef habitat would experience a reduction in favorable conditions, although some hard-bottom protection measures would remain, while removal of WTGs and their foundations would favor the increase of targeted species that prefer soft-bottom habitat.

Highly migratory species may also be attracted to the wind turbine foundations (Fayram and De Risi 2007). Flatfish, clams, and squid species are likely to remain in open soft-bottom sandy areas, although offshore wind structures may act as substrate for larval settlement. Furthermore, altered community composition could change natural mortality of certain species due to predation (decrease) or refuge (increase), and increase competition between species, which could have beneficial and adverse effects, depending on the species (Langhammer 2012). These effects are not anticipated to result in stock-level impacts that would affect fisheries.

The presence of structures (including transmission cable infrastructure) would have long-term impacts on commercial fisheries and for-hire fishing by increasing the risk of allisions, entanglement or gear loss/damage, and navigational hazards. Although portions of cable infrastructure achieving target burial depths (3.3 to 9.8 feet [1 to 3 meters] below stable seafloor elevation) would not likely pose a risk to vessels using mobile bottom-tending gear (Eigaard et al. 2015), the conversion of soft sediment to hard bottom via protective cover could negatively affect vessels fishing with bottom-tending mobile gear (e.g., dredges, trawls) by increasing the risk of snagging structure and the resultant vessel instability. The need to change vessel transit routes may also affect commercial and for-hire recreational fisheries by affecting travel time, fuel consumption, and overall trip costs. Certain sectors of the commercial fishing industry will likely be at higher risk operating within a WEA (e.g., dredges, trawls) due to maneuverability and entanglement hazards. Similar considerations also apply to fisheries-dependent and fisheries-independent surveys. Several long-standing fisheries surveys utilize mobile gear and have stations that will fall within offshore wind lease areas. These stations may need to be repositioned or non-standardized gear used, which will induce inconsistency in the data compared to the historical time series.

The USCG has stated that it does not plan to create exclusionary zones around offshore wind facilities during their operation (BOEM 2018). However, the height of wind turbines above the ocean would make them visually detectable at a considerable distance during the day (in good weather) and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all structures would have appropriate markings and lighting in accordance with USCG, BOEM, and IALA guidelines, and NOAA would chart wind turbine locations and could include a physical or virtual AIS at each turbine. Some fishing vessels operating in or near offshore wind facilities may experience radar clutter and shadowing.

Notwithstanding these safety measures, some fishermen have commented that, because of safety considerations, they would not enter an offshore wind array during inclement weather, especially during low-visibility events (Kirkpatrick et al. 2017); during interviews with commercial fishers, ten Brink and Dalton (2018) found that fishermen had concerns that low visibility, wind, or crew exhaustion could lead to vessels colliding with WTGs.

In addition, a potential effect of the presence of the offshore cables and wind turbines associated with offshore wind energy development is the entanglement and damage or loss of commercial and recreational fishing gear. Economic impacts on fishing operations associated with gear damage or loss include the costs of gear repair or replacement, together with the fishing revenue lost while gear is being repaired or replaced. In addition, comments from the fishing industry have included concerns that fishing vessel insurance companies may not cover claims for incidents within a WDA resulting in gear damage or loss, or they may increase premiums for vessels that operate within these areas. Because mobile fishing gear is actively pulled by a vessel over the seafloor, the chance of snagging this gear type on Project infrastructure is much greater than if—as in the case of fixed gear—the gear was set on the infrastructure or waves or currents pushed the gear into the infrastructure. The risk of damage or loss of deployed gear as a result of offshore wind development could affect mobile and fixed-gear commercial fisheries and for-hire recreational fishing.

While the depth to which offshore power cables are buried is specific to individual projects, standard commercial practice is to bury cables 3 to 10 feet (0.9 to 3.0 meters) deep in waters shallower than 6,562 feet (2,000 meters) to protect them from external hazards such as fishing gear and anchors (BOEM 2018). Fishing gear does not typically penetrate that deep into the sediment and would normally not snag or become entangled in cables buried at these depths. In a study of seafloor depletion and recovery from bottom-trawl disturbance, Hiddink et al. (2017) found that hydraulic dredges, at 6.3 inches (16.1 centimeters), penetrated the ocean floor the deepest of any bottom-trawl gear. Therefore, even with the common practice of dredge vessels fishing the same or similar tow paths on multiple occasions during the same trip, it is unlikely that fishing gear would penetrate deep enough to snag or become tangled in a buried cable. However, due to underlying geology, cables may not be able to be buried to the minimum target depth along their entire distance. BOEM assumes less than 10 percent of the cables may not achieve the target burial depth and would require cable protection in the form of rock placement, concrete mattresses, or half-shells (BOEM 2021a). While cables are typically marked on nautical charts to aid in avoidance, mobile bottom-tending gear (trawl and dredge gear) could be snagged on these cable protection measures and cause damage or gear loss. The extent of economic impacts due to gear damage or loss would vary depending on the extent of damage to the fishing gear. To avoid these economic impacts, some vessel operators may not trawl or dredge over inter-array or export cables, but this could result in increased operating costs (e.g., additional fuel to arrive at more distant locations, additional crew compensation due to more days at sea) or lower revenue (e.g., fishing in a less-productive area or for a less valuable species).

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

Fishing vessel operators unwilling or unable to travel through or deploy fishing gear in WDAs may be able to find suitable alternative fishing locations and continue to earn revenue, while others may prefer to switch the species they target or the gear they use, behaviors similar to those of fishers experiencing reduced access to fisheries due to the cumulative effect of fishing regulations (Murray et al. 2010) or shifting species composition due to climate change and warming waters (Papaioannou et al. 2021). Both scenarios involve adaptive behavior and some measure of tolerating risk on the part of fishers, and not all fishers are willing to do so. O'Farrell et al. (2019) found some fishers have low vessel mobility, less explorative behavior, are risk averse, and take shorter trips, while others have high mobility, a greater explorative behavior, are tolerant of risk, and conduct longer trips. Papaioannou et al. (2021) also found that smaller trawlers had a higher affinity for their fishing grounds and were less likely to switch fishing grounds than larger trawlers and, if they do seek alternative fishing locations, it is often within rather than beyond their "traditional" fishing grounds.

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

Space use conflicts could cause a temporary or permanent reduction in fishing activities and fishing revenue, as some displaced fishing vessels may not opt to, or may not be able to, fish in alternative fishing grounds. Potential increases in structure-affiliated species (e.g., black sea bass) may result in an increase in for-hire recreational vessel trips in and around turbine structures. This may result in increased gear or space use conflicts as commercial fisheries and for-hire recreational fishing compete for space between turbines. Commercial fishing vessels, particularly those using mobile gear, which typically fish in areas designated as a WEA may be displaced, and this relocation of fishing activity outside of offshore wind lease areas could increase conflict among commercial fishing interests as other areas are encroached. The competition is expected to be higher for less-mobile species such as lobster, crab, surfclam/ocean quahog, and sea scallop.

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

Table 3.6.1-15 shows the annual commercial fishing revenue exposed (i.e., the amount of revenue that could be potentially affected by WEA development) to offshore wind energy development in the Mid-Atlantic and New England regions by FMP fishery from 2021 through 2030 (NMFS 2021f). However, these amounts represent a lower-bound estimate of the maximum exposed revenue, as it is calculated using average historical revenue overlapping the WEAs and is based on vessel trip reporting data, which do not fully capture all fishery operations in the WEAs.

The amount of revenue at risk increases as proposed offshore wind energy projects are constructed and come online and would continue beyond 2030 during the continued operational phases of the offshore wind energy projects. The largest impacts in terms of exposed revenue are expected to be in the sea scallop, other FMP, non-disclosed species, and non-FMP fisheries, and surfclam/ocean quahog FMP fisheries. The maximum exposed revenue is projected to occur in 2030, but exposure will continue to increase in years thereafter until facilities are decommissioned.

Table 3.6.1-15. Annual commercial fishing revenue (in $1,000s) exposed to offshore wind energy development in the New England and Mid-Atlantic regions under the No Action Alternative by Fishery Management Plan

FMP Group	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030*
Mackerel, Squid, and Butterfish	$0.11	$0.11	$388.43	$625.18	$821.63	$1,187.76	$1,341.04	$1,474.91	$1,608.77	$1,608.77
Summer Flounder, Scup, Black Sea Bass	$0.15	$0.15	$306.08	$458.93	$641.68	$913.00	$1,098.87	$1,263.83	$1,428.79	$1,428.79
Northeast Multispecies(small-mesh)	$0.00	$0.00	$143.55	$185.44	$275.53	$366.48	$394.86	$411.72	$428.57	$428.57
Skates	–	–	$260.53	$299.64	$360.34	$455.44	$506.68	$538.91	$571.14	$571.14
American Lobster	$0.00	$0.00	$331.97	$377.13	$449.60	$606.01	$705.63	$760.30	$814.98	$814.98
Monkfish	$0.00	$0.00	$439.94	$513.04	$620.05	$784.47	$888.22	$970.77	$1,053.31	$1,053.31
Sea Scallop	$0.00	$0.00	$465.66	$2,709.55	$2,983.86	$7,927.08	$12,794.32	$17,634.56	$22,474.79	$22,474.79
Jonah Crab	$0.00	$0.00	$56.46	$93.99	$239.69	$326.31	$350.67	$371.17	$391.68	$391.68
Other FMPs, non-disclosed species and non-FMP fisheries	$0.42	$0.42	$783.50	$936.47	$1,123.64	$1,723.86	$2,137.48	$2,519.32	$2,901.16	$2,901.16
Golden and Blueline Tilefish	–	–	$4.14	$9.60	$55.69	$76.27	$81.37	$86.35	$91.33	$91.33
Northeast Multispecies (large-mesh)	–	–	$182.64	$197.21	$214.93	$264.12	$286.49	$300.78	$315.07	$315.07
Bluefish	$0.00	$0.00	$5.92	$8.51	$12.56	$16.08	$18.06	$19.60	$21.13	$21.13
Spiny Dogfish	–	–	$21.46	$28.71	$33.55	$39.48	$43.59	$45.70	$47.80	$47.80
Surfclam, Ocean Quahog	–	–	$132.53	$169.30	$792.71	$1,191.92	$1,591.13	$1,990.34	$2,389.56	$2,389.56
Atlantic Herring	–	–	$65.78	$97.88	$117.20	$169.57	$211.01	$243.39	$275.78	$275.78
Highly Migratory Species	$0.00	$0.00	$0.15	$0.21	$0.63	$0.86	$1.09	$1.31	$1.52	$1.52
All FMP and non-FMP Fisheries	$0.69	$0.69	$3,588.73	$6,710.80	$8,743.28	$16,048.69	$22,450.51	$28,632.95	$34,815.38	$34,815.38

Source: NMFS 2021f and excludes the Proposed Action.

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

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

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

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

Once offshore wind projects are completed, some commercial fishers may avoid the offshore wind lease areas if large numbers of recreational fishers are drawn to the areas by the prospect of higher catches. WTG foundations and associated scour protection may produce an artificial reef effect, potentially increasing fish and invertebrate abundance within a facility's footprint (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). According to ten Brink and Dalton (2018), the influx of recreational fishermen into the Block Island Wind Farm caused some commercial fishers to cease fishing in the area because of vessel congestion and gear conflict concerns. If these concerns cause commercial fishers to shift their fishing effort to areas not routinely fished, conflict with existing users could increase as other areas are encroached. In general, the potential for conflict among commercial fishers due to fishing displacement may be higher for fishers engaged in fisheries that have regulations that constrain where fishing can occur, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishers, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to offshore wind energy facilities by the artificial reef effect, and fishers targeting these species concentrate their fishing effort in offshore wind lease areas as a result. Overall, the adverse impacts from vessel traffic would be long term and moderate.

Climate change: Climate change is affecting commercial fisheries and for-hire recreational fishing and is predicted to continue to do so. The primary driver of climate change-induced impacts on fisheries resources stems from an increase in sea surface and bottom temperature resulting in shifts in distribution, habitat utilization, and movement (Fabrizio et al. 2014; Hopkins and Cech 2003; Secor et al. 2019; Sims et al. 2002). These shifts in species distribution have changed, and will continue to change, the distribution of commercial fishing effort, impacting commercial and for-hire recreational fishermen and coastal communities (Hare et al. 2016; Rogers et al. 2019). Ocean acidification, resulting from enriched levels of CO_2 in the marine environment, may impact growth and survival of many important crustacean and bivalve species including lobster, oyster, and scallops (Talmage and Gobler 2010; Keppel et al. 2012).

Additional impacts on commercial fisheries and for-hire recreational fishing can result from climate change events such as an increase in the magnitude and frequency of storms and shoreline changes due to sea level rise. Increased freshwater input into nearshore estuarine habitats from stronger and more frequent precipitation events can result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016). These effects may directly or indirectly impact commercially and recreationally important species and result in a decrease in catch or an increase in fishing costs (e.g., transit costs to other fishing grounds, need to switch to different fishing gear to target a different species). Thus, the viability of businesses engaged in or supporting commercial fisheries and for-hire recreational fishing could be affected. The economies of communities reliant on commercial and for-hire recreational fisheries may also be vulnerable to climate change-induced effects, as fishing-related infrastructure near the shore could be adversely affected by sea level rise (Colburn et al. 2016).

3.6.1.3.2 Conclusions

Under the No Action Alternative, commercial fisheries and for-hire recreational fishing would continue to follow current regional trends and respond to current and future environmental trends and societal activities.

Although the Project would not be built as proposed under the No Action Alternative, BOEM expects planned and ongoing offshore wind activities and future non-offshore wind activities to have continuing temporary to long-term impacts (displacement, space use conflicts, navigational and fishing hazards, changes in target species abundance and distribution) on commercial fisheries and for-hire recreational fishing, primarily through new cable emplacement, noise, port expansion, presence of structures, vessel traffic, and ongoing climate change. The extent of impacts on commercial fisheries and for-hire recreational fishing would vary by fishery due to different target species, gear type, and location of activity.

BOEM anticipates **moderate** to **major** long-term impacts on commercial fisheries and **moderate** long-term impacts on for-hire recreational fisheries as a result of ongoing activities other than offshore wind. This is largely driven by the effects of climate change and the ability for fisheries management agencies to readily adapt to changing distributions, and other climate-related effects.

In addition to ongoing activities, reasonably foreseeable (i.e., planned) activities other than offshore wind may also contribute to impacts on commercial fisheries and for-hire fishing, particularly from increased vessel traffic and climate change. BOEM anticipates **moderate** to **major** long-term impacts on commercial fisheries from planned actions other than offshore wind (dependent largely on the ability for management to adapt to climate change). For-hire recreational fisheries would experience **moderate** long-term impacts due to the potential need to shift fishing grounds as well as ongoing effects of climate change. In the context of reasonably foreseeable trends (e.g., environmental, infrastructure) BOEM expects the combination of ongoing activities and reasonably foreseeable activities other than offshore wind to result in **moderate** to **major** long-term impacts on commercial fisheries and **moderate** long-term impacts on for-hire recreational fisheries.

Considering all the IPFs together, BOEM anticipates the overall impacts associated with offshore wind activities in the geographic analysis would result in **major** long-term impacts on commercial fisheries and **moderate** long-term impacts on for-hire recreational fishing due primarily to the presence of structures (e.g., through gear loss, navigational hazards, space use conflicts, and potential impacts on fisheries surveys), new cable emplacement and from pile-driving noise. The presence of structures may also induce a **moderate beneficial** long-term impact, particularly on the for-hire recreational fishing.

The No Action Alternative would forgo any current or planned fisheries monitoring that may be performed by US Wind, the results of which could provide an understanding of the effects of offshore wind development in and around the Project area, benefit future management of commercial and for-hire fisheries and inform planning of other offshore developments. However, other ongoing and future surveys could still provide similar data to support similar goals.

3.6.1.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-1) would influence the magnitude of the impacts on commercial fisheries and for-hire recreational fishing.

- The export cable landfall's potential to interfere with nearshore fishing grounds during construction.
- The route of the inter-array cables and the offshore export cable, including the ability to reach target burial depth.
- The type of cable protection measures when burial depth is insufficient. Cables that may not achieve the proper burial depth and would require cable protection in the form of rock placement, concrete mattresses, or half-shells. Such covers can change the fish habitat (soft-bottom habitat to hard-bottom habitat) and can also damage fishing gear and equipment, which in turn could cause a potential safety hazard should gear snag or hook on to seafloor structures.
- The time of the year during which construction occurs. For-hire recreational fisheries are generally most active when the weather is more favorable, while commercial fishing is active year-round with many species harvested throughout the year. However, certain fisheries have peak times. Construction activities can affect access to fishing areas and availability of fish in the area, thereby reducing catch and fishing revenue.

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

- WTG and OSS number, size, and location: the level of impacts related to presence and location of structures. The number and size of WTGs and OSSs will influence the magnitude of impacts stemming from navigation, accessibility/displacement, and habitat conversion effects. Because known fishing grounds exist within the Project area (e.g., Triangle Reef), presence or lack of structures on or in the vicinity of these grounds will greatly influence the magnitude of impact.
- Season of construction: although commercial and for-hire recreational fishing occurs year-round, most for-hire recreational fishing occurs April through October. Construction outside of this window would have a lesser effect on commercial fisheries and for-hire recreational fishing than construction during the active season.

3.6.1.5 Impacts of Alternative B – Proposed Action on Commercial Fisheries and For-Hire Recreational Fishing

3.6.1.5.1 Construction and Installation

3.6.1.5.1.1 Onshore Activities and Facilities

Port Utilization: Construction of the Project would require a range of construction and support vessels, including vessels for transferring crew, transporting heavy cargo, and conducting heavy lifts, as well as multipurpose vessels and barges. All these vessels would add traffic to port facilities and would require berthing. For the Project, construction vessels would travel between the Lease Area and the following ports that are expected to be used during construction: Sparrows Point, Maryland, as the primary fabrication facility, storage, and load out site for construction activities; and Ocean City, Maryland; Portsmouth, Virginia; Port Norris, New Jersey; and Lewes, Delaware, as the primary support ports for crew transfers and large vessels (COP, Volume I, Table 3-1; US Wind 2023).

Sparrows Point in Baltimore, the primary port used for the Project's construction activities, is not heavily used by offshore commercial fishing vessels or for-hire recreational fishing vessels, and mostly serves as a regional industrial port. The additional vessel volume in the ports associated with Project construction could cause vessel traffic congestion, difficulties with navigating, and an increased risk for collisions, together with reduced access to high-demand port services (e.g., fueling, provisioning) by existing port users, including commercial and for-hire recreational fishing vessels. Therefore, the Proposed Action would generate temporary and negligible to moderate impacts on commercial fisheries and for-hire recreational fishing associated with port utilization.

The moderate impacts of port utilization under the Proposed Action alone would not considerably increase the level of impact under the No Action Alternative. In the context of reasonably foreseeable environmental trends, combined impacts due to port utilization from ongoing and planned actions, including the Proposed Action would be negligible to moderate temporary impacts.

3.6.1.5.1.2 Offshore and Inshore Activities and Facilities

BOEM expects construction and installation to affect commercial fisheries and for-hire recreational fishing resources through the following primary IPFs: anchoring, cable emplacement and maintenance, noise, presence of structures, vessel traffic, and climate change.

Anchoring: Vessel anchoring would cause temporary impacts on fishing vessels and fishing activities. Anchoring vessels (including jack-up and grounding) would pose a navigational hazard to fishing vessels, but US Wind does not anticipate using an anchored vessel for installation of monopiles. All impacts would be localized and potential navigation hazards would be temporary (hours to days). The anticipated impacts on commercial fisheries and for-hire recreational fishing of anchoring would be minor.

Construction of other offshore wind projects would include vessel anchoring during survey activities and the construction of offshore components. In addition, there could be increased anchoring/mooring of met/ocean buoys. All impacts would be localized and temporary (hours to days). In the context of reasonably foreseeable environmental trends, combined anchoring impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned actions would likely be minor and temporary.

Cable emplacement and maintenance: The Proposed Action would include approximately 125.6 miles (204.2 kilometers) of inter-array cables, approximately 142.5 miles (229.3 kilometers) of offshore export cables and 42.2 miles (68.0 kilometers) of inshore export cable, US Wind proposes to bury the inter-array and inshore export cables to a target depth of 3.3 to 6.6 feet (1 to 2 meters) and the offshore export cables to 3.3 to 9.5 feet (1 to 3 meters), but not more than 13.1 feet (4 meters). Cable installation would begin with route clearance activities including a pre-installation survey and grapnel run to remove debris which would be disposed of in appropriate shore side facilities. Pre-installation seabed preparations such as leveling, pre-trenching or boulder removal are not currently expected. Cable installation would use water jetting technology which allows for direct installation and burial of the cable and is regarded as the most environmentally sensitive installation methods compared to mechanical dredging and other plowing methods. US Wind estimates a maximum of 10 percent of the offshore export cable would require additional protection such as concrete mattresses and scour protection but is likely to be significantly less (COP, Volume II, Section 3.6.1). Cable-laying activities, including route clearance activities, would directly disrupt commercial and for-hire recreational fishing in areas of active construction, although disruption in any given area would be temporary. As indicated in Sections 3.5.2 and 3.5.5, hard clam landings occur in inland bays of Delaware, but the proposed inshore export cable route occurs in a previously disturbed area within the bay and impacts to hard clam landings are unlikely to occur.

For export cable and inter-array cable installation, US Wind expects to use a specialized cable-laying vessel. Fishing activities for all gear types could be disrupted during periods of active cable site preparation and installation along the inter-array and export cable routes. Fishing vessels may not have access to affected areas, which could lead to reduced revenue if alternative fishing locations are not available or there is increased conflict over other fishing grounds.

Overall, cable-laying activities would not restrict large areas, and navigational impacts would be on the timescale of hours to days. In the context of reasonably foreseeable environmental trends, the combined impacts from new cable emplacement and maintenance activities on commercial fisheries and for-hire recreational fishing from ongoing and planned actions, including the Proposed Action would likely be localized, temporary minor impacts.

Noise: The types of impacts from construction noise of the Proposed Action on commercial fisheries and for-hire recreational fisheries described for the No Action Alternative would also occur under the Proposed Action. Noise impacts associated with offshore construction activities for up to 119 foundations, including pile-driving, trenching for cable placement, G&G investigations, and vessels, could cause indirect impacts on commercial and for-hire recreational fisheries within the Lease Area through their direct impacts on species targeted by the commercial and for-hire fisheries.

Noise can temporarily disturb fish and invertebrates in the immediate vicinity of the source, causing a temporary behavior change, including leaving the area affected by the sound source. Impacts on commercial fisheries and for-hire recreational fishing would depend on the duration of the noise -producing activity. Once the noise-generating activity ceases, most fish and invertebrate species would return to or recolonize the affected area. Therefore, impacts from noise-generating activities on commercial and for-hire recreational fisheries are anticipated to be temporary and negligible to minor impacts from the Proposed Action alone.

The negligible to minor impacts of noise under the Proposed Action alone would not considerably increase the impacts of noise beyond the impacts under the No Action Alternative. In the context of reasonably foreseeable environmental trends, combined noise impacts from ongoing and planned actions, including the Proposed Action would be similar to the impacts under the No Action Alternative, and would range from negligible to moderate temporary impacts.

Presence of structures: The various types of impacts on commercial fisheries and for-hire recreational fishing that could result from the presence of structures are described in detail in Section 3.6.1.2, *Future Offshore Wind Activities (without Proposed Action)*. The Proposed Action may result in the installation of up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower foundations.

The installation of components, as well as the presence of construction vessels and permanent structures, could restrict harvesting and fishing activities in the Project area. The location of the proposed infrastructure within the Project area could affect transit corridors and access to preferred or traditional fishing locations. Transiting through the Project area could also create challenges associated with using navigational radar when there are many radar targets that may obscure smaller vessels and where radar returns may be duplicated under certain meteorological conditions like heavy fog. Larger vessels may find it necessary to travel around the Project area to avoid maneuvering among the WTGs.

The impacts from structures associated with the Proposed Action on commercial fisheries and for-hire recreational fishing are similar to those presented for other projects and are anticipated to range from negligible to major for the Proposed Action. However, the Proposed Action would not increase the impacts across entire fisheries beyond those impacts expected under the No Action Alternative. However, impacts on local commercial fisheries and for-hire recreational fishing in the Lease Area would be greater than under the No Action Alternative. Magnitude of impact will also vary depending on distance from the Project area, vessel size, and type of gear used (e.g., large mobile-gear vessels would be affected more than smaller fixed-gear vessels). There would also be a minor beneficial impact on local for-hire recreational fishing (e.g., from fish aggregation effects).

In the context of reasonably foreseeable environmental trends, the combined impacts from the presence of structures on commercial fisheries and for-hire recreational fishing from ongoing and planned actions, including the Proposed Action, would likely range from negligible to major long-term impacts.

Vessel traffic: The Proposed Action would generate a small increase in vessel traffic compared to the planned activities scenario (Appendix D), with a peak during the Project construction. The installation of offshore components for the Project and the presence of construction vessels (up to 37 construction vessels operating at any given time) could temporarily restrict fishing vessel movement and thus transit and harvesting activities within the Lease Area and along the Offshore Export Cable Route. Construction support vessels, including vessels carrying assembled WTGs or WTG components, would be present in the waterways between the Wind Farm Area and the ports used during the Proposed Action construction and installation.

The Proposed Action would result in the use of numerous vessels operating at some phase during construction and installation, with most transiting to and from the Project area from Baltimore, Maryland. Based on information provided by US Wind, the Proposed Action would generate a total of 2,343 vessel trips (round trips) over the 3-year construction and installation phase and approximately the same number of vessel trips per year during decommissioning as during construction and installation. The construction vessels that would be used for Project construction are described in the COP (Volume I, Chapter 4.0 and Table 4-1; US Wind 2023).

Fishing vessels transiting in proximity to the Project area or ports being utilized by construction and installation vessels would be required to avoid Project vessels and restricted safety zones though routine adjustments to navigation. Although fishing vessels may experience increased transit times in some situations, these situations are spatially and temporally limited, and, overall, BOEM expects vessel activities in the open waters between the Lease Area and ports and along the Offshore Export Cable Route to have minor impacts on fishing vessels during the construction and installation phase.

Ongoing activities, future activities, and other offshore wind development could incrementally affect commercial fishing vessels as more projects are developed. In the context of reasonably foreseeable environmental trends, the combined impacts from increased vessel traffic on commercial fisheries and for-hire recreational fishing from ongoing and planned actions, including the Proposed Action would range from minor to moderate temporary impacts.

Climate change: As described under the No Action Alternative (Section 3.6.1.3), climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters and shifting species distributions, influencing the distributions of commercial and for-hire recreational fisheries. Ocean acidification has impacts on the settlement and survival of shellfish (PMEL n.d.) and would contribute to potential alterations in finfish migration patterns or reductions in invertebrate populations for species with calcareous shells. These impacts could lead to changes in migratory patterns, timing, available fisheries resources, and prey abundance and distribution. However, the implementation of offshore wind projects such as the Proposed Action would likely result in a long-term net decrease in greenhouse gases. Whie the decrease may not be measurable, it would be expected to help reduce climate change to some degree, although any negligible benefit would only last until the Project is decommissioned. The intensity of impacts resulting from climate change are uncertain, but are likely to be minor to moderate. The intensity and type of impacts in the context of reasonably foreseeable environmental trends and planned actions, including the Proposed Action resulting from climate change are uncertain, but are likely to be moderate long-term impacts.

3.6.1.5.2 Operations and Maintenance

3.6.1.5.2.1 Onshore Activities and Facilities

Port Utilization: During O&M, port facilities would be used by support vessels for maintenance of Project infrastructure. These vessels would require dock space and would add traffic to port facilities, which could result in reduced access to port services such as fueling and provisioning. However, compared to the construction and installation phase of the Project, the O&M portion of the project would require a more limited number of vessels. Given the limited number of vessels required, impacts on commercial fisheries and for-hire recreational fishing from port utilization would be negligible.

Project-related O&M activities such as WTG and OSS maintenance activities, routing inspections, and other maintenance activities requiring deep-draft vessels or jack-up barges will be predominantly based out of Ocean City and Sparrows Point, Maryland (COP, Volume I, Tables 2-6 and 3-1; US Wind 2023). The Project would use a variety of vessels to support O&M activities, including crew transfer vessels, service operation vessels, jack-up vessels, and supply vessels. The Project would generate an average of 822 vessel trips per year for O&M activities (COP, Volume II, Appendix C1; US Wind 2023).

Ocean City is also used by commercial fishing vessels and for-hire recreational fishing vessels and is among the top five for commercial fishing revenue attributed to catch from the Lease Area between 2008 and 2019 (Table 3.6-9). The additional vessel volume in this port associated with the Project's O&M activities could cause vessel traffic congestion, difficulties with navigating, and an increased risk for collisions, together with reduced access to high-demand port services (e.g., fueling, provisioning) by existing port users, including commercial and for-hire recreational fishing vessels. Therefore, the Proposed Action would generate long term and negligible to moderate impacts on commercial fisheries and for-hire recreational fishing associated with port utilization during O&M.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined port utilization impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind, which would be negligible to moderate and long-term.

3.6.1.5.2.2 Offshore and Inshore Activities and Facilities

The Project would require routine, preventive maintenance and equipment inspections. Impacts from climate change would be the same as during construction. Because vessel traffic would be significantly less during operations than during construction, impacts from anchoring, noise, and vessel traffic (including space use conflicts) would be less than during construction. Noise from pile-driving and other installation-related noise such as G&G surveys prior to foundation emplacements and trenching would not occur during the operations phase; therefore, those impacts would not occur. Beyond the IPFs listed above, BOEM expects O&M to affect commercial and for-hire recreational fisheries resources through the following IPFs: cable emplacement and maintenance and presence of structures.

Anchoring: Although anchoring impacts would primarily occur during Project construction, some impacts could also occur during O&M. Anchoring vessels and other structures used in O&M of the Project would pose a navigational hazard to fishing vessels. O&M activities for the Project include routine operating procedures for WTGs, OSSs, foundations, inter-array and offshore export cables and would occur on a predefined routine basis. More details on Project O&M details can be found in the COP (Volume I, Chapter 6.0; US Wind 2023). Corrective or non-routine maintenance would also be possible throughout the life of the Project. Anchoring activities associated with O&M would be similar to construction but with shorter duration. These impacts would be localized (within a few hundred meters of anchored vessels) and temporary (hours to days in duration). Adverse effects of offshore wind energy-related anchoring on commercial fisheries and for-hire recreational fishing are expected to be long term, though periodic in nature, and minor.

Cable emplacement and maintenance: The COP (Volume I, Section 6.1.5; US Wind 2023) describes the routine operating procedures for power cables, which include remote monitoring, surveys to monitor cable depth, and reburial or placement of additional protective measures as required. Non-routine emergencies could also occur that would require major repair work to export or inter-array cables. If cable repairs are needed, support vessels would temporarily impact commercially important fish and invertebrate species, but only in a localized area immediately adjacent to the repair location. Commercial and for-hire recreational fishing vessels would also be excluded from small areas during routine cable surveys, which are expected to occur in year 1, year 3, and then every 5 years thereafter. Assuming repairs would be infrequent and would affect only small segments of the cables, impacts on commercial fisheries and for-hire recreational fishing from cable maintenance would be negligible.

In the context of reasonably foreseeable environmental trends, the impacts cable emplacement and maintenance from ongoing and planned actions would be similar to the impacts under the No Action Alternative and would likely qualify as minor and long-term.

Noise: Noise impacts associated with O&M activities for the Proposed Action include operation of the up to 121 WTGs (PDE), routine inspections of project components, and vessel traffic. While noise associated with operational WTGs may be audible to some finfish and invertebrates, this would only occur at relatively short distances from the WTG foundations, and there is no information to suggest that such noise would negatively affect this resource (English et al. 2017). Therefore, noise impacts from operating WTGs on commercial and for-hire recreational fisheries would be unlikely.

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

Noise from vessels would be considered low intensity and would not be expected to affect species on a fisheries level; therefore, impacts on commercial and for-hire recreational fisheries would be minor.

For all the above noise-generating activities, once the activity ceases, most fish and invertebrate species would be expected to return to or recolonize the affected area. Therefore, impacts from noise -generating activities on commercial and for-hire recreational fisheries would be temporary and minor to moderate, depending on the need for G&G activities.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined noise impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind. Noise impacts would depend on the timing and overlap of disturbance areas, but would be moderate and long-term, with a vast majority of the contribution coming from G&G activities, if needed.

Presence of structures: The presence of structures can lead to impacts on commercial and for-hire recreational fisheries through navigation hazards and allisions, entanglement and gear loss/damage, fish aggregation, habitat conversion, migration disturbances, space use conflicts, and effort displacement. The Proposed Action would result in the placement of up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower foundations within the Lease Area.

Marine traffic patterns were identified from multiple sources, including AIS, and VMS, which showed that fishing vessels predominantly crossed the Lease Area in an east-west direction, between Ocean City and the eastern fishing grounds. Active fishing vessels were identified as transiting less than 5 knots (9.3 km/h). The vessels transiting from Ocean City were almost exclusively identified as fishing for scallops or surfclam/ocean quahog (Figures 3.6.1-14 and 3.6.1-15). The primary fishing gear utilized in the vicinity of the Lease Area includes dredges, trawls, gillnets, and pots or traps. Fishers have expressed specific concerns about fishing vessels operating trawl gear, as described for the No Action Alternative (Section 3.6.1.3). US Wind's Navigation Safety Risk Assessment (NSRA) (COP, Volume II, Appendix K1; US Wind 2023) concluded that the spacing between WTGs in the evaluated layout provides sufficient room for maneuvering and fishing within the Lease Area. The average fishing vessel in the Traffic Survey Area has a length of 75 feet (23 meters) and therefore, there is an average of 56 vessel lengths between any two Project structures, allowing ample space for trailing gear.

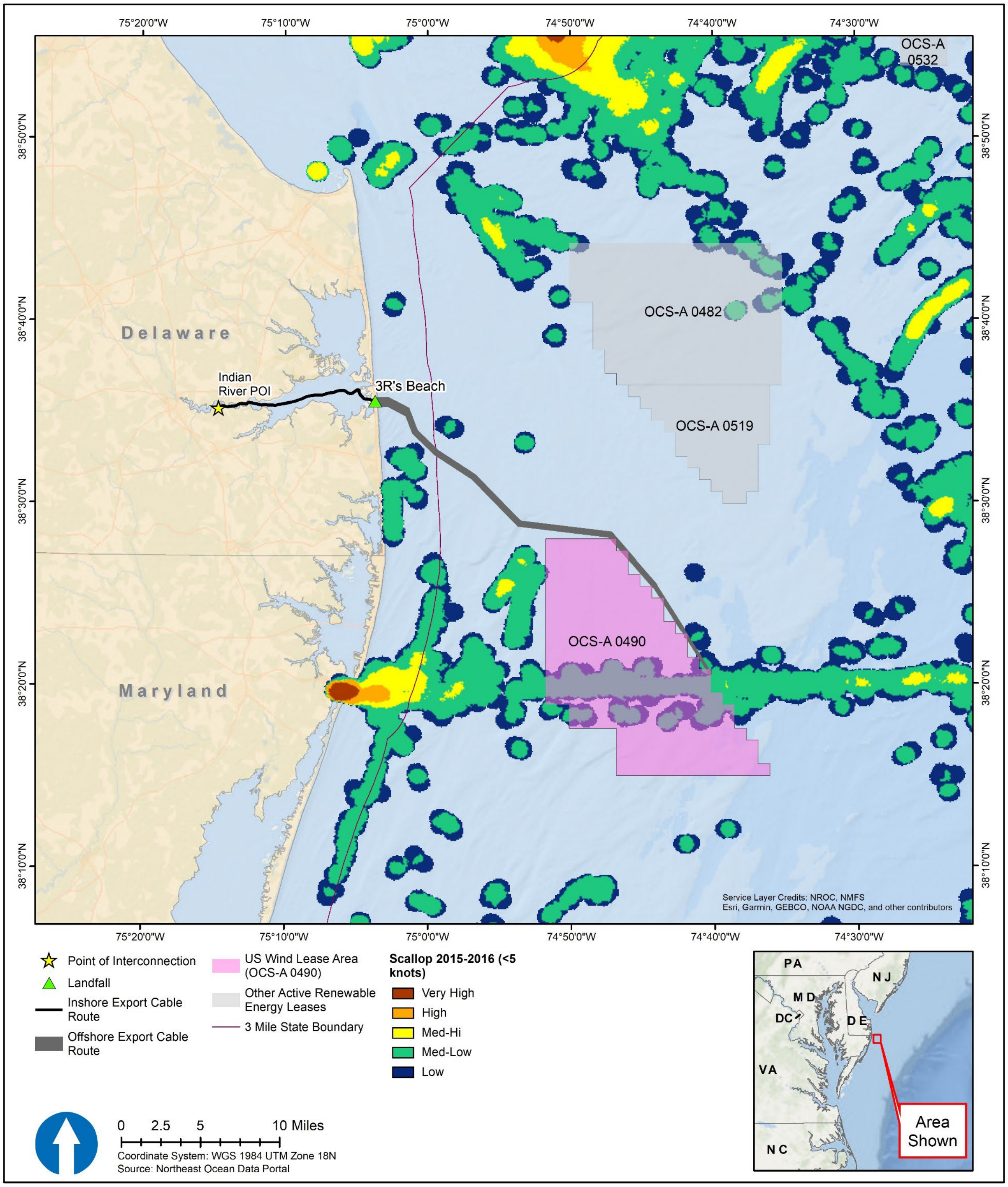


Figure 3.6.1-14. Scallop commercial fishing vessel activity (2015-2016) in the Project area

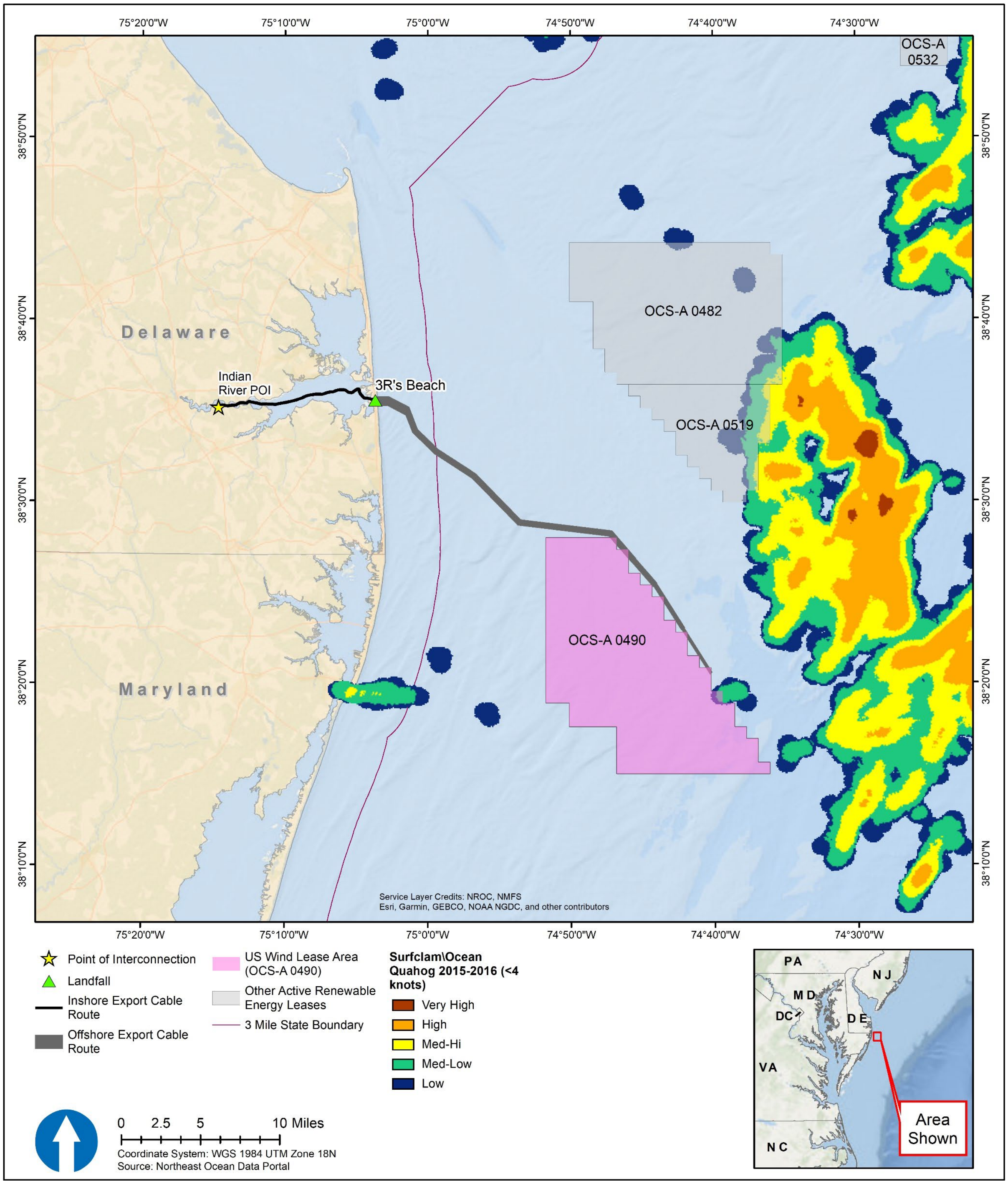


Figure 3.6.1-15. Surfclam commercial fishing vessel activity (2015-2016) in the Project area

While the NSRA shows that it is technically feasible to navigate and maneuver fishing vessels and mobile gear through the Lease Area, BOEM is aware that maneuverability within the Lease Area may vary depending on many factors, including vessel size, fishing gear or method used, communication with nearby vessels, and environmental conditions such as wind, sea state, current, and visibility. BOEM also recognizes that even when it is feasible to fish within the Lease Area, some fishermen might still not consider it safe to do so. Furthermore, operating within the Lease Area with other vessels and gear types present may restrict vessel maneuverability. Fishing in the Lease Area would not be as problematic for for-hire recreational fishing vessels that bottom fish with hook and line gear because these vessels generally operate over a fixed location or under a controlled drift. However, fishing for HMS may involve troll gear using many feet of lines and hooks behind the vessel, and in turn, following large pelagic fish once they are hooked; these activities pose additional maneuverability challenges when structures are present.

A collision or allision from a multiple-vessel interaction is possible during the operational lifetime of the Project. The most recent available USCG Marine Casualty and Pollution Data (Marine Information for Safety and Law Enforcement [MISLE] system) was analyzed for the 13.5-year period from January 2002 to July 2015 (COP, Volume II, Appendix K1; US Wind 2023). The average number of Marine Casualty cases per year was 1. The involved vessels were primarily recreational, passenger, and commercial fishing. Allisions with offshore structures at speeds less than 4 knots (7.4 km/h) would most likely result in some damage to the vessel but no damage to the structure. At speeds greater than 4 knots (7.4 km/h), significant vessel damage is likely with potential for damage to the structure. Fishing vessels transit from Ocean City and the fishing grounds through the Lease Area at an average speed between 9 and 15 knots (16.7 and 27.8 km/h); however, the risk of allisions would be mitigated through navigational lighting requirements and AIS transponders on foundations. The potential changes in fishing vessel transit routes or availability of fishing grounds due to the presence of structures could have long-term moderate impacts on commercial fisheries and for hire recreational fishing due to increased navigation time, increased fuel costs, and displacement from prime or preferred fishing grounds.

Commercial and recreational fishing gear is periodically lost due to entanglement with buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, temporary impacts on fish, invertebrates, and habitat, but would likely cause no impacts at a fishery level. The proposed new structures would increase the risk of gear loss/damage by entanglement and could affect fishing vessels differently depending on the size of the vessel and the fishing gear. The extent of the impacts would depend on the vessel size, the fishing gear, and foundation locations. Larger vessels with mobile gear are the most at risk for entanglement, as they are the most limited in maneuverability and are towing large gear (trawl nets). US Wind has established a process for gear loss compensation for commercial fishermen to mitigate gear and revenue losses over the life of the Project. The impact from gear loss and damage is expected to have a moderate impact on commercial fisheries and a minor impact on for-hire recreational fishing, as the impacts would be localized to known/charted infrastructure. However, the risk of impacts would persist for as long as the structures remain.

Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon vertical relief that aggregates structure-oriented fishes. These impacts are localized and can be temporary to permanent (as long as structures are in place). Fish aggregation may be considered adverse, beneficial, or neutral. Commercial and for-hire recreational fishing can occur near these structures. However, commercial mobile fishing gear risks snagging on the structures while trying to take advantage of this aggregation. The proposed new infrastructure would modify existing soft-bottom habitat, and to a lesser extent, hard-bottom habitat. Structure-oriented species would benefit (e.g., lobster, striped bass, black sea bass, scup, Atlantic cod); however, the local biomass increases are not anticipated to be significant. This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding on the communities, as well as increased private and for-hire recreational fishing opportunities around the infrastructure. Such changes could also result in increased space use conflicts between and within commercial and recreational fishing operations. These impacts would be both beneficial and adverse, likely resulting in minor impacts on commercial fisheries, negligible to minor impacts on for-hire recreational fisheries, and minor beneficial impacts on commercial and recreational fishery resources. Impacts are expected to be localized to the individual foundations and may be temporary to permanent (for as long as foundations are present).

Human-made structures in the marine environment (e.g., shipwrecks, artificial reefs, buoys, oil platforms) can affect finfish or invertebrates that approach the structures during migration. This could slow species migrations. Foundations would remain for the life of the Project, and scour/cable protection would likely permanently remain. However, temperature is expected to be a more substantial driver of habitat occupation and species movement and migratory animals would likely be able to proceed from structures unimpeded. Therefore, this impact is anticipated to be negligible on commercial fisheries and for-hire recreational fishing.

The presence of the turbines would affect the accessibility and availability of fish for commercial and for-hire recreational fishing for the life of the Project. In particular, the location of the turbines within the Lease Area could impact transit corridors and access to preferred fishing locations. Depending on the width and location of transit corridors through, or routes around, the Lease Area, commercial and for-hire recreational fishing fleets may find it more challenging to safely transit to and from homeports as there may be less space for maneuverability and greater risk of allision or collision if there is a loss of steerage. Transitioning through the Lease Area could also create challenges associated with using navigational radar when there are many radar targets that may obscure smaller vessels and where radar returns may be duplicated under certain meteorological conditions like heavy fog. Larger vessels may find it necessary to travel around the Lease Area to avoid maneuvering among the WTGs. Fishing vessels not able to travel through or deploy fishing gear within the Lease Area would need to travel longer distances access fishing locations, resulting in increased travel time and trip costs. Additionally, as commercial fishing vessels typically stay out at sea over multiple days, BOEM expects vessels would be navigating at nighttime or during adverse weather conditions.

NMFS (2021d, e) estimated that annual commercial fishing revenue from the US Wind Lease Area ranged from $126,000 (2019) to $501,000 (2009) between 2008 and 2019, with an annual average of

$274,000 during that time period (Table 3.6.1-16). The percentage of each permit's total commercial fishing revenue attributed to catch within the Lease Area during 2008 through 2021 was also analyzed to evaluate the economic importance of fishing grounds in the Lease Area across the commercial fishing fleet (NMFS 2022d). The vessel-level annual revenue percentages were divided into quartiles with the first quartile representing the lowest 25 percent of ranged percentages and the fourth quartile representing the highest 25 percent. The distribution of the vessel-level annual revenue percentages from the Lease Area is provided in the boxplot on Figure 3.6.1-16. The boxplot begins at the first quartile, or the value beneath which 25 percent of all vessel-level revenue percentages fall. A thick line within the box identifies the median, the observation that 50 percent of vessel-level revenue percentages are above or beneath. The box ends at the third quartile, or the vessel-level revenue percentage beneath which 75 percent of observations fall. Nonparametric estimates of the minimum and maximum values are also indicated by the "whiskers" (dashed line terminating in a vertical line) that jut out from each side of the box. Any points outside of these whiskers are vessel-level revenue percentages that are considered outliers, or a vessel that derived an exceptionally high proportion of its annual revenue from the Lease Area in comparison to other vessels that fished in the area.
Table 3.6.1-17 presents the minimum, first quartile, median, third quartile, and maximum values for the Lease Area from 2009 through 2021.

Table 3.6.1-16. Commercial fishing 12-year total revenue from MarWin (US Wind 1) and Momentum (US Wind 2)

Year	MarWin (US Wind 1)	Momentum (US Wind 2)	Total Revenue	Average Annual Revenue
2008	$223,000	$138,000	$361,000	$180,500
2009	$248,000	$253,000	$501,000	$250,500
2010	$201,000	$130,000	$331,000	$165,500
2011	$156,000	$101,000	$257,000	$128,500
2012	$130,000	$77,000	$207,000	$103,500
2013	$103,000	$83,000	$186,000	$93,000
2014	$122,000	$114,000	$236,000	$118,000
2015	$176,000	$160,000	$336,000	$168,000
2016	$186,000	$124,000	$310,000	$155,000
2017	$99,000	$97,000	$196,000	$98,000
2018	$130,000	$111,000	$241,000	$120,500
2019	$72,000	$54,000	$126,000	$63,000
Total	$1,846,000	$1,444,000	$3,290,000	$274,167

Source: NMFS 2021d, e; data current as of November 15, 2022

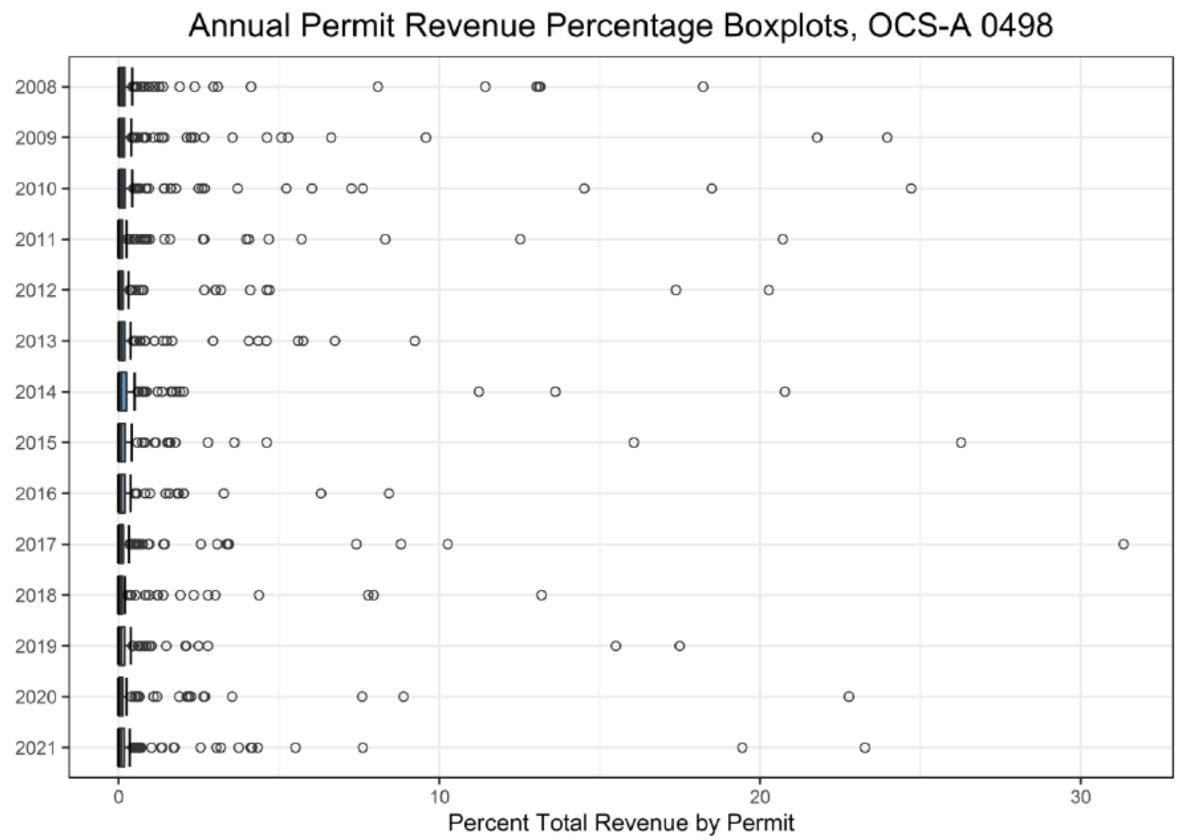


Figure 3.6.1-16. Percentage of total commercial fishing revenue of federally permitted vessels derived from the Lease Area by vessel (2008-2021)
Source: NMFS 2023

Table 3.6.1-17. Analysis of 14-year permit revenue boxplots for the Lease Area (2008-2021)

Min	1st Quartile	Median	3rd Quartile	Max
0%	0%	0.04%	0.15%	37%

Source: NMFS 2023

A total of 75 percent of the permitted vessels that fished the Lease Area derived less than 0.15 percent of their total annual revenue from the area (NMFS 2023). The highest percentage of total annual revenue attributed to catch within the Lease Area was 37 percent in 2017, but varied from year to year. Although outliers derived a high proportion of their annual revenue from the Lease Area in comparison to other vessels that fished in the area, Figure 3.6.1-16 shows that, in any given year, the revenue percentage for the majority of outliers was below 5 percent. As such, while some vessels depended heavily on the Lease Area for their commercial fishing revenue, most derived a small percentage of their total annual revenue from the area.

The economic impacts associated with lost fishing revenues would be less than the total annual revenue from within the Lease Area. Potential displacement of fishing vessels and increased competition on fishing grounds unoccupied by structures would have long-term impacts. Space use conflicts could cause a temporary or permanent reduction in fishing activities and fishing revenue, as some displaced fishing vessels may not opt to, or may not be able to, fish in alternative fishing grounds. Commercial fishing vessels have well established and mutually recognized traditional fishing locations. The relocation of fishing activity outside the Lease Area or Offshore Export Cable Route may increase conflict among fishermen as other areas are encroached. Competition is expected to be higher for less mobile species (e.g., lobster, crab, surfclam/ocean quahog, scallop). Structures associated with the Project could lead to fish aggregation of structure-oriented species, increasing the opportunities for for-hire recreational fishery resources. This could contribute to space use conflicts with the commercial fisheries within the Lease Area. US Wind has established a process for gear loss compensation to mitigate gear and revenue losses over the life of the Project. Moderate adverse impacts are expected on commercial fisheries, and minor to moderate impacts are expected on for-hire recreational fishery resources due to potential displacement and lost revenue.

Overall, the presence of structures could result in long-term minor to moderate impacts on commercial and for-hire recreational fisheries during O&M. In the context of reasonably foreseeable environmental trends, the impacts of the presence of structures from ongoing and planned actions would be similar to the impacts under the No Action Alternative and would depend on the timing and overlap of disturbance areas and would likely qualify as negligible to major.

Vessel traffic: Based on information provided by the US Wind, the Proposed Action would generate a total of 7,506 vessel trips (round trips) over the life of the project (COP, Volume II, Appendix C1; US Wind 2023) and could temporarily restrict fishing vessel movement and thus transit and harvesting activities within the Project area and along the inter-array and export cable routes. Overall, the adverse effects of vessel traffic on commercial and for-hire fishing vessels are expected to be moderate and long term.

While the Project area will not be closed to fishing during operation, routine maintenance and vessel traffic may cause congestion issues near and around the Project area for commercial and for-hire recreational fishing vessels. Vessels that choose to avoid the Project area could incur increased operating costs such as increased fuel costs due to longer transit times to and from more distant fishing grounds and additional crew compensation due to more days at sea, among other factors. These vessels could also experience lower revenue due to fishing potentially less-productive fishing grounds, potentially having to switch to less valuable species, and potentially encountering more competition for a given resource.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined vessel traffic impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind. Increased vessel traffic during the O&M time frame would result in moderate long-term impacts.

3.6.1.5.3 Conceptual Decommissioning

Conceptual decommissioning: BOEM expects the impacts of decommissioning to be similar to those described for construction and installation. All foundations/Project components (including cables) would be removed to 15 feet (4.6 meters) below the mudline (30 C.F.R. § 285.910(a)), unless other methods are deemed suitable through consultation with the regulatory authorities, including BOEM. Any cut and cleared cables would typically have the exposed ends weighted with clump anchors so that the cables cannot be snagged by fishing gear. Removal of structures that produce an artificial reef effect would result in loss of any beneficial fishery impacts that would have occurred during operations, but would also eliminate the potential allisions and snag hazards. Therefore, the impacts on commercial fisheries and for-hire recreational fishing from decommissioning would be negligible to major, with a moderate beneficial impact due to structure removal and the associated elimination of impacts associated with the presence of the foundations and other Project infrastructure.

In the context of reasonably foreseeable environmental trends, decommissioning impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned actions would likely be negligible to major and temporary.

3.6.1.5.4 Conclusions

Project construction and installation, O&M, and conceptual decommissioning could affect port and fishing access, as well as transit and harvesting activities, fishing gear interactions, and target species catch. BOEM anticipates the impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing would vary by fishery and fishing operation due to differences in target species abundance in the Project area, gear type, and predominant location of fishing activity. It is conceivable that some of the small number of fishing operations that derive a large percentage of their total revenue from areas where Project facilities would be located would choose to avoid these areas once the facilities become operational. In the event that these specific fishing operations are unable to find suitable alternative fishing locations, they could experience long-term, major disruptions. However, it is estimated that most vessels would only have to adjust somewhat to account for disruptions due to impacts. In addition, the impacts of the Proposed Action could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect. Therefore, BOEM expects the long-term impacts resulting from the Proposed Action would range from **negligible** to **major**, depending on the fishery and fishing operation.

In the context of reasonably foreseeable environmental trends in the area, the incremental impacts contributed by the Proposed Action to the overall impacts on commercial fisheries and for-hire recreational fishing would be substantial. BOEM anticipates the overall impacts on commercial fisheries and for-hire recreational fishing associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be **major** and long-term because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely, even with LPMs. This impact rating is primarily driven by climate change and the presence of offshore structures.

3.6.1.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Commercial Fisheries and For-Hire Recreational Fishing

The relevant change from the Proposed Action would be the inclusion of an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore

Export Cable Route). Alternative C would result in the same types of impacts on commercial fisheries and for-hire recreational fishing from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, although there may be slightly reduced construction impacts due to the relocation of the export cable route to avoid Indian River Bay and the Indian River. Under Alternative C, impacts on commercial fisheries and for-hire recreational fishing that would occur in Indian River Bay or the Indian River under the Proposed Action would not occur. Given that the portion of the export cable route in Indian River Bay is a relatively short section of the overall cable export, route, BOEM does not expect the avoidance of Indian River Bay or the Indian River to substantially reduce overall impacts on commercial fisheries and for-hire recreational fishing and would remain the same as for the Proposed Action (negligible to major).

In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C to the overall impacts on commercial and for-hire recreational fishing would be similar or slightly less than those described for the Proposed Action.

3.6.1.6.1 Conclusions

The anticipated **negligible** to **major** long-term impacts associated with Alternative C would not be substantially different than those of the Proposed Action. While this action alternative could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, operation, and decommissioning impacts would still occur. In addition, impacts could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect. When considering all the IPFs from ongoing and planned activities, including offshore wind, the long-term impact on commercial fisheries and for-hire recreational fishing would remain **major**.

3.6.1.7 Impacts of Alternatives D – No Surface Occupancy to Reduce Visual Impacts and E – Habitat Minimization on Commercial Fisheries and For-Hire Recreational Fishing

For Alternative D, the relevant change from the Proposed Action would be the removal of 32 WTGs and 1 OSS within 14 miles (22.5 kilometers) from shore to minimize visual impacts. For Alternative E, the relevant change from the Proposed Action would be the removal of 11 WTGs and repositioning of the Offshore Export Cable Route.

Even with removal of the WTGs, OSSs, and repositioning of the Offshore Export Cable Route, implementation of these action alternatives would result in most of the same types of impacts from all the IPFs on commercial fisheries and for-hire recreational fisheries from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, with some impacts being minimally decreased. The repositioning of the Offshore Export Cable Route in Alternative E may have additional benefits to commercial or recreational fisheries in that it preserves natural fish habitat of the area.

Alternatives D and E would reduce the overall footprint of the Project, providing more area within the Lease Area for commercial fishing vessels to operate and fish without potential impacts from structures, slightly reducing the potential for gear entanglement and loss, as well as allisions. There would likely be fewer construction vessel trips, slightly decreasing congestion and possibly slightly reducing the risk of vessel collisions.

In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by these action alternatives to the overall impacts on commercial fisheries and for-hire recreational fishing would be similar to or slightly less than those described under the Proposed Action.

3.6.1.7.1 Conclusions

The anticipated **negligible** to **major** long-term impacts associated with Alternatives D and E would not be substantially different than those of the Proposed Action. While these action alternatives could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, operation, and decommissioning impacts would still occur. In addition, impacts could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect. When considering all the IPFs from ongoing and planned activities, including offshore wind, the long-term impact on commercial fisheries and for-hire recreational fishing would remain **major**.

3.6.1.8 Comparison of Alternatives

As described in Section 3.6.1.4, the potential impacts associated with the Proposed Action in combination with ongoing and planned activities would likely be similar to impacts expected under the No Action Alternative. The Proposed Action would impact commercial fisheries and for-hire recreational fishing through anchoring, cable emplacement and maintenance, noise, port utilization, presence of structures, increased vessel traffic, and climate change. Under the No Action Alternative, these impacts would not occur as a direct result of the Proposed Action.

As discussed in Sections 3.6.1.5, 3.6.1.6, and 3.6.1.7 the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although the number of WTGs and OSSs and the route of the Offshore Export Cable Route vary slightly depending on the alternative, the long-term impacts on commercial fisheries and for-hire recreational fishing would likely be **negligible** to **major**, IPF dependent, for each action alternative. In addition, impacts could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect.

In the context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur under the same scenario (Appendix D). Therefore, impacts would only vary if the alternative's incremental contributions differ. BOEM expects individual long-term impacts on commercial fisheries and for-hire recreational fishing to range from **negligible** to **major**, depending on the IPF. The overall long-term impacts of any action alternative on commercial fisheries and for-hire recreational fishing when combined with past, present, and reasonably foreseeable activities would be **negligible** to **major**.

3.6.2 Cultural Resources

This section discusses potential impacts on cultural resources from the Proposed Action, action alternatives, and ongoing and planned activities in the cultural resources geographic analysis area. The cultural resources geographic analysis area (Figure 3.6.2-1) is equivalent to the Project's area of potential effects (APE), as defined in the implementing regulations for National Historic Preservation Act (NHPA) Section 106 at 36 CFR 800, Protection of Historic Properties. In 36 CFR 800.16(d), the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alteration in the character or use of historic properties, if any such properties exist." BOEM (2020) defines the Project APE as the following:

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

The term "cultural resources" refers to archaeological sites, buildings, structures, objects, and districts, which may include cultural landscapes and traditional cultural properties (TCP). These resources may be historic properties as defined in 36 CFR 800 and may be listed on national, state, or local historic registers or be identified as being important to a particular group during consultation. Federal, state, and local regulations recognize the public's interest in cultural resources. Many of these regulations, including NEPA and the NHPA, as well as the Maryland Historical Trust Act, which protects Maryland's historic properties, require a project to consider how it might affect significant cultural resources. Cultural resources in this section are discussed in terms of three categories: cultural resources landward of the shoreline (hereafter referred to as *onshore*), resources seaward of the shoreline (hereafter referred to as *offshore*), and resources within the viewshed from which Proposed Action elements would be visible (hereafter referred to as *visual*).

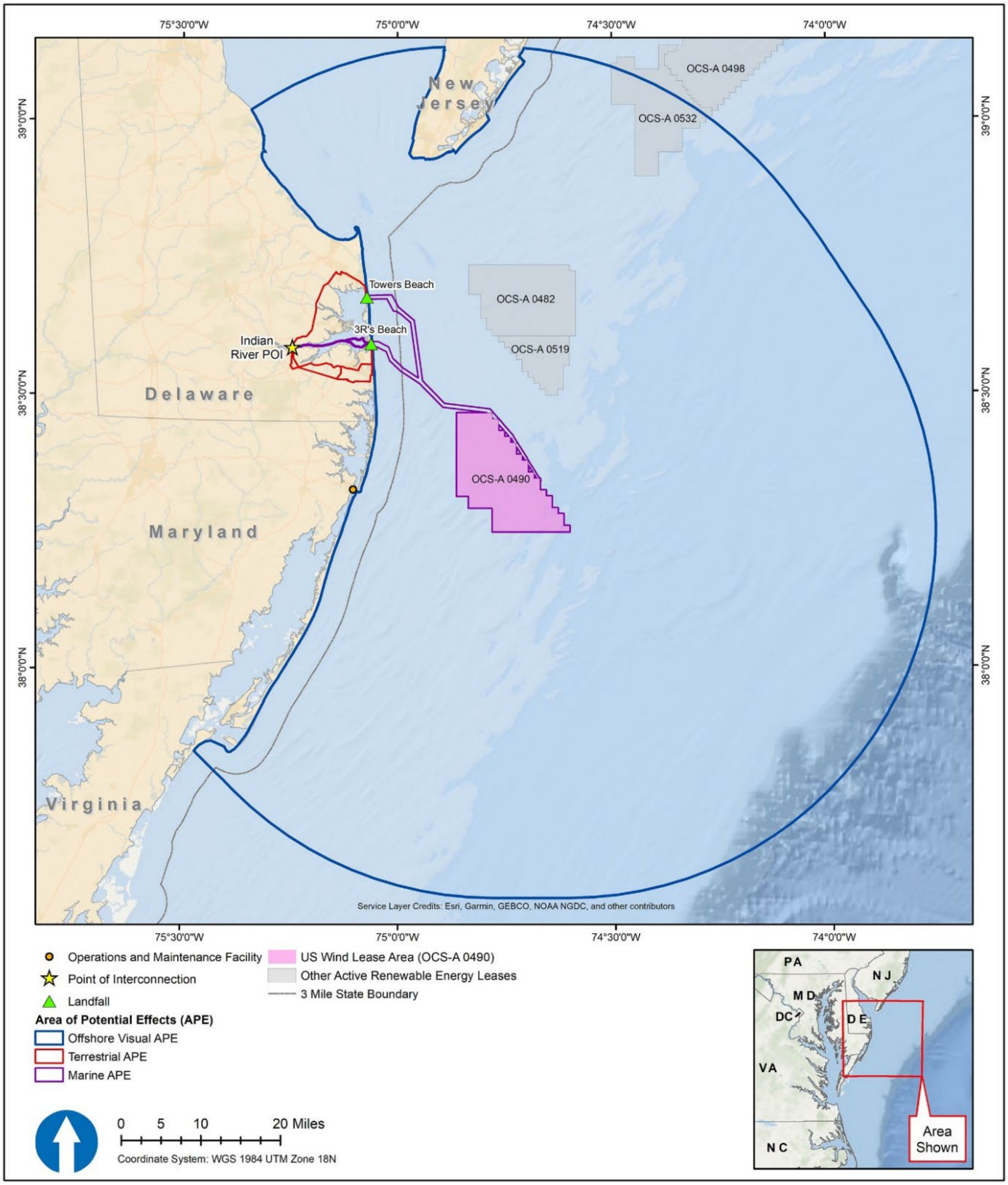


Figure 3.6.2-1. Cultural resources geographic analysis area

3.6.2.1 Description of the Affected Environment and Future Baseline Conditions

This section discusses baseline conditions in the geographic analysis area for cultural resources as described in the COP (Volume II, Chapter 14.0 and Appendices I1, I2, and I3; US Wind 2023). Specifically, this includes onshore and offshore areas potentially affected by the Project's land- or bottom-disturbing activities, areas where structures from the Proposed Action would be visible, and the area of intervisibility where structures from both the Proposed Action and offshore wind projects would be visible simultaneously.

US Wind has conducted onshore and offshore cultural resource investigations to identify known and previously undiscovered cultural resources within the marine archaeological, terrestrial archaeological, and viewshed portions of the APE. Table 3.6.2-1 presents a summary of the pre-Contact period and post-Contact period cultural context of Delaware and Maryland, the area where Onshore Export Cable Route alternatives and O&M Facility would be located, based on the Project's Terrestrial Archaeological Resources Assessment (COP, Volume II, Appendix I2; US Wind 2023). Appendix J, *Finding of Adverse Effect under Section 106 of the National Historic Preservation Act*, provides details on supplemental cultural resources studies, including scope, methods, results, and key findings.

Table 3.6.2-1. Summary of Delaware and Maryland prehistoric and historic contexts

Period	Description
Paleoindian (>14,500–11,500 B.P.)	This period is categorized by small, nomadic hunting groups traversing recently deglaciated landscapes. Paleoindian sites are identified by the presence of Clovis fluted points. People likely arrived in Delaware around 11,500 years B.P. They may have inhabited or used land now submerged along the OCS.
Archaic Period (10,000–3,000 B.P.)	This period is typically divided into three subperiods: Early Archaic (10,000–8000 B.P.), Middle (8000–6000 B.P.), and Late (6000–3000 B.P.). The Early Archaic period was marked by rapid sea level rise and coastal wetland boundary changes. By the Middle Archaic period, stone tool manufacture included grinding and polishing. In the Late Archaic period, both climate and sea level rise began to stabilize. This greater stability fostered increased sedentism. Material culture expanded rapidly, as evidenced by a wide array of new hunting and fishing technologies. Tribal-level societies also emerged during this time.
Woodland Period (3,000–European Contact)	This period is typically divided into three subperiods: Early (3000–2000 B.P.), Middle (2000–1000 B.P.), and Late (1,000 B.P.–European Contact). During the Early Woodland Period, pottery became prevalent, as did lithics like broadspears. During the Middle and Late Woodland Period, pottery became more refined, but agriculture did not develop as hardily in Delaware as it did in other regions.
Contact and Colonization (European Contact–1775)	During the Contact Period, Native American groups interacted with European explorers and early colonizers. Sites dating from the Contact period should contain physical evidence (e.g., European trade goods) of such interaction, but as of 2004, no sites with clear evidence of such interaction had been investigated in Delaware. By the end of the Contact Period, Delaware's indigenous population had declined precipitously, either because of disease or conflict or because they had moved out of the area. However, one local group, the Nanticoke Tribe, maintained a presence in the vicinity of the Project region through this period and into the twentieth century, moving from Maryland into Delaware in the mid-1700s.

Period	Description
Revolutionary War (1775–1783)	The onset of the American Revolution marked the beginning of Delaware's transformation from colony to state (1770–1830). While Sussex County was relatively distant from the main centers of active military conflict, its coastal residents nonetheless suffered recurrent raids from British shore parties, and the region's commercial vessel traffic was adversely affected by the British blockade of Delaware Bay and its approaches.
Antebellum Period (1783–1861)	The economy of Delaware's southern counties continued to rest primarily on agriculture, and the improvement of internal transportation links connecting Maryland and Delaware and the establishment of light industries such as mills, iron foundries, and distilleries encouraged the growth of communities. On the coast, fishing and oystering emerged as important components of the regional economy, while the coastal vessel traffic entering and exiting Delaware Bay continued to increase.
American Civil War (1861–1865)	Midway through the 19th century, the outbreak of the Civil War disrupted what until then had been an uneventful period of largely agricultural-related economic development. Delaware and Maryland remained in the Union but became in effect two of four border states where divided loyalties were the rule.
Reconstruction and Early 20th Century (1865–1945)	The most significant development of the post-war period was the advent of reliable rail service into the region. By 1880, four railroad lines served various communities within Sussex County connecting markets and bringing tourists to coastal towns for recreation and more.
World War II and Postwar (1945–Present)	Chicken ranching became a prominent industry and the seafood industry declined. Recreation at the seaside, as well as in national and state parks, fuels industry especially along the coast.

Source: COP, Volume II, Appendix I2; US Wind 2023

B.P. = before present; OCS = Outer Continental Shelf

The US Wind identified one pre-Contact archaeological site within the terrestrial APE for the onshore substation site (COP, Volume II, Appendix I2; US Wind 2023).

Offshore cultural resources in the region, such as submerged historic properties, include pre-Contact and post-Contact period Native American and European-American resources. Offshore archaeological resources include pre-Contact period Native American landscapes on the OCS, which likely contain Native American archaeological sites inundated and buried as sea levels rose at the end of the last Ice Age. Marine geophysical remote-sensing studies performed for the Proposed Action identified 14 ancient, submerged landform features (hereafter referred to as ancient submerged landforms) with the potential to contain Native American archaeological resources, all of which were within the Lease Area. In addition to ancient submerged landforms, 15 potential submerged historic properties were identified via marine remote-sensing studies. This included 13 within the Lease Area, one in the Offshore Export Cable Route in federal waters, and one near the Offshore Export Cable Route in state waters. These resources include five post-contact shipwrecks and 10 as of yet uncharted, unidentified wrecks or other resources. Based on known historic and modern maritime activity in the region, the Lease Area and Offshore Export Cable Route have a high probability for containing shipwrecks and related debris fields (COP, Volume II, Appendix I1; US Wind 2023).

Cultural resources review of the offshore visual area identified four historic districts (including one National Historic Landmark [NHL]) and seven individual historic properties. Review of the onshore visual area identified no historic properties (COP, Volume II, Appendix I3; US Wind 2023).

3.6.2.2 Impact Level Definitions for Cultural Resources

Definitions of impact levels are provided in Table 3.6.2-2. Table F-12 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on cultural resources.

Table 3.6.2-2. Impact level definitions for cultural resources

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

CFR = Code of Federal Regulations; NRHP = National Register of Historic Places; TCP = traditional cultural property

3.6.2.3 Impacts of Alternative A – No Action on Cultural Resources

When analyzing the impacts of the No Action Alternative on cultural resources, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, regional commercial, industrial, and recreational activities would continue to affect cultural resources. Ongoing activities within the geographic analysis area that contribute to onshore impacts on cultural resources include ground-disturbing activities and the introduction of intrusive visual elements. These activities could disturb or destroy terrestrial archaeological resources or damage, destroy, or diminish the integrity that conveys the historic significance of buildings, structures, objects, and historic districts onshore. The primary sources of ongoing offshore impacts include dredging, cable emplacement, and activities that disturb the seafloor. Onshore and offshore construction activities and associated impacts are expected to continue at current trends, range in severity from minor to major, and could affect cultural resources. The incremental contribution of offshore wind development projects on slowing or arresting impacts related to global warming and climate change would result in beneficial impacts on cultural resources that range from negligible to minor beneficial.

Planned non-offshore wind activities that may affect cultural resources include new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (Appendix E, *Planned Activities Scenario*, contains a description of ongoing and planned activities). These activities may result in ground disturbance, which could disturb or destroy terrestrial archaeological resources; seafloor disturbance, which could damage or destroy submerged historic properties or ancient, submerged landforms; construction, which could damage, destroy, or diminish the integrity of buildings, structures, objects, and historic districts onshore; or introduction of intrusive visual elements, which could diminish integrity of setting, feeling, or association for cultural resources. Appendix D, Table D1-8 provides a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for cultural resources.

3.6.2.3.1 Future Offshore Wind Activities (without Proposed Action)

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

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

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

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

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

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

Cable emplacement and maintenance: Construction of offshore wind infrastructure would have permanent, geographically extensive, adverse impacts on cultural resources. Offshore wind projects would result in seafloor disturbance from foundation construction and installation of inter-array and offshore export cables. A BOEM (2012) study suggests that the Maryland/Delaware wind Lease Area and associated Offshore Export Cable Route would likely contain submerged historic properties and ancient, submerged landform features, which could be affected by offshore construction activities.

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

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

Climate change: IPFs related to climate change, including sea level rise, ocean acidification, increased storm severity/frequency, and increased sedimentation and erosion, could result in long-term/permanent impacts on cultural resources. Sea level rise will lead to the inundation of terrestrial archaeological sites and historic standing structures. Increased storm severity/frequency will likely increase the severity and frequency of damage to coastal historic standing structures. Increased erosion along coastlines could lead to the complete destruction of coastal archaeological sites and the collapse of historic structures as erosion undermines their foundations. Ocean acidification could accelerate the rate of decomposition/corrosion of shipwreck, downed aircraft, and other marine archaeological resources on the seafloor. The incremental contribution of future offshore wind energy projects on slowing or arresting global warming and climate change related impacts would result in beneficial impacts on cultural resources.

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

Lighting: Development of offshore wind projects would increase the amount of offshore anthropogenic light from vessels, area lighting during construction and decommissioning of projects (to the degree that construction occurs at night), and use of aircraft and vessel hazard/warning lighting on WTGs and OSSs during operations. Up to 485 new WTG and 19 OSS (other than those for the Proposed Action) could potentially be visible from the geographic analysis area for cumulative visual effects on historic properties, with the largest number visible from the portions of the geographic analysis area in New Jersey and fewer structures visible in Delaware, Maryland, and Virginia.

Construction and decommissioning lighting would be most noticeable if construction activities occur at night. Up to two planned offshore wind projects (GSOE and Skipjack Phases I and II) could contribute to cumulative visual effects on historic properties. These could be constructed from 2023 through 2030 (with up to two projects simultaneously under construction in 2024; Appendix D, *Planned Activities Scenario*). Some of the offshore wind projects could require nighttime construction lighting, and all would require nighttime hazard lighting during operations. Construction lighting from any project would be temporary, lasting only during nighttime construction, and could be visible from shorelines and elevated locations, although such light sources would be limited to individual WTG or OSS sites rather than the entirety of the lease areas in the geographic analysis area. Aircraft and vessel hazard lighting systems would be in use for the entire operational phase of each offshore wind project, resulting in long-duration impacts (Section 3.6.9, *Scenic and Visual Resources*). The intensity of these impacts would be relatively low, as the lighting would consist of small, intermittently flashing lights at a significant distance from the resources.

The impacts of construction and operational lighting would be limited to cultural resources on the coast of Maryland and Delaware for which a dark nighttime sky is a contributing element to historical integrity. While some resources such as historic buildings and lighthouses would be closed to stakeholders at night, and some resources such as historic districts generate their own nighttime light, the dark nighttime sky is still a contributing element to these cultural resources. The intensity of lighting impacts would be limited by the distance between resources and the nearest lighting sources. Most of the proposed WTGs would be approximately 13 to 26 miles (20.9 to 41.8 kilometers) from the closest coastal locations with views of the WTGs. The intensity of lighting impacts would be further reduced by atmospheric and environmental conditions such as clouds, fog, and waves that could partially or completely obscure or diffuse sources of light. As a result, nighttime construction and decommissioning lighting would have temporary, intermittent, and localized adverse impacts on a limited number of cultural resources. Operational lighting would have longer-term, continuous, and localized adverse impacts on a limited number of cultural resources.

Lighting impacts would be reduced if aircraft detection lighting system (ADLS) is used to meet FAA aircraft hazard lighting requirements. ADLS would activate the aviation lighting on WTGs and OSSs only when an aircraft is within a predefined distance of the structures (Section 3.6.9, Visual Resources). For the Proposed Action, ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS (Capitol Airspace Group 2023). BOEM assumes that the use of ADLS on offshore wind projects other than the Proposed Action would result in similar limits on the frequency of WTG and OSS aviation warning lighting use. This technology, if used, would reduce the already low-level impacts of lighting on cultural resources. As such, lighting impacts on cultural resources would be negligible.

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

Presence of structures: Impacts on offshore cultural resources would be limited to ancient submerged landforms that extend beyond the marine archaeological APE. Installation of other structures, such as foundations, inter-link cables, or inter-array cables from other offshore wind projects would not occur within the marine archaeological APE. Based on marine archaeology assessments conducted for the Project (COP, Volume II, Appendix I1; US Wind 2023), BOEM assumes that other planned offshore wind projects in the geographic analysis area would also affect ancient submerged landform features unless these features could be avoided. Any damage to ancient submerged landform features in these limited areas of cumulative impact would threaten the viability of the affected portion of these resources.

The development of other offshore wind projects would introduce new, modern, and intrusive visual elements to the viewsheds of cultural resources along the coast of Maryland. Up to 485 new WTG and

OSS foundations (excluding the Proposed Action) would be added within the analysis area for cumulative visual effects on historic properties.

Impacts on cultural resources from the presence of structures would be limited to those cultural resources from which offshore wind projects would be visible, which would typically be limited to historic buildings, structures, objects, and districts and could include significant landscapes and TCPs relatively close to shorelines and on elevated landforms near the coast. The magnitude of impacts from the presence of structures would be greatest for cultural resources for which a maritime view, free of modern visual elements, is an integral part of their historic integrity and contributes to their eligibility for listing on the NRHP. Due to the distance between the reasonably foreseeable wind development projects and the nearest cultural resources, in most instances exceeding 10.1 miles (16.2 kilometers), WTGs of individual projects would appear relatively small on the horizon, and the visibility of individual structures would be further affected by environmental and atmospheric conditions such as vegetation, clouds, fog, sea spray, haze, and wave action (Section 3.6.9). While these factors would limit the intensity of impacts, the presence of visible WTGs from offshore wind activities would have long-term, continuous, minor impacts on cultural resources.

3.6.2.3.2 Conclusions

BOEM expects ongoing and planned activities including offshore wind to have continuing short- and long-term impacts on cultural resources. The primary source of onshore impacts from ongoing activities includes ground-disturbing activities and the introduction of intrusive visual elements, while the primary source of offshore impacts includes dredging, cable emplacement, and activities that disturb the seafloor. These ongoing activities would have **minor** to **major** impacts on individual onshore and offshore cultural resources. Planned non-offshore wind activities could include the same types of onshore and offshore actions listed for ongoing activities, and in different locations than ongoing activities. These planned activities would also have **minor** to **major** impacts on individual onshore and offshore cultural resources depending on the scale and extent of impacts and the unique characteristics of the resource. Examples of individual resources are ancient, submerged landforms, terrestrial archaeological sites, historic standing structures, and TCPs. Impacts would vary widely because the impacts would be dependent on the unique characteristics of the individual resources. BOEM expects the combination of ongoing and planned non-offshore wind activities to result in **minor** to **major** impacts on individual cultural resources depending on the scale and extent of impacts and the unique characteristics of the resources. The construction and O&M of offshore wind projects would have **minor** to **major** effects, as well as **negligible** to **minor beneficial** impacts on individual offshore cultural resources from the incremental contribution of offshore wind projects on slowing or arresting impacts related to global warming and climate change would result in beneficial impacts on cultural resources. The construction and installation of onshore components and port expansions, as well as their O&M, would have **negligible** to **major** impacts on individual cultural resources.

Under the No Action Alternative, existing environmental trends and activities would continue, and cultural resources would continue to be affected by natural and human caused IPFs. The No Action Alternative would result in **minor** to **major** impacts on cultural resources. Considering state and federal requirements to avoid, minimize, or mitigate impacts on cultural resources, BOEM anticipates that impacts on cultural resources associated with the No Action Alternative combined with all planned activities (including other offshore wind activities) in the geographic analysis area would be **moderate**. The primary sources of impacts would be physical disturbance from onshore and offshore construction, as well as changes in views from cultural resources. The impacts would be geographically limited to marine and terrestrial archaeological resources within onshore and offshore construction areas and historic structures and TCPs for which an uninterrupted sea view, free of intrusive visual elements, is a contributing element to NRHP eligibility with views of offshore and onshore wind components. The duration of impacts would range from temporary to permanent, while the extent and frequency of impacts would be largely dependent on the unique characteristics of individual cultural resources, resulting in a range of potential impacts from **minor** to **major**.

While impacts on cultural resources could range from **minor** to **major**, BOEM anticipates that implementation of existing state and federal cultural resource laws and regulations would reduce the magnitude of overall impacts on cultural resources due to requirements to avoid, minimize, or mitigate Project-specific impacts on cultural resources. These state and federal requirements may not be able to reduce the severity of impacts on some cultural resources due to the unique character of specific resources but would reduce the severity of potential impacts in most cases, resulting in overall **moderate** impacts on cultural resources.

3.6.2.4 Relevant Design Parameters and Potential Variances in Impacts

The primary Project design parameters that would influence the magnitude of the impact on cultural resources are provided in Appendix C, *Project Design Envelope and Maximum-Case Scenarios*, and include the following:

- WTG, Met Tower, and OSS number and size or location: the visual impact and ground disturbance related to Offshore Project elements are proportional to the number of WTGs and OSSs installed and the location of the Met Tower; fewer WTGs and OSSs would present less hazard to marine cultural resources and a lesser visual burden. The location of the Met Tower could change which, if any, cultural resources are affected.
- Offshore and onshore export cables: the routes chosen (including variants within the general route) would determine which, if any, historic resources are affected. The sections below detail the pertinent differences among the options with respect to cultural resources.

3.6.2.5 Impacts of Alternative B – Proposed Action on Cultural Resources

Under the Proposed Action, US Wind would install up to 121 WTGs (PDE), 4 OSS, and 1 Met Tower, as well as an onshore substation and associated inter-array, interconnector, and export cables. The potential impacts of these facilities on cultural resources include damage or destruction of terrestrial archaeological sites or TCPs from onshore ground-disturbing activities and damage to or destruction of submerged archaeological sites or other underwater cultural resources (e.g., shipwreck; debris fields; ancient, submerged landforms) from offshore bottom-disturbing activities, resulting in a loss of scientific or cultural value. Potential impacts also include demolition of, damage to, or alteration of historic buildings, structures, objects, or districts, including landscapes and TCPs, resulting in a loss of historic or cultural value.

Potential visual impacts also include introduction of visual elements out of character with the setting or feeling of historic properties if that setting is a contributing element to the resource's eligibility for listing in the NRHP. The most impactful IPFs would include lighting and the presence of structures. Table 3.6.2-3 lists onshore historic properties with potential views of the Proposed Action for which an uninterrupted sea view, free of modern visual elements, is a contributing element to NRHP eligibility, and which could therefore be adversely affected by lighting and the presence of structures.

Table 3.6.2-3. Historic properties affected by lighting and presence of structures

Historic Property	Location	NRHP Eligibility
Fort Miles Historic District	East and south of Lewes in Sussex County, Delaware	NRHP listed
U.S. Coast Guard Tower	Ocean City, Maryland	Recommended eligible pending SHPO concurrence
Oceanside North Ocean City Survey District	Ocean City, Maryland	Recommended eligible pending SHPO concurrence

NRHP = National Register of Historic Places; SHPO = state historic preservation officer

3.6.2.5.1 Construction and Installation

3.6.2.5.1.1 Onshore Activities and Facilities

Accidental releases: In the event of an accidental onshore release—such as from a construction vehicle—the volume of materials released is unlikely to require cleanup operations that would permanently affect cultural resources. As a result, the impacts of accidental releases from onshore construction of the Proposed Action on cultural resources would be short term, localized, and negligible. While the onshore facilities for other offshore wind projects have not been identified, they are unlikely to affect the same areas as the Proposed Action. Therefore, the Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, and these combined impacts would be localized, short term and negligible.

Cable emplacement and maintenance: The export cables at the 3R's Beach landfall will transition using HDD and construction activities will occur within an existing parking lot. The transition of the Inshore Export Cable Route from Indian River to the substation site will also occur using HDD and will occur adjacent to the existing substation at the Indian River Power Plant. As a result, the Proposed Action would have negligible impacts on onshore cultural resources. While the onshore facilities for other offshore wind projects have not been identified, they are unlikely to affect the same areas as the Proposed Action. Therefore, the Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, and these combined impacts would be localized, short term and negligible.

Land disturbance: As described above, construction of the new onshore substations would disturb land adjacent to the existing substation at the Indian River Power Plant. Previously recorded archaeological site 7S-G-010, is located within the onshore substation APE (COP, Volume II, Appendix I2; US Wind 2023). This site—specifically the precontact portion of the site that has intact subsurface deposits—is considered eligible for the NRHP (COP, Volume II, Appendix I2; US Wind 2023). US Wind is redesigning the substation to avoid impacts to the archaeological site (specifically the NRHP-eligible areas). With these changes, the Proposed Action would have no adverse effect, if avoidance is not feasible additional investigations will be conducted in accordance with NHPA Section 106 Mitigation Measures (Appendix G).

Other land disturbance would be associated with the cable landfall site at the 3R's Beach parking lot, as well as the O&M Facility. There are no previously identified archaeological sites at either the 3R's Beach landfall site or O&M Facility and archaeological potential at both sites is low (COP, Volume II, Appendix I2; US Wind 2023).

Construction of onshore components for offshore wind activities could result in ground-disturbing construction activities which could impact known cultural resources and undiscovered cultural resources (if present) and could affect undiscovered archaeological sites. BOEM anticipates federal (i.e., NEPA and NHPA Section 106 fulfilled through NEPA substitution) and state-level requirements to identify cultural resources, assess impacts, and implement measures to avoid, minimize, or mitigate impacts would minimize impacts on cultural resources from the reasonably foreseeable offshore wind developments.

To address potential changes to the Project design or inadvertent archaeological discoveries during construction, US Wind has committed to prepare an Unanticipated Discovery Plan (Appendix G, Table G-1).

With implementation of the substation redesign and mitigation measures listed above, the impacts of land disturbance from onshore construction of the Proposed Action on terrestrial cultural resources would be short term, localized, and negligible. While the onshore facilities for other offshore wind projects have not been identified, they are unlikely to affect the same areas as the Proposed Action. Therefore, the Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, and these combined impacts would be localized, short term, and negligible.

Lighting: Lighting required for onshore construction could affect resources for which a dark nighttime sky is a contributing element to their historic integrity, cultural resources stakeholders use at night, and resources that do not generate a substantial amount of their own light pollution. Based on the location of the substation and the presence of dense forest vegetation around the substation site, lighting from the Proposed Action's onshore construction would have a negligible impact on cultural resources. While the onshore facilities for other offshore wind projects have not been identified, they are unlikely to affect the same areas as the Proposed Action. Therefore, the Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, and these combined impacts would be localized, short term, and negligible.

Port utilization: Proposed Action construction would include development and use of an offshore wind manufacturing and assembly facility at Sparrows Point in Baltimore County. No other port expansion is proposed in connection with Proposed Action construction. Noise generated by Proposed Action construction at ports could affect cultural resources near ports for which low noise levels are a contributing element to historic integrity, especially if no sound buffering exists between the port and those resources. Based on the size of the ports and the distance between noise-generating port activities and likely receptors, the Proposed Action's port utilization during construction would have a negligible impact on cultural resources.

The Proposed Action's construction ports are all active ports (or in the case of Sparrows Point, an active industrial site that was previously a major steel manufacturing plant; Section 3.6.5, *Land Use and Coastal Infrastructure*). BOEM assumes that state and federal legal requirements to identify and assess—and to avoid, minimize, and mitigate—potential impacts on cultural resources were or would be followed as part of any port expansions. As a result, onshore construction would have negligible impacts on cultural resources. In the context of reasonably foreseeable trends, the Proposed Action would contribute an undetectable increment to the combined impacts of accidental releases from ongoing and planned activities including offshore wind, which would be short term, localized, and negligible.

3.6.2.5.1.2 Offshore and Inshore Activities and Facilities

Accidental releases: In the event of an accidental offshore release—such as from a construction vessel—the volume of materials released is unlikely to require cleanup operations that would permanently impact cultural resources. As a result, the impacts of accidental releases from onshore construction of the Proposed Action on cultural resources would be short term, localized, and negligible. While the onshore facilities for other offshore wind projects have not been identified, they are unlikely to affect the same areas as the Proposed Action. Therefore, the Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, and these combined impacts would be localized, long term and negligible.

Anchoring: Anchoring and gear utilization could affect cultural resources. Of the total 15 potential submerged historic properties affected by the Proposed Action; 13 are in the Lease Area, one is in the Offshore Export Cable Route in federal waters, and one is near the Offshore Export Cable Route in state waters (Table 3.6.2-4). All 14 of the ancient, submerged landforms are in the Lease Area (Table 3.6.2-5). US Wind has committed to avoiding the 15 potential submerged historic properties identified in the Lease Area and along Offshore Export Cable Route during construction, O&M, and decommissioning activities.

Table 3.6.2-4. Potential submerged historic properties associated with the Proposed Action

Potential Submerged Historic Property	Description	Location*
Target 1	Charted shipwreck, possibly Elizabeth Palmer	Lease Area
Target 2	Charted shipwreck, possibly W.L. Steed	Lease Area
Target 3	Unknown potential cultural resource	Lease Area
Target 4	Charted shipwreck, unknown shipwreck	Lease Area
Target 5	Unknown potential cultural resource	Lease Area
Target 6	Unknown potential cultural resource	Lease Area
Target 7	Charted shipwreck; H Buoy Wreck (barge) and unknown chartered wreck	Lease Area
Target 8	Unknown potential cultural resource	Lease Area
Target 9	Unknown potential cultural resource	Lease Area
Target 10	Charted shipwreck; unknown shipwreck	Lease Area
Target 11	Unknown potential cultural resource	Lease Area
Target 12	Unknown potential cultural resource	Lease Area
Target 13	Unknown potential cultural resource	Lease Area
Target 14	Unknown potential cultural resource	Offshore Export Cable Route (Federal waters)
Target 15	Uncharted debris	In vicinity of Offshore Export Cable Route (State waters)

*note: target 15 is located in state waters, but outside the current preliminary area of potential effects.

The fifteen submerged historic properties in the Lease Area and Offshore Export Cable Route are unevaluated for inclusion in the NRHP, and it is recommended that further study be conducted to determine eligibility. If the resources cannot be avoided, a detailed mitigation plan will need to be developed and implemented. The 14 ancient submerged landform features in the Lease Area are considered eligible for inclusion in the NRHP and if they cannot be avoided, detailed mitigation plans will need to be developed and implemented.

Table 3.6.2-5. Ancient submerged landforms associated with the Proposed Action

Ancient Submerged Landform	Location
P-01	Within Lease Area; Outside PAPE
P-02	Within Lease Area; Near WTG C01
P-03-A	Within Lease Area; near IAC
P-03-B	Within Lease Area; near IAC
P-03-C	Within Lease Area; near IAC
P-03-D	Within Lease Area; Outside PAPE
P-03-E	Within Lease Area; Outside PAPE
P-04-A	Within Lease Area; near IAC
P-04-B	Within Lease Area; near IAC
P-05-A	Within Lease Area; Outside PAPE
P-05-B	Within Lease Area; Outside PAPE
P-05-C	Within Lease Area; Outside PAPE
P-05-D	Within Lease Area; Outside PAPE
P-05-E	Within Lease Area; Outside PAPE

IAC = inter-array cable; PAPE = preliminary area of potential effects

Due to the avoidance commitments, BOEM does not anticipate impacts on the majority of known shipwrecks and other submerged historic properties from development of the Proposed Action (Appendix J, *Finding of Adverse Effect under Section 106 of the National Historic Preservation Act*).

Construction of the Proposed Action and other offshore wind projects could result in anchoring within the geographic analysis area that could affect cultural resources. BOEM anticipates that lead federal agencies and relevant SHPOs would require US Winds for offshore wind projects to conduct extensive geophysical remote-sensing surveys (i.e., similar to those conducted for the Proposed Action) to identify and avoid submerged historic properties and ancient submerged landform features as part of NEPA and NHPA Section 106 compliance activities fulfilled through the NEPA substitution process as described in 36 CFR 800.8(c). BOEM would also continue to require developers to avoid, minimize, or mitigate impacts on any identified marine archaeological resources and ancient, submerged landform features during construction, O&M, and decommissioning. As a result, in context of reasonably foreseeable trends, the Proposed Action would contribute a noticeable increment to the combined anchoring and gear utilization impacts from ongoing and planned activities including offshore wind on shipwreck and debris field resources, as well as ancient submerged landforms. Impacts on cultural resources would be long term and moderate to major unless these resources could be avoided.

Cable emplacement and maintenance: The installation of inter-array cables, offshore export cables and inshore export cables would include route clearance activities including a pre-installation survey and grapnel run (to remove marine debris that could impact cable lay and burial), and cable installation via jet plow, mechanical plow, or mechanical trenching, which could affect cultural resources. Of the total 15 potential submerged historic properties, one is in the Offshore Export Cable Route (where it intersects with the lease area in federal waters), and one is in the vicinity of the Offshore Export Cable Route in state waters. No ancient, submerged landforms are in the Offshore Export Cable Route. The Proposed Action has committed to avoiding the 15 potential submerged historic properties identified in the Lease Area and along the Offshore Export Cable Route during construction, O&M, and decommissioning activities.

Both reconnaissance and intensive level archaeological surveys were conducted within the terrestrial archaeology portion of the APE, with the exception of some parcels that could not be accessed at the time of the initial surveys. One site, 7S-G-010, located at the terminus of the Inshore Export Cable Route and in the preliminary APE (PAPE) for the proposed onshore substations, is potentially eligible and requires further investigation. US Wind has committed to attempting to avoid the site. If site avoidance is unfeasible, additional archaeological investigations are recommended. The region that the Onshore Export Cable Route (and alternatives discussed in Section 3.6.2.6, Alternative C – Landfall and Onshore Export Cable Routes) passes through generally has a high potential for containing archaeological resources with some areas, such as parking lots and marshlands. Once the PAPE is refined, further investigation will be necessary to determine potential effects on historic properties within the terrestrial archaeology APE. The Phase 1B archaeological survey is still pending for the proposed onshore substation sites and additional route segments and potential additional parcels near the onshore substation.

Offshore wind projects would result in construction of WTGs and OSSs, inter-array cable systems, and an Offshore Export Cable Route. As with the Proposed Action, other offshore wind projects would likely be able to avoid impacts on shipwrecks, downed aircraft, and debris field cultural resources due to their relatively small, discrete size but may be unable to avoid impacts on all ancient, submerged landforms. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined cable emplacement impacts on cultural resources from ongoing and planned activities including offshore wind, which would be localized, long term, and minor for shipwrecks, downed aircraft, and debris fields; and long term, widespread, and moderate to major for ancient, submerged landforms. BOEM has committed to working with Native American tribes, US Wind, consulting parties, and the Maryland SHPO to develop specific treatment plans to address impacts on ancient submerged landforms that cannot be avoided by future offshore wind development projects. US Wind has committed to avoiding all 14 ancient submerged landforms resulting in no impacts to these resources. If for some reason avoidance is not feasible the magnitude of the impacts would be moderate to major due to the permanent, irreversible nature of impacts.

Lighting: Development of the offshore wind industry would increase the amount of offshore anthropogenic light from vessels and area lighting during construction and decommissioning of projects (to the degree that construction occurs at night). Impacts from lighting on WTGs, OSSs, and the Met Tower are discussed as part of O&M. The susceptibility and sensitivity of cultural resources to lighting impacts from the Proposed Action would vary based on the unique characteristics of individual cultural resources.

Construction of the Proposed Action may require nighttime vessel and construction area lighting. The lighting impacts would be short term and limited to construction of the Proposed Action. The intensity of nighttime construction lighting from the Proposed Action would be limited to the active construction area at any given time. Impacts would be further reduced by the distance between the nearest construction area (i.e., the closest line of WTGs) and the nearest cultural resources on the coast. The intensity of lighting impacts would be further reduced by atmospheric and environmental conditions such as clouds, fog, and waves that could partially or completely obscure or diffuse sources of light.

U.S. Wind's Historic Resources Visual Effects Assessment for the Proposed Action did not identify any properties for which a dark nighttime sky is a contributing element to historical integrity (COP, Volume II, Appendix I3; US Wind 2023). The three onshore properties listed in Table 3.6.2-3 are likely to have views of vessel lighting from Proposed Action construction, due to distance and location in Maryland and Delaware. Resources in New Jersey and Virginia are likely too far away to have views of vessel lights at or near the water level. As a result, lighting during Proposed Action construction would have a short-term, negligible impact on cultural resources in the geographic analysis area.

Construction of other offshore wind projects in the geographic analysis area would contribute similar lighting impacts from nighttime vessel and construction area lighting as under the Proposed Action. As a result, nighttime construction and decommissioning lighting associated with the Proposed Action and other ongoing and planned activities including offshore wind would have short-term and minor impacts on cultural resources in the geographic analysis area. In context of reasonably foreseeable trends, the Proposed Action would contribute a noticeable increment to the combined lighting impacts on cultural resources from ongoing and planned nighttime vessel and construction area lighting for historic properties in Maryland and Delaware, and none of the combined lighting impacts for historic properties in New Jersey and Virginia.

Presence of structures: The presence of structures, including foundations and scour protection for WTGs and OSSs, in the Lease Area could affect offshore cultural resources. Of the total 15 potential submerged historic properties, 13 are in the Lease Area. All 14 ancient, submerged landforms are in the Lease Area. The Proposed Action has committed to avoiding all 15 potential submerged historic properties identified in the Lease Area during construction, O&M, and decommissioning activities. The Proposed Action may avoid impacts under this IPF on up to 14 ancient, submerged landforms within the Lease Area. 11 Ancient submerged landforms will be avoided by the 164-ft (50-m) buffer and three will be avoided through micro-siting (Appendix J, *Finding of Adverse Effect under Section 106 of the National Historic Preservation Act*). Due to the avoidance commitments, BOEM does not anticipate impacts on known shipwrecks, other potential cultural resources, or ancient submerged landforms within the Lease Area from development of the Proposed Action. As a result, the presence of structures under the Proposed Action would have no or negligible impacts on most marine cultural resources.

More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are inadvertently discovered during construction. However, the protocols identified in the Unanticipated Discovery Plan would apply to minimize impacts (Appendix G, *Mitigation and Monitoring*). In addition, BOEM has committed to developing a Monitoring Plan and working with Native American tribes, US Wind, consulting parties, and the Maryland SHPO.

3.6.2.5.2 Operations and Maintenance

3.6.2.5.2.1 Onshore Activities and Facilities

Presence of structures: Structures at the O&M port (which would be existing structures) and at the onshore substation would be the only onshore components of the Proposed Action that would be visible. Based on the location of the substation and the presence of forest vegetation around the substation site, the Proposed Action's onshore structures would have a negligible impact on cultural resources. While the onshore facilities for other offshore wind projects have not been identified, they are unlikely to affect the same areas as the Proposed Action. Therefore, in the context of reasonably foreseeable trends, the Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, and these combined impacts would be localized, long term, and negligible.

3.6.2.5.2.2 Offshore and Inshore Activities and Facilities

Accidental releases: Accidental release of hazardous materials and trash or debris, if any, could affect cultural resources. The up to 121 WTG foundations (PDE) and 4 OSS foundations for the Proposed Action would include storage for up to 1,390 gallons (5,262 liters) of oil sources per WTG and up to 84,972 gallons (321,654 liters) of fluids per OSS for a maximum of 508,078 gallons (1,923,284 liters) for 121 WTGs and 4 OSSs. The volume of materials released is unlikely to require cleanup operations that would permanently affect cultural resources. As a result, the impacts of accidental releases from the Proposed Action on cultural resources would be short term, localized, and negligible. In the unlikely event of simultaneous spills from multiple foundations, impacts could be minor to moderate, depending on the volume of materials spilled.

Impacts from other offshore wind projects would be similar to those of the Proposed Action and negligible in most cases, except for rare cases of large-scale accidental releases that represent moderate to major impacts. In context of reasonably foreseeable trends, the Proposed Action would contribute an undetectable increment to the combined impacts of accidental releases from ongoing and planned activities including offshore wind, which would be short term, localized, and negligible. The Proposed Action would account for 53 percent of the WTGs and OSSs in the geographic analysis area, and there is a low risk of a leak of fuel, fluids, or hazardous materials from any of the WTGs and OSSs, which would include storage of these substances.

Lighting: Proposed Action O&M would include aviation hazard and marine navigation lighting on WTG, OSS, and Met Tower foundations, as well as aviation warning lighting on WTGs, OSSs, and the Met Tower. The susceptibility and sensitivity of cultural resources to lighting impacts from the Proposed Action would vary based on the unique characteristics of individual cultural resources. While nighttime lighting during Proposed Action O&M would be visible from three historic properties listed in Table 3.6.2-3, U.S. Wind's Historic Resources Visual Effects Assessment for the Proposed Action did not identify any resources for which a dark nighttime sky is a contributing element to historical integrity. As described in Section 3.6.9, US Wind has committed to voluntarily implementing ADLS to reduce operational nighttime lighting impacts (COP, Volume II, Chapter 1.5; US Wind 2023). With ADLS, FAA warning lights for the Proposed Action would be illuminated approximately 0.1 percent of nighttime hours (Section 3.6.9, Visual Resources), which would avoid nearly all visual impacts on cultural resources.

USCG navigation warning lights would be mounted near the top of the transition piece on each WTG and OSS. The lighting on WTG positions at the edge of the Lease Area is designed to be visible up to at least 5 nautical miles (9.3 kilometers) in adverse weather conditions (COP, Volume II, Appendix K2; US Wind 2023). Navigation lights on the Met Tower would be designed to be visible up to 10 nautical miles (18.5 kilometers) (COP, Volume II, Appendix K2; US Wind 2023). This lighting could be visible to mariners at sea and may also be visible from coastal vantage points, particularly in clear viewing conditions.

Overall, lighting from Proposed Action O&M would have intermittent (rather than continuous) and negligible impacts on the three cultural resources in the APE for direct visual effects offshore.

Permanent aviation and vessel warning lighting would be required on all WTGs and OSSs built by other offshore wind projects. For the purpose of this analysis, BOEM assumes that all other offshore wind projects in the cumulative lease areas would use ADLS as well. In the context of reasonably foreseeable trends, the Proposed Action would contribute a noticeable increment to the combined lighting impacts on cultural resources from ongoing and planned aviation and vessel warning lighting on WTGs and OSSs. These impacts would be intermittent and minor for all three cultural resources in the APE for direct visual effects offshore. Use of ADLS by other offshore wind projects would significantly reduce the frequency of these impacts, resulting in negligible impacts.

Presence of structures: A Historic Resources Visual Effects Assessment for the Proposed Action determined that the construction of the WTGs would adversely affect the three historic properties listed in Table 3.6.2-3 (COP, Volume II, Appendix I3; US Wind 2023). The studies determined that an uninterrupted sea view, free of modern visual elements, is a contributing element to the NRHP eligibility of the three historic properties. Although the operational life of the Project is 35 years, and the WTGs and OSSs would be removed after that period, the presence of visible WTGs from the Proposed Action alone would have long-term, continuous, widespread, moderate impacts on these resources. The study determined that the scale, extent, and intensity of these impacts would be partially mitigated by environmental and atmospheric factors such as clouds, haze, fog, sea spray, vegetation, and wave height that would partially or fully screen the WTGs from view during various times throughout the year. In addition, the Proposed Action would only affect seaward views from these resources. To further minimize the Proposed Action's effects, US Wind has voluntarily committed to designing the Project to minimize visual impacts on cultural resources to the extent feasible, including adjustment to WTG locations, ADLS, and markings. This includes:

- Use of an ADLS to minimize nighttime effects by only activating the FAA-required warning lights when an aircraft is in the vicinity of the Wind Farm Area (Section 3.6.9.5, Visual Resources); and
- Use of non-reflective off-white FAA-recommended paint color no lighter than Pure White (RAL 9010), and no darker than Light Grey (RAL 7035) on offshore infrastructure to minimize daytime visual effects.

BOEM conducted a Cumulative Historic Resources Visual Effects Assessment to evaluate visual impacts on the eleven historic properties listed in Table 3.6.2-3. The planned activities scenario effects assessment determined the number of WTGs from the Proposed Action and seven other offshore wind projects that could be theoretically visible (based on distance, topography, vegetation, and intervening structures) from each of the historic properties affected by the Proposed Action. Other offshore wind projects included in the cumulative WTG count from historic properties included GSOE (Lease Area OCS-A 0482), Ocean Wind 1 (Lease Area OCS-A 0498), Atlantic Shores Wind South (Lease Area OCS-A 0499), Skipjack I and II (Lease Area OCS-A 0519), and Ocean Wind 2 (Lease Area OCS-A 0532). The Cumulative Historic Resources Visual Effects Assessment demonstrated that portions of WTGs could theoretically be visible from all three properties.

The intensity of visual impacts on the historic properties could be limited by distance and environmental and atmospheric factors. As discussed in Section 3.6.9, the visibility of WTGs would be further reduced by environmental and atmospheric factors such as cloud cover, haze, sea spray, vegetation, and wave height. While these factors would limit the intensity of impacts, the presence of visible WTGs from ongoing and planned activities, including offshore wind and the Proposed Action, would have long-term, continuous, minor impacts on the historic properties listed above. The Proposed Action would contribute a noticeable increment to these impacts for properties in Maryland and Delaware, but this impact would not affect the integrity of any of the historic properties to the extent that it would make them ineligible for the NRHP.

3.6.2.5.3 Conceptual Decommissioning

The impacts of onshore and offshore Project decommissioning on cultural resources would be similar to the impacts described for construction. Decommissioning would require onshore and offshore lighting, land disturbance, and port utilization for removal of onshore and offshore structures. Land and subsurface disturbance impacts from onshore and offshore cable removal could be reduced if cables are retired in place rather than removed. The impacts of Proposed Action decommissioning would range from negligible to major.

Proposed Action decommissioning would contribute a substantial increment of the combined onshore infrastructure impacts on cultural resources from ongoing and planned activities including offshore wind. In context of reasonably foreseeable environmental trends, decommissioning impacts of the Proposed Action and other ongoing or planned activities would be short term and range from negligible to major.

3.6.2.5.4 Conclusions

The Proposed Action would have a range of **negligible** to **major** impacts on cultural resources, if ancient submerged landforms prove to be unavoidable by the Proposed Action. Impacts could be reduced through mitigation measures that US Wind commits to implement as a result of the NHPA Section 106 consultation process fulfilled through NEPA substitution as described in 36 CFR 800.8(c). Greater impacts would occur without the pre-construction NHPA requirements to identify historic properties, assess potential effects, and develop treatment plans to resolve effects through avoidance, minimization, or mitigation. These NHPA-required, “good-faith” efforts to identify historic properties and address impacts resulting in or contributing to US Wind making several commitments to reduce the magnitude of impacts on cultural resources including the following:

- Implementing an Unanticipated Discovery Plan;
- Consulting with Native American tribes and the SHPO and to support avoidance of known cultural resources to the extent practicable and identifying additional minimization or mitigation measures as necessary; and
- Designing the Project to minimize visual impacts on cultural resources to the extent feasible, including adjustment to WTG locations, using ADLS hazard lighting (if approved), and using non-reflective FAA-approved paint colors on offshore structures.

BOEM anticipates that NHPA requirements to identify historic properties and resolve adverse effects would similarly reduce the significance of potential impacts on historic properties from offshore wind projects as they complete the NHPA Section 106 review process fulfilled through NEPA substitution as described in 36 CFR 800.8(c). However, mitigation of adverse visual effects on historic properties will still be needed under the Proposed Action. The overall impacts on historic properties from the Proposed Action would likely qualify as **moderate** because a notable and measurable impact requiring mitigation is anticipated. In most cases, the resource would likely recover completely when the affecting agent were gone, or remedial or mitigating action were taken.

In the context of other reasonably foreseeable environmental trends, the Proposed Action would contribute a substantial increment to the combined impacts from ongoing and planned activities including offshore wind. BOEM anticipates the overall impacts on cultural resources associated with the Proposed Action when combined with other ongoing and planned activities including offshore wind would be **moderate**.

3.6.2.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Cultural Resources

This alternative would result in the inclusion of an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route). Site 7S-G-10 (described in Section 3.6.2.5.1 (Alternative B, Construction and Installation), would also be affected by all Alternative C Onshore Export Cable Routes.

Alternative C-1 would use a different Offshore Export Cable Route, which would make landfall at Towers Beach, and could interconnect with the electrical grid at the proposed Indian River substation (the same as Alternative B).

Under Alternative C there are 17 potential submerged historic properties within the Lease Area and in the vicinity of the Offshore Export Cable Route. The 14 potential submerged historic properties within the Lease Area (Targets 1-14) are the same for both Alternative C-1 (Towers Beach landfall) and C-2 (3R's Beach landfall) as for Alternative B. There are three additional potential submerged historic properties (Targets 16, 17, and 18) that are located in the vicinity of the Alternative C-1 Offshore Export Cable Route in state waters (Table 3.6.2-6).

Table 3.6.2-6. Potential submerged historic properties associated with Alternative C-1

Potential Submerged Historic Property	Description	Location*
Target 16	Uncharted shipwreck	Offshore Export Cable Route 2 (State waters)
Target 17	Chartered shipwreck; unknown shipwreck	Offshore Export Cable Route 2 (State waters)
Target 18	Possible uncharted shipwreck	Offshore Export Cable Route 2 (State waters)

*note: targets 16-18 are located in state waters, but outside the current preliminary area of potential effects.

Under Alternative C-1, the Onshore Export Cable Route 2 extends along existing roads and right of ways; as such, disturbed areas along these roads and right of ways are expected to have a low archaeological potential. However, undisturbed land adjacent to the roadways and land near waterways along the route are considered to have a high archaeological potential. Four previously recorded archaeological sites intersect the Alternative C-1 Onshore Export Cable Route 2 (Table 3.6.2-7), and numerous previously recorded historic properties, cemeteries, and structures are adjacent to or near the route. If the applicant selects Alternative C-1, BOEM would require a Phase 1 survey to assess the Onshore Export Cable Route 2 (Appendix G, *Mitigation and Monitoring*).

Table 3.6.2-7. Previously recorded archaeological sites associated with Alternative C-1 Onshore Export Cable Route 2

Archaeological Site	Description	Eligibility
7S-G-202	Satterfield House and West Cemetery site, c. 1800s	Eligible
7S-G-204	Lingo site, c. 1800s	Ineligible
7S-G-003	Pre-Contact site with mortuary component	Disturbed (on completed developed land)
7S-G-075	Woodland I Period site	Unevaluated

Source: COP, Volume II, Appendix I2; US Wind 2023

Alternative C-2 would use the same Offshore Export Cable Route and landfall site (3R's Beach) as Alternative B but would use an Onshore Export Cable Route between the landfall site and the Indian River substation that avoids Indian River Bay and the Indian River. As such, impacts of Alternative C-2 on marine archeological resources would be the same as for Alternative B.

Alternative C-2 includes three Onshore Export Cable Route options between 3Rs Beach and the onshore substation site, all of which extend along existing roads and right of ways. Numerous historic structures and cemeteries that are eligible for or listed in the NRHP are located along roads that comprise the Alternative C routes between Ocean View and Millville, Delaware. Listed and eligible archaeological resources in the APE for the various routes are summarized in Table 3.6.2-8. If US Wind selects Alternative C-2, BOEM would require a Phase 1 survey to assess the Onshore Export Cable Route option selected (Appendix G, *Mitigation and Monitoring*).

Table 3.6.2-8. Archaeological Resources associated with the Onshore Export Cable Routes of Alternative C-2

Alternative Route	Sites	Eligibility
Onshore Export Cable Route 1a	Dagsboro Historic District (7S-K-186)	NRHP eligible
	Prince Georges Episcopal Chapel and cemetery (7S-K-086)	NRHP Listed
Onshore Export Cable Route 1b	Pre-contact site (7S-K-044)	Unevaluated
	Pre-contact site (7S-K-024)	Unevaluated
	Archaic Period site (7S-K-213)	Unevaluated (within 2 meters of Onshore Export Cable Route 1b)
Onshore Export Cable Route 1c	Pre-contact site (7S-K-044)	Unevaluated
	Pre-contact site (7S-K-024)	Unevaluated
	Archaic Period site (7S-K-213)	Unevaluated (within 2 meters of the Onshore Export Cable Route 1c)

Source: COP, Volume II, Appendix I2; US Wind 2023
NRHP = National Register of Historic Places

3.6.2.6.1 Conclusions

Under Alternative C-1 or C-2, some of the impacts on cultural resources from Alternative B would not occur during construction and installation. BOEM would provide a more detailed analysis of the impacts of the Alternative C-1 and C-2 on cultural resources in a supplemental NEPA analysis if the Alternative is selected. However, O&M and decommissioning would have similar impacts as described under Alternative B for all IPFs, except as discussed below.

The region that the Onshore Export Cable Route (and alternatives discussed in Section 3.6.2.6, Alternative C – Landfall and Onshore Export Cable Routes) passes through generally has a high potential for containing archaeological resources with some areas. Once the PAPE is refined, further investigation will be necessary to determine potential effects on historic properties within the terrestrial archaeology APE. The Phase 1B archaeological survey is still pending for the proposed onshore substation sites and additional route segments and potential additional parcels near the onshore substation.

Alternative C-1 would not affect any additional offshore resources, as US Wind would avoid the three submerged historic properties, and impacts would be avoided on offshore resources similar to Alternative B, since no impacts to offshore resources are anticipated under Alternative B. These differences notwithstanding, Alternative C would have similar impacts as Alternative B: **negligible** to **major** (for impacts on ancient, submerged landforms) with an overall **moderate** impact on cultural resources. In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C would be similar to Alternative B. Alternative C would contribute a substantial increment to the combined impacts from ongoing and planned activities including offshore wind, which would be **moderate**.

3.6.2.7 Impacts of Alternatives D – No Surface Occupancy to Reduce Visual Impacts and E – Habitat Impact Minimization Alternative

3.6.2.7.1 Construction and Installation

Alternative D would exclude all WTGs and OSSs within 14 mi (22.5 kilometer) of the shoreline, resulting in the exclusion of 32 WTGs and 1 OSS. Alternative E would result in the exclusion of 11 WTG foundations within the Lease Area. The exclusion of foundations and associated inter-array cables would reduce but would not eliminate impacts on ancient submerged landforms. The exclusion of WTG and OSS structures would reduce nighttime lighting during construction, O&M, and decommissioning and could reduce (but would not eliminate) potential impacts from the IPFs for lighting and the presence of structures on the three historic properties listed in Table 3.6.2-3. Use of a different Offshore Export Cable Route could result in different impacts (but would not eliminate impacts) on ancient, submerged landforms than Alternative B. Alternatives D and E would have the same impacts on onshore cultural resources as Alternative B.

3.6.2.7.1.1 Onshore Activities and Facilities

Implementation of Alternatives D and E would reduce some impacts on cultural resources but would not change any impact magnitudes compared to Alternative B. As a result, Alternatives D and E would have negligible to major impacts on cultural resources, with an overall moderate impact. In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives D and E would be similar to Alternative B. Alternatives D and E would contribute a substantial increment to the combined impacts from ongoing and planned activities including offshore wind, which would be moderate.

3.6.2.7.2 Conclusions

Implementation of Alternatives D and E would result in similar effects on cultural resources as Alternative B. Alternatives D and E would not avoid impacts on onshore or offshore resources compared to Alternative B.

These differences notwithstanding, Alternatives D and E would have similar impacts as Alternative B: **negligible** to **major** (for impacts on ancient, submerged landforms) with an overall **moderate** impact on cultural resources. In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives D and E would be similar to Alternative B. Alternatives D and E would contribute a substantial increment to the combined impacts from ongoing and planned activities including offshore wind, which would be **moderate**.

3.6.2.8 Comparison of Alternatives

As described in Section 3.6.2.5, the Proposed Action in combination with ongoing and planned activities would have similar impacts on cultural resources as the No Action Alternative. The Proposed Action would affect cultural resources primarily through cable emplacement and maintenance, land disturbance, lighting (affecting resources for which a dark nighttime sky is a contributing element to historical integrity), and the physical and visual effects of the presence of structures (i.e., damage to ancient, submerged landforms, as well as visual effects on resources for which an uninterrupted sea view, free of intrusive visual elements, is a contributing element to NRHP eligibility). Under the No Action Alternative, these impacts would not occur.

The action alternatives could reduce or change the extent of impacts on onshore and offshore cultural resources, compared to Alternative B. Alternatives C-1 and C-2 could affect different onshore resources due to the inclusion of Onshore Export Cable Routes. Alternative C-1 could affect different offshore resources due to the use of different Offshore Export Cable Routes. Alternatives D and E could reduce (but would not completely avoid) impacts on ancient, submerged landforms due to the reduced number of foundations and reduced extent of inter-array cables. These differences notwithstanding, the action alternatives would not result in meaningfully different impacts on cultural resources compared to Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **negligible** to **major** with an overall **moderate** impact. In context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternatives on cultural resources when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **negligible** to **major** with an overall **moderate** impact.

If BOEM requires mitigation measures beyond the design features described in Section 3.6.2.4, adverse Project impacts on cultural could be further reduced and beneficial impacts could be increased; however, overall impact magnitudes would remain the same as described in this section.

3.6.3 Demographics, Employment, and Economics

The reader is referred to Appendix F, *Impact-Producing Factor Tables and Assessment of Resources with Minor (or Lower) Impacts*, for a discussion of current conditions and potential impacts on demographics, employment, and economics from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.6.4 Environmental Justice

This section discusses environmental justice impacts from the Proposed Action, action alternatives, and ongoing and planned activities in the environmental justice geographic analysis area. The geographic analysis area for environmental justice (Figures 3.6.4-1 through 3.6.4-6) includes the counties where proposed onshore infrastructure and potential ports are located, as well as the counties in closest proximity to the Lease Area: Sparrows Point (Port of Baltimore), Maryland; Worcester County (including Ocean City), Maryland; Sussex County (including the City of Lewes), Delaware; Cape Charles, Virginia; Portsmouth (Hampton Roads area), Virginia; and Port Norris, New Jersey. These counties and cities are the most likely to experience beneficial or adverse environmental justice impacts from the Proposed Action related to onshore and offshore construction and use of port facilities.

Environmental justice impacts are characterized for each IPF as negligible, minor, moderate, or major using the four-level classification scheme outlined in Section 3.6.4.2 below. A determination of whether impacts are "disproportionately high and adverse" is made in accordance with EO 12898 and is provided in the conclusion sections for the Proposed Action and action alternatives.

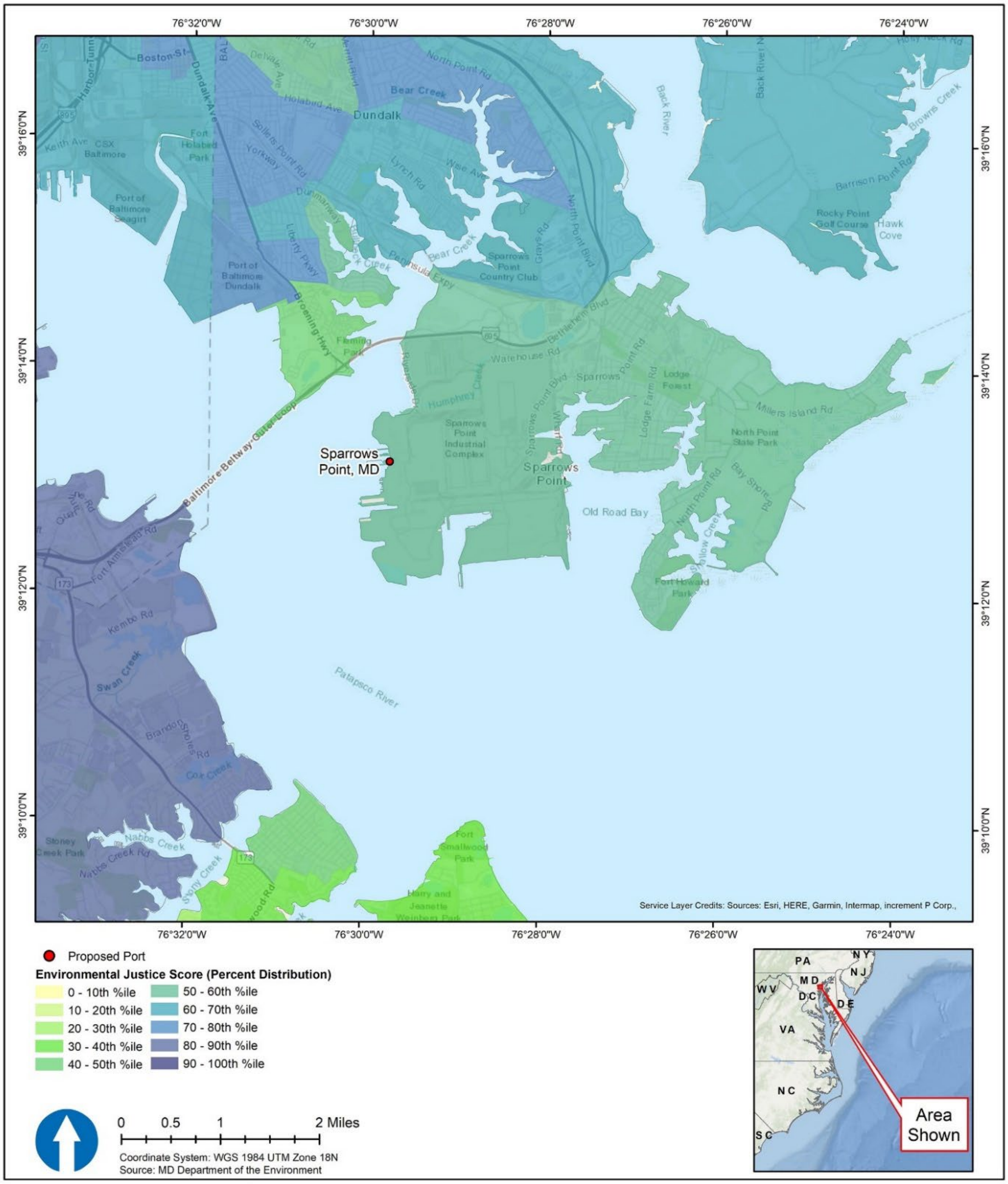


Figure 3.6.4-1. Environmental justice communities near Sparrows Point, Maryland

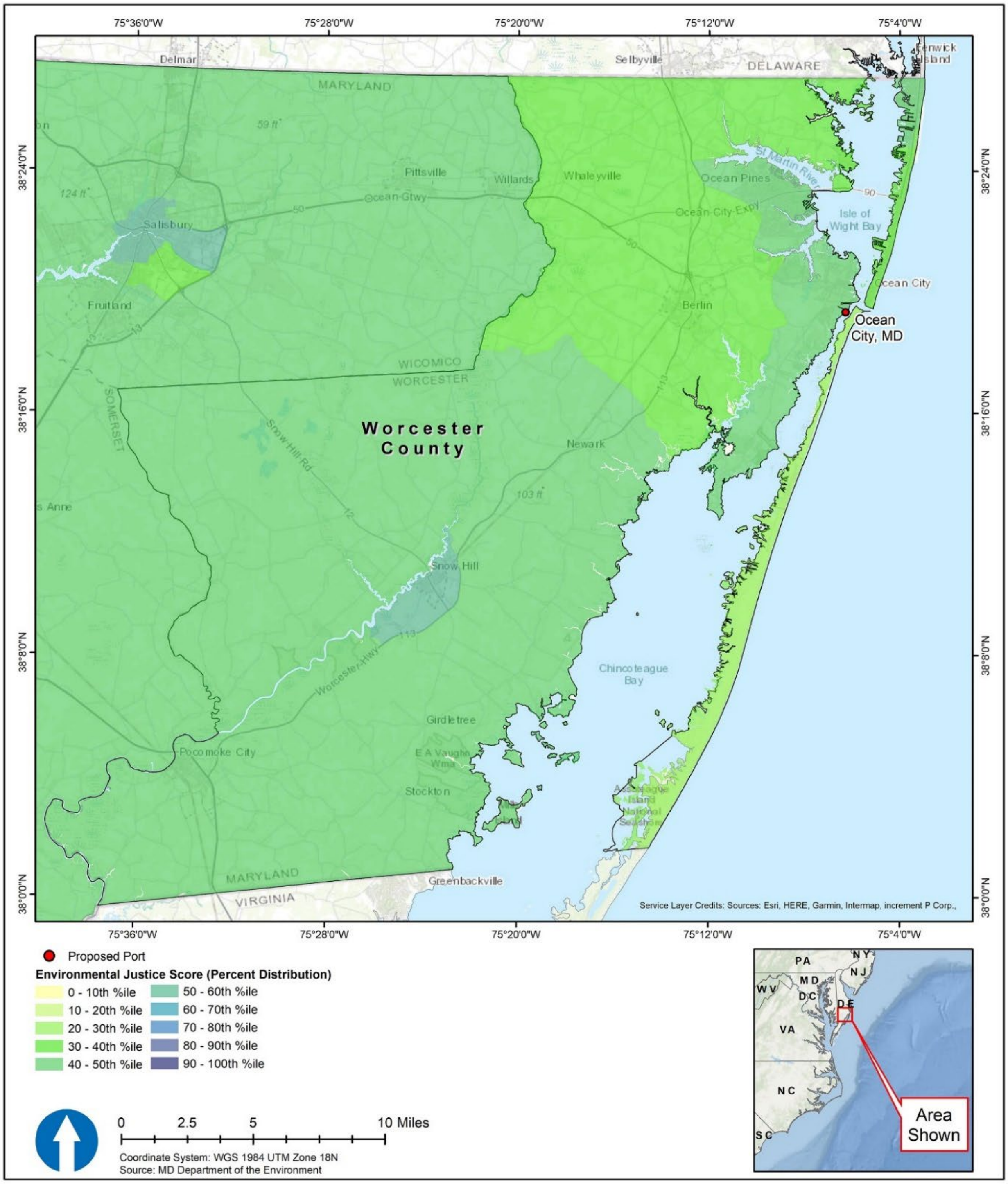


Figure 3.6.4-2. Environmental justice communities in Worcester County, Maryland

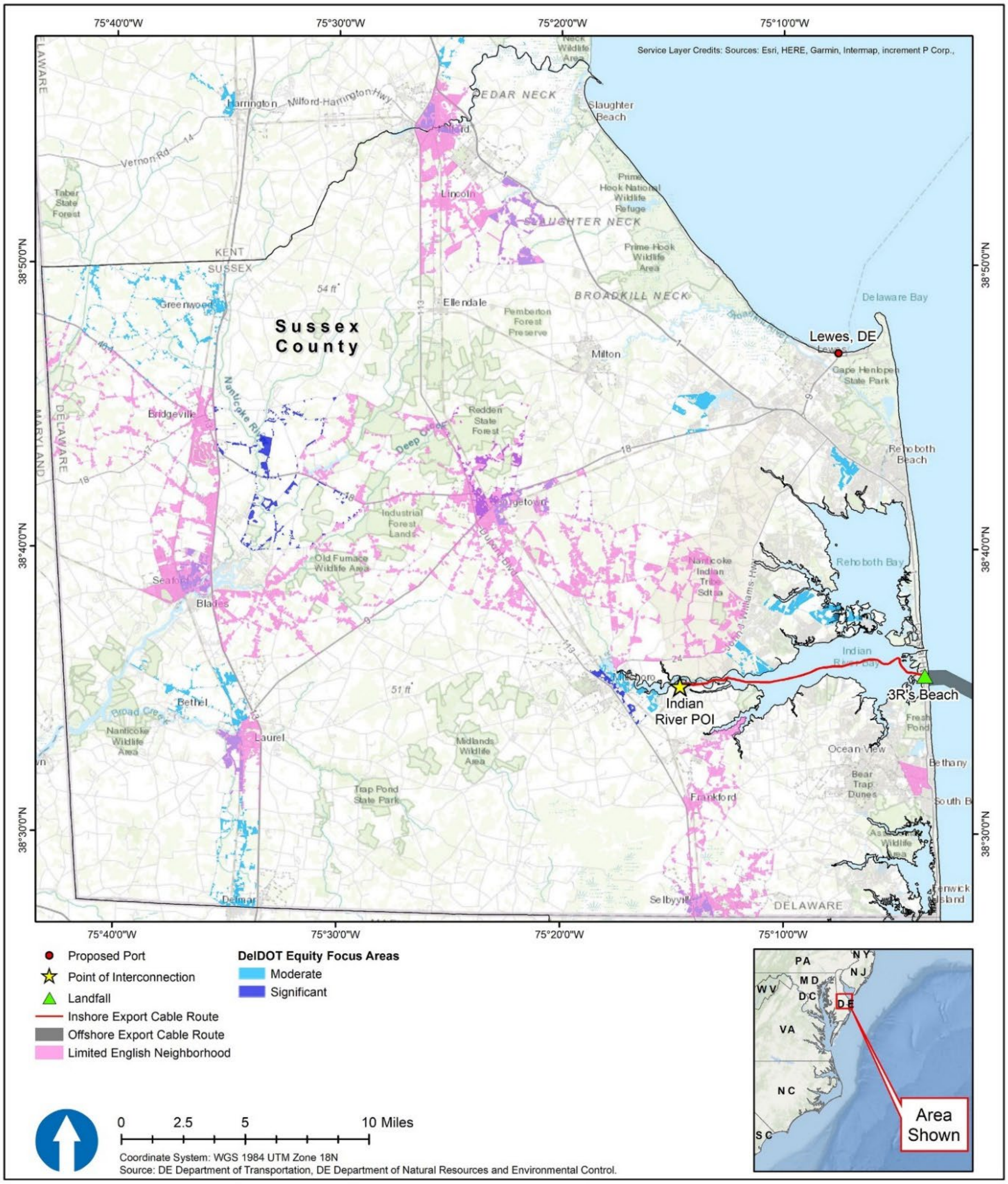


Figure 3.6.4-3. Environmental justice communities in Sussex County, Delaware

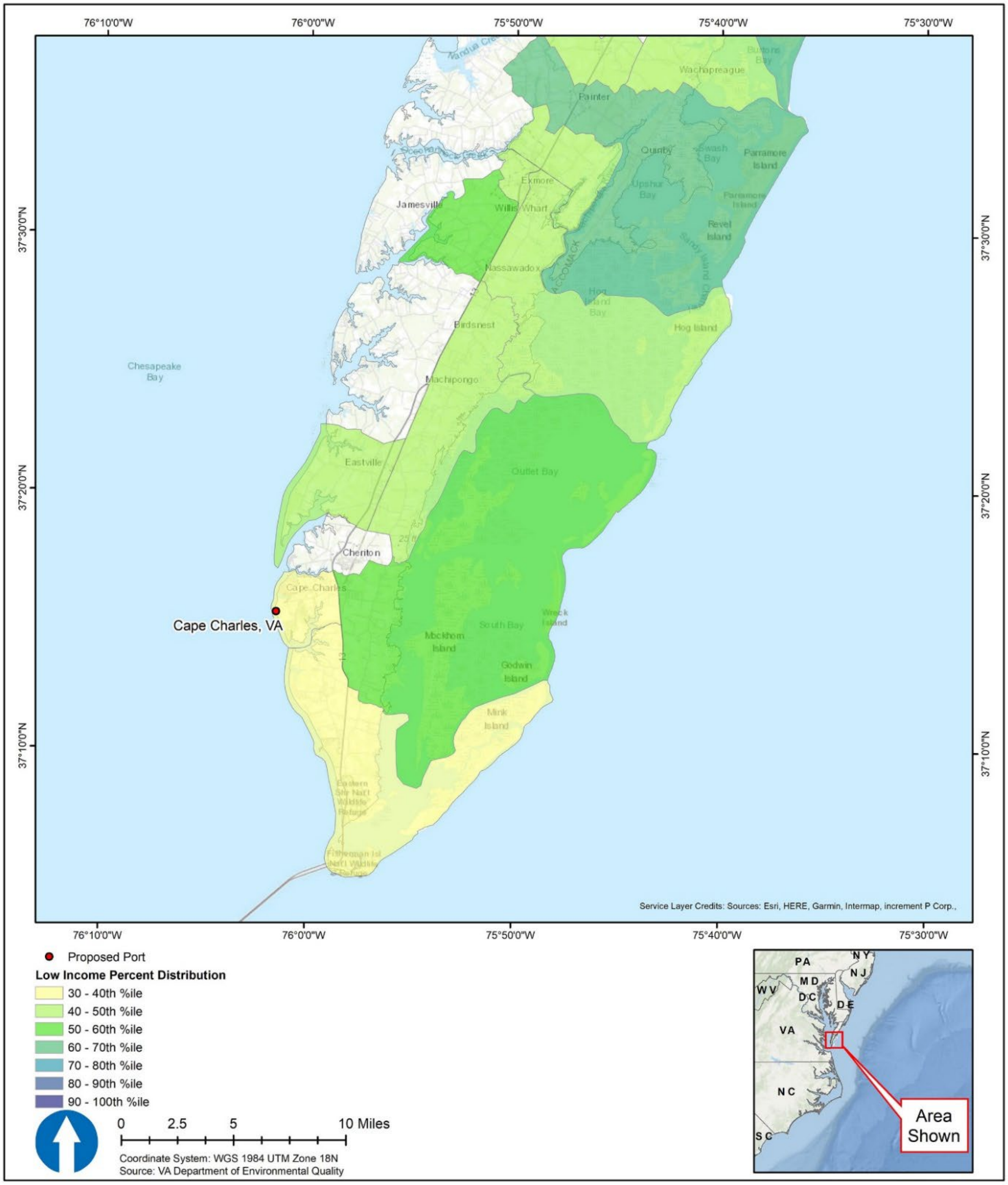


Figure 3.6.4-4. Environmental justice communities near Cape Charles, Virginia

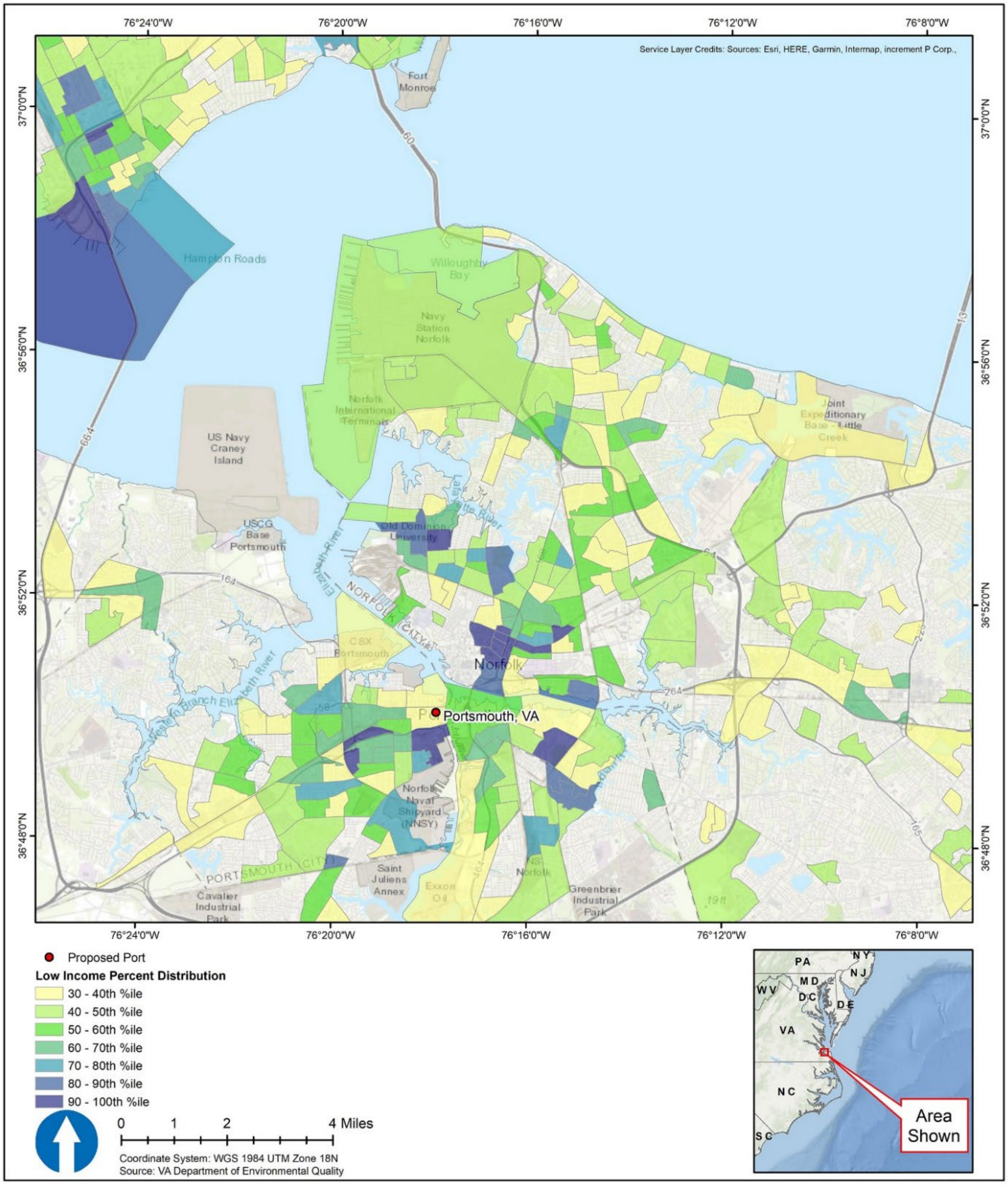


Figure 3.6.4-5. Environmental justice communities in Portsmouth, Virginia

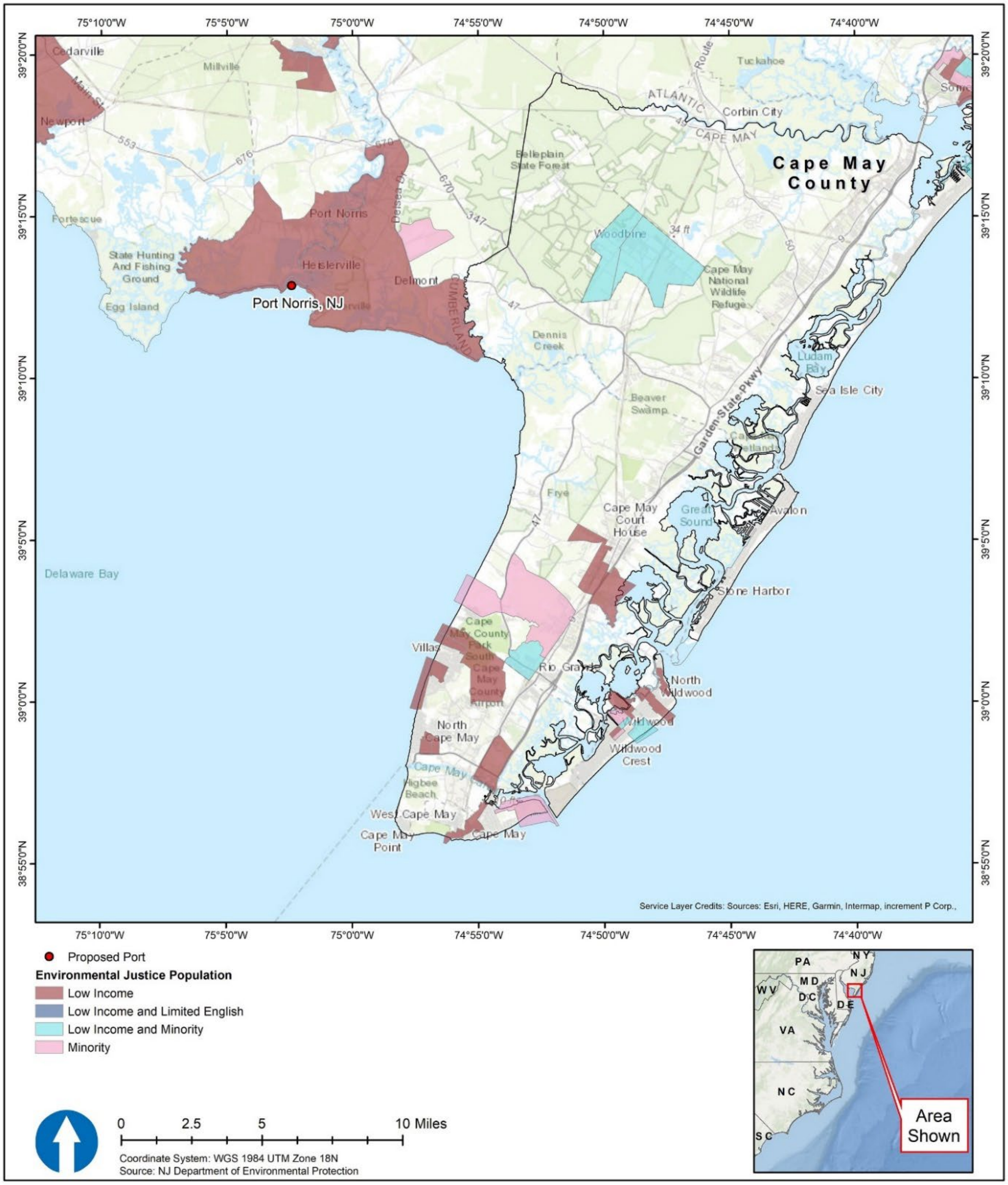


Figure 3.6.4-6. Environmental justice communities near Port Norris, New Jersey

3.6.4.1 Description of the Affected Environment and Future Baseline Conditions

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Subsection 1-101). When determining whether environmental effects are disproportionately high and adverse, agencies are to consider whether there is or will be an impact on the natural or physical environment that significantly and adversely affects a minority population, low-income population, or Native American tribe, including ecological, cultural, human health, economic, or social impacts; and whether the effects appreciably exceed those on the general population or other appropriate comparison group (CEQ 1997). Beneficial impacts are not typically considered environmental justice impacts; however, this section identifies beneficial effects on environmental justice populations, where appropriate, for completeness.

EO 12898 directs federal agencies to consider the following with respect to environmental justice as part of the NEPA process (CEQ 1997).

- The racial and economic composition of affected communities;
- Health related issues that may amplify project effects on minority or low-income individuals; and
- Public participation strategies, including community or tribal participation in the NEPA process.

In January 2021, President Joseph R. Biden issued EO 14008, *Tackling the Climate Crisis at Home and Abroad,* which affirmed the United States' emphasis on environmental justice, including, "investing [in] and building a clean energy economy that creates well-paying union jobs, turning disadvantaged communities—historically marginalized and overburdended—into healthy, thriving communities. Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts" (Section 219). This EO also established the Justice40 Initiative with its goal that, "40 percent of the overall benefits [from certain Federal investments] flow to disadvantaged communities" (Section 223).

According to USEPA guidance, environmental justice analyses must address disproportionately high and adverse impacts on minority populations (i.e., who are non-white, or who are white and have Hispanic ethnicity) when minority populations represent more than 50 percent of the population of an affected area or when the percentage of minority or low-income populations in the affected area is "meaningfully greater" than the minority percentage in the "reference population"—defined as the population of a larger area in which the affected population resides (i.e., a county, state, or region depending on the geographic extent of the analysis area). Low-income populations are those that fall within the annual statistical poverty thresholds from the U.S. Department of Commerce, U.S. Census Bureau, Population Reports, Series P-60 on Income and Poverty (USEPA 2016).

CEQ and USEPA guidance do not define “meaningfully greater” in terms of a specific percentage or other quantitative measure. Because Virginia, Maryland, and Delaware do not provide specific thresholds, this analysis defines an environmental justice population in those states as a block group that either (1) meets USEPA’s “50 percent” criterion for race, or (2) is in the 80th percentile or higher for minority or low-income status as compared to the respective state population. The USEPA’s Environmental Justice Screening and Mapping Tool’s (EJScreen) data were used to assess the 50 percent criterion for race and the 80th percentile criterion for minority and low-income status (USEPA 2021a). Environmental justice populations meeting the minority or income criteria, or both, are present within and near Sparrows Point (Figure 3.6.4-1), Cape Charles (Figure 3.6.4-4); Portsmouth (Figure 3.6.4-5), and Port Norris (Figure 3.6.4-6).

The CEQ’s Climate and Economic Justice Screening Tool (CEJST) identifies disadvantaged communities as those that meet more than one burden threshold and the associated socioeconomic threshold. CEJST also designates the lands of federally recognized tribes as disadvantaged. Disadvantaged communities under this measure are present within and near Sparrows Point (Figure 3.6.4-7), Worcester County (Figure 3.6.4-8), Sussex County (Figure 3.6.4-9), Cape Charles (Figure 3.6.4-10), Portsmouth (Figure 3.6.4-11), and Port Norris (Figure 3.6.4-12) (CEQ 2022).

The DelDOT’s Equity Analysis Tool uses American Community Survey data to determine moderate and significant environmental justice neighborhoods (Figure 3.6.4-3). Moderate Environmental Justice Neighborhoods are defined as areas where the percent of the population in poverty is greater than the State average and minorities are two times greater than the State average; where minority population or percent of population in poverty is two times greater than the State average; or where the median household income is less than or equal to $45,985 (Johnson 2023). Significant Environmental Justice Neighborhoods are those where the percent of the population in poverty is greater than the State average and minorities are three times greater than the State average; where minority population or percent of population in poverty is three times greater than the State average; or where the median household income is less than or equal to $28,070 (Johnson 2023).

The Commonwealth of Virginia’s Environmental Justice Act defines low-income communities as those with, “an annual household income equal to or less than the greater of (i) an amount equal to 80 percent of the median income of the area in which the household is located, as reported by the Department of Housing and Urban Development, and/or (ii) 200 percent of the Federal Poverty Level” and “any census block group in which 30 percent or more of the population is composed of people with low income” (Va. Code, Article 12, § 2.2-234).

The Virginia Environmental Justice Act also describes a “community of color” as “any geographically distinct area where the population of color, expressed as a percentage of the total population of such area, is higher than the population of color in the Commonwealth expressed as a percentage of the total population of the Commonwealth” (Va. Code, Article 12, § 2.2-234). Virginia does not provide separate mapping of the low-income communities and communities of color described above. Block groups in Cape Charles and Portsmouth, identified in Figures 3.6.4-4 and 3.6.4-5 (respectively) as meeting federal criteria for consideration as environmental justice communities generally also meet the state criteria.

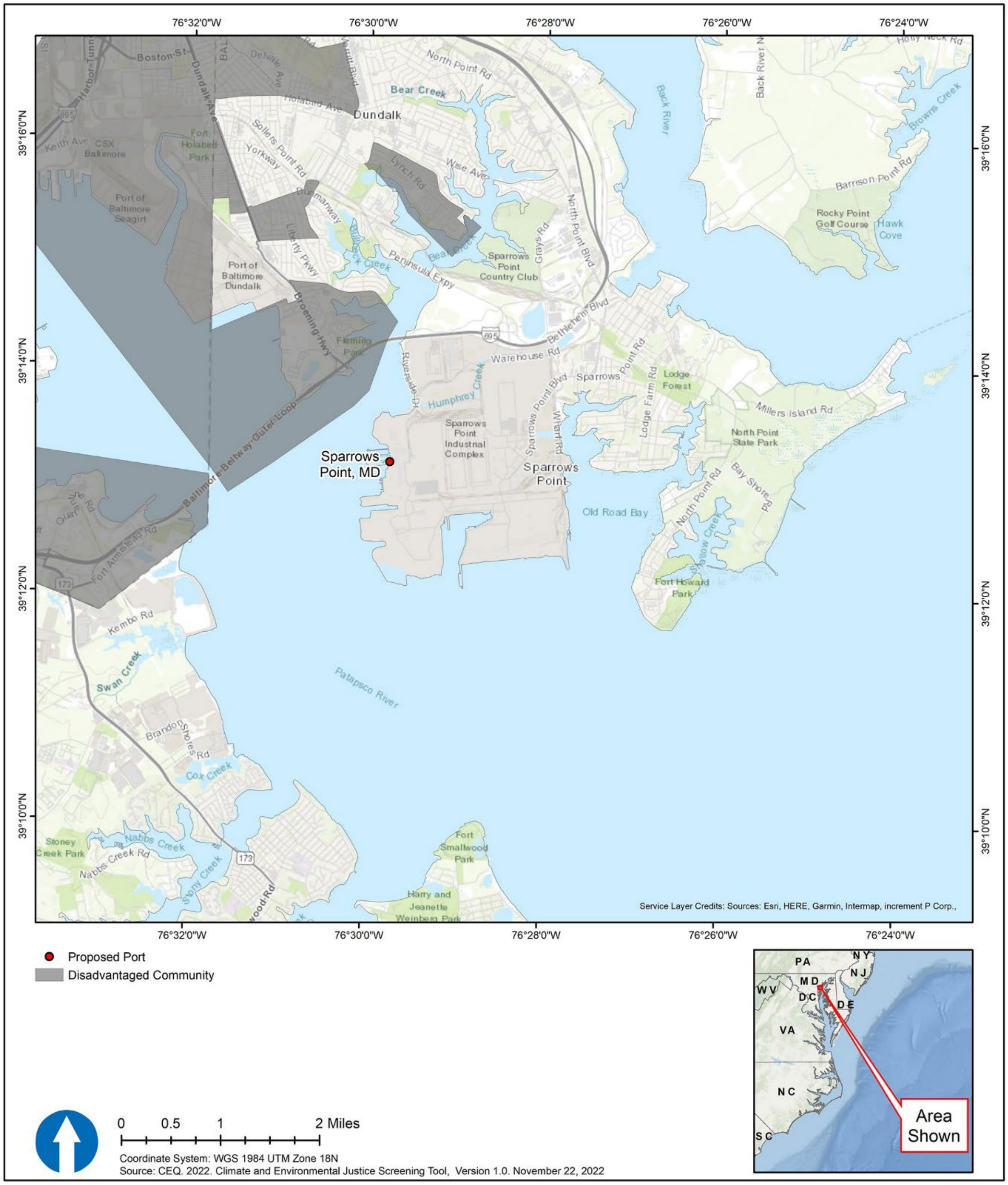


Figure 3.6.4-7. Disadvantaged communities near Sparrows Point, Maryland

Source: Climate and Economic Justice Screening Tool (CEJST)

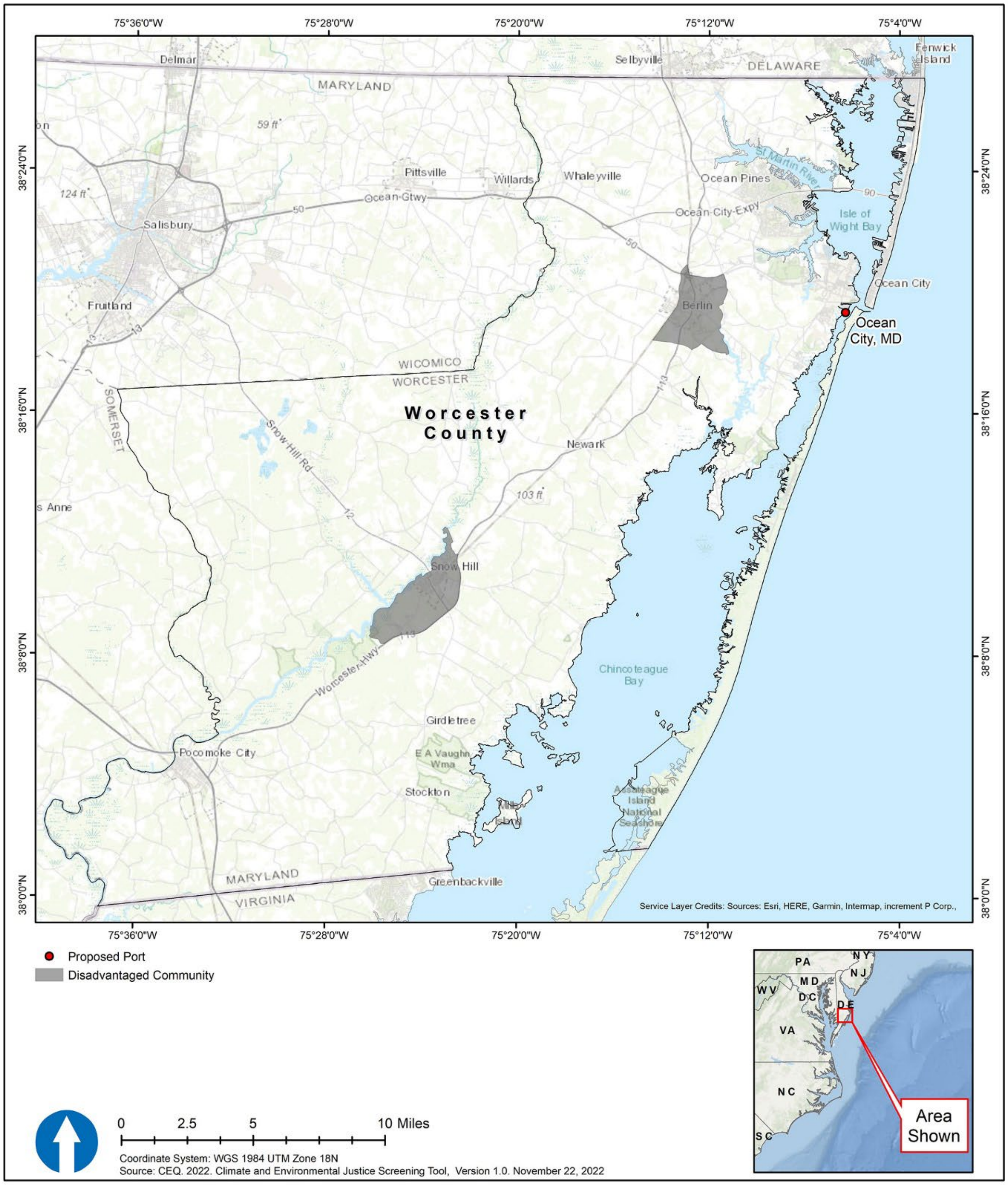


Figure 3.6.4-8. Disadvantaged communities in Worcester County, Maryland

Source: Climate and Economic Justice Screening Tool (CEJST)

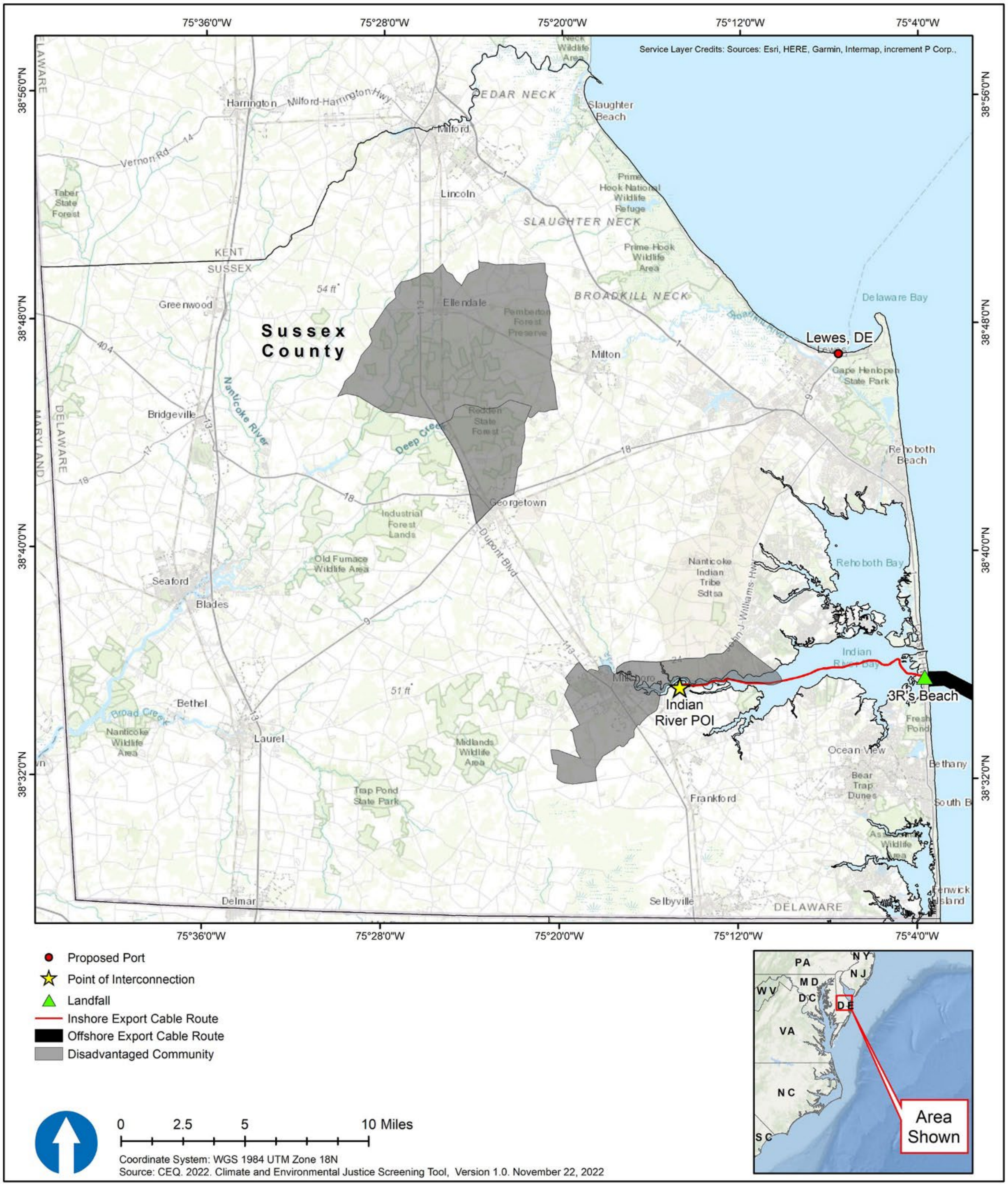


Figure 3.6.4-9. Disadvantaged communities in Sussex County, Delaware

Source: Climate and Economic Justice Screening Tool (CEJST)

Figure 3.6.4-10. Disadvantaged communities near Cape Charles, Virginia
Source: Climate and Economic Justice Screening Tool (CEJST)

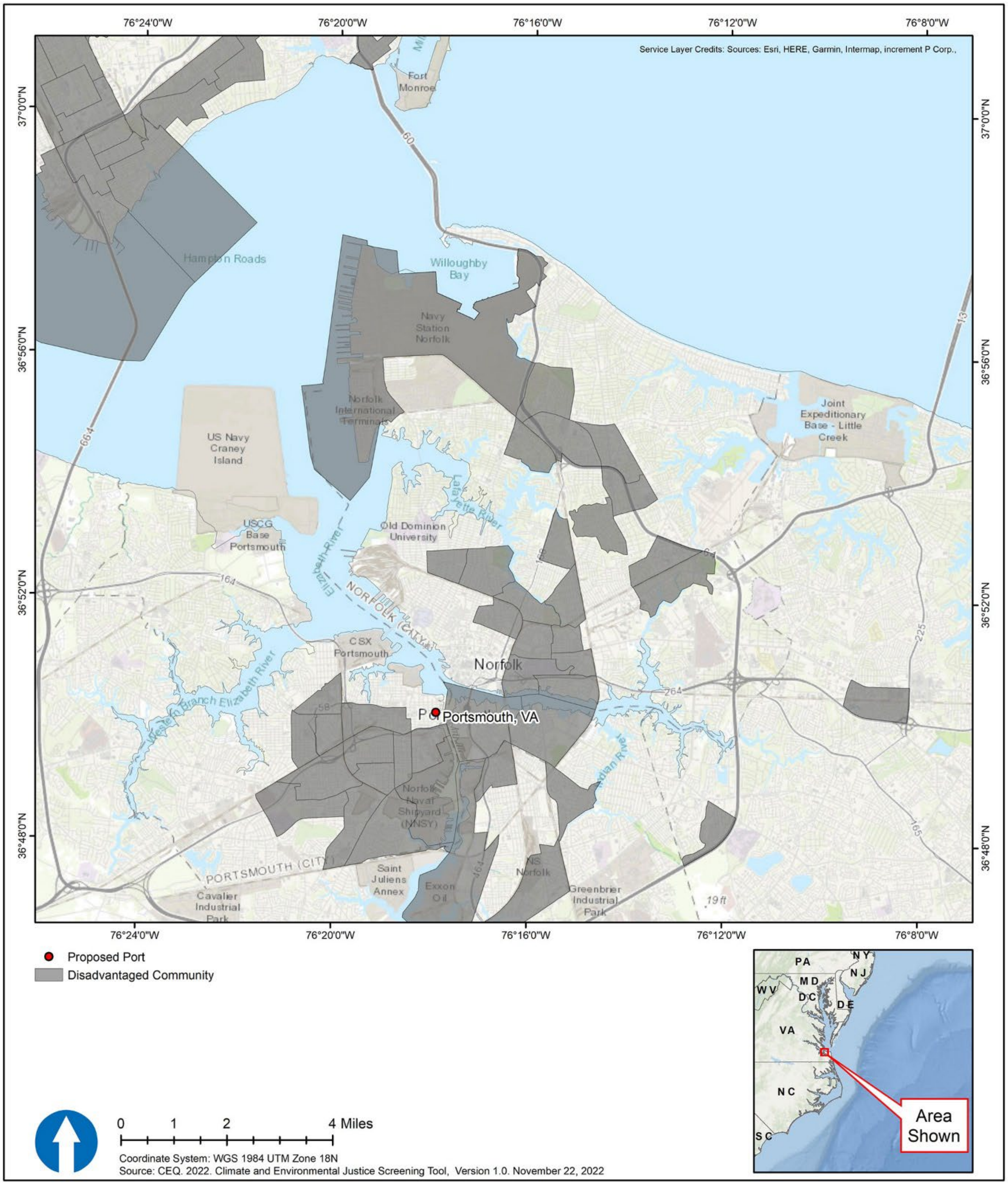


Figure 3.6.4-11. Disadvantaged communities near Portsmouth, Virginia

Source: Climate and Economic Justice Screening Tool (CEJST)

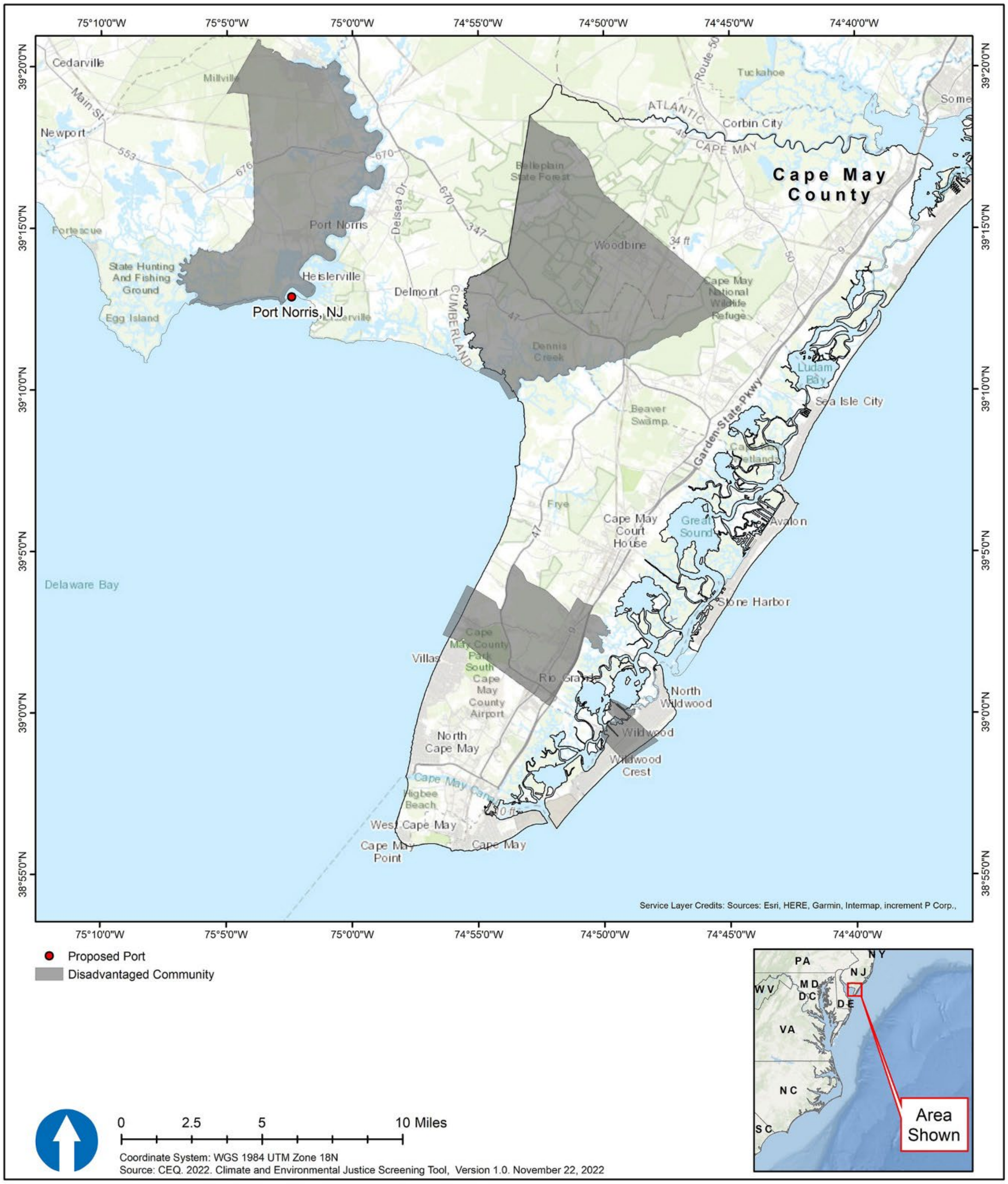


Figure 3.6.4-12. Disadvantaged communities near Port Norris, New Jersey

Source: Climate and Economic Justice Screening Tool (CEJST)

The State of New Jersey's Environmental Justice Law (New Jersey Statutes Annotated 13:1D-157) directs the state to publish a list of overburdened communities. An overburdened community, as defined by the law, is any census block group in which:

- At least 35 percent of the household qualify as low-income households (at or below twice the poverty threshold as determined by the U.S. Census Bureau);
- At least 40 percent of the residents identify as minority or as members of a state-recognized tribal community; or
- At least 40 percent of the households have limited English proficiency (without an adult that speaks English "very well" according to the U.S. Census Bureau) (NJDEP 2021).

Using this definition, environmental justice communities in the New Jersey portion of the geographic analysis area are found within a 1-mile (1.6-kilometer) radius of Port Norris (Figure 3.6.4-6). This analysis defines any state-identified overburdened community in New Jersey as an environmental justice community. Some of the block groups identified as being overburdened on Figure 3.6.4-6 are also identified as meeting federal environmental justice criteria (i.e., 80th percentile or higher compared to the state); however, because the New Jersey criteria for overburdened criteria are more stringent and specific, the mapping provided by the State of New Jersey is considered to be the more inclusive definition of environmental justice communities near Port Norris.

Table 3.6.4-1 summarizes trends for non-white populations and the percentage of residents with household incomes below the federally defined poverty line in the geographic analysis area counties. The nonwhite population percentage generally increased throughout the geographic analysis area between 2000 and 2020. The percentage of population living under the poverty level has generally increased from 2000 to 2010 and declined slightly through 2020, although poverty trends were less uniform than nonwhite population trends on a jurisdiction-by-jurisdiction basis.

Low-income and minority workers may be employed in commercial fishing and supporting industries that provide employment on commercial fishing vessels, at seafood processing and distribution facilities, and in trades related to vessel and port maintenance, or operation of marinas, boat yards, and marine equipment suppliers and retailers. NOAA's social indicator mapping (NOAA 2023a) was used to identify environmental justice populations in the geographic analysis area that also have a high level of fishing engagement or fishing reliance. The fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities:

- Commercial fishing engagement measures the presence of commercial fishing throughout fishing activity as shown through permits, fish dealers, and vessel landings. A high rank indicates more engagement.
- Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity. A high rank indicates more reliance.
- Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. A high rank indicates more engagement.
- Recreational fishing reliance measures the presence of recreational fishing in relation to the population size of the community. A high rank indicates increased reliance.

Table 3.6.4-1. Race and poverty trends

Jurisdiction	Non-white Population Percentage			Percentage of Population Below the Federal Poverty Level		
	2000	2010	2020	2000	2010	2020
State of Maryland	37.9%	45.3%	52.8%	8.5%	8.6%	9.0%
Edgemere (Sparrows Point)[1]	7.1%	7.2%	12.6%	7.0%	10.6%	7.5%
Ocean City	5.6%	11.2%	13.5%	8.4%	11.3%	9.7%
Worcester County	19.6%	19.7%	21.1%	9.6%	10.1%	9.2%
State of Delaware	27.5%	34.7%	42.2%	9.2%	11.0%	11.4%
City of Lewes	13.2%	11.3%	11.1%	6.3%	13.3%	5.1%
Sussex County	21.5%	24.4%	27.7%	10.5%	11.7%	11.7%
Commonwealth of Virginia	29.8%	35.2%	41.4%	9.6%	10.3%	10.0%
Cape Charles	46.6%	39.6%	27.8%	28.4%	18.5%	16.0%
Portsmouth	54.7%	59.7%	64.3%	16.2%	15.2%	15.7%
State of New Jersey	34.0%	40.7%	48.1%	8.5%	9.1%	9.7%
Port Norris	43.3%	36.7%	39.4%	16.1%	14.8%	15.5%

Source: U.S. Census Bureau 2000, 2010a, b, 2020a, b

[1] The Edgemere census-designated place includes Sparrows Point.

Figures 3.6.4-13 and 3.6.4-14 show the level of fishing engagement and reliance in coastal communities in the geographic analysis area. Coastal communities with a high level of commercial or recreational fishing engagement or reliance are near but do not specifically overlap with environmental justice communities in Portsmouth (Figures 3.6.4-5, 3.6.4-11, 3.6.4-13 and 3.6.4-14).

NOAA has also developed social indicator mapping related to gentrification pressure (NOAA 2023a). The gentrification pressure indicators measure factors that, over time, may indicate a threat to the viability of a commercial or recreational working waterfront. Gentrification indicators are related to housing disruption, retiree migration, and urban sprawl.

- Housing disruption represents factors that indicate a fluctuating housing market where some displacement may occur due to rising home values and rents including changes in mortgage values. A high rank means more vulnerability for those in need of affordable housing and a population more vulnerable to gentrification.
- Retiree migration characterizes communities with a higher concentration of retirees and elderly people in the population including households with inhabitants over 65 years old; populations receiving social security or retirement income; and level of participation in the work force. A high rank indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living.
- Urban sprawl describes areas experiencing gentrification through increasing population density, proximity to urban centers, home values, and the cost of living. A high rank indicates a population more vulnerable to gentrification.

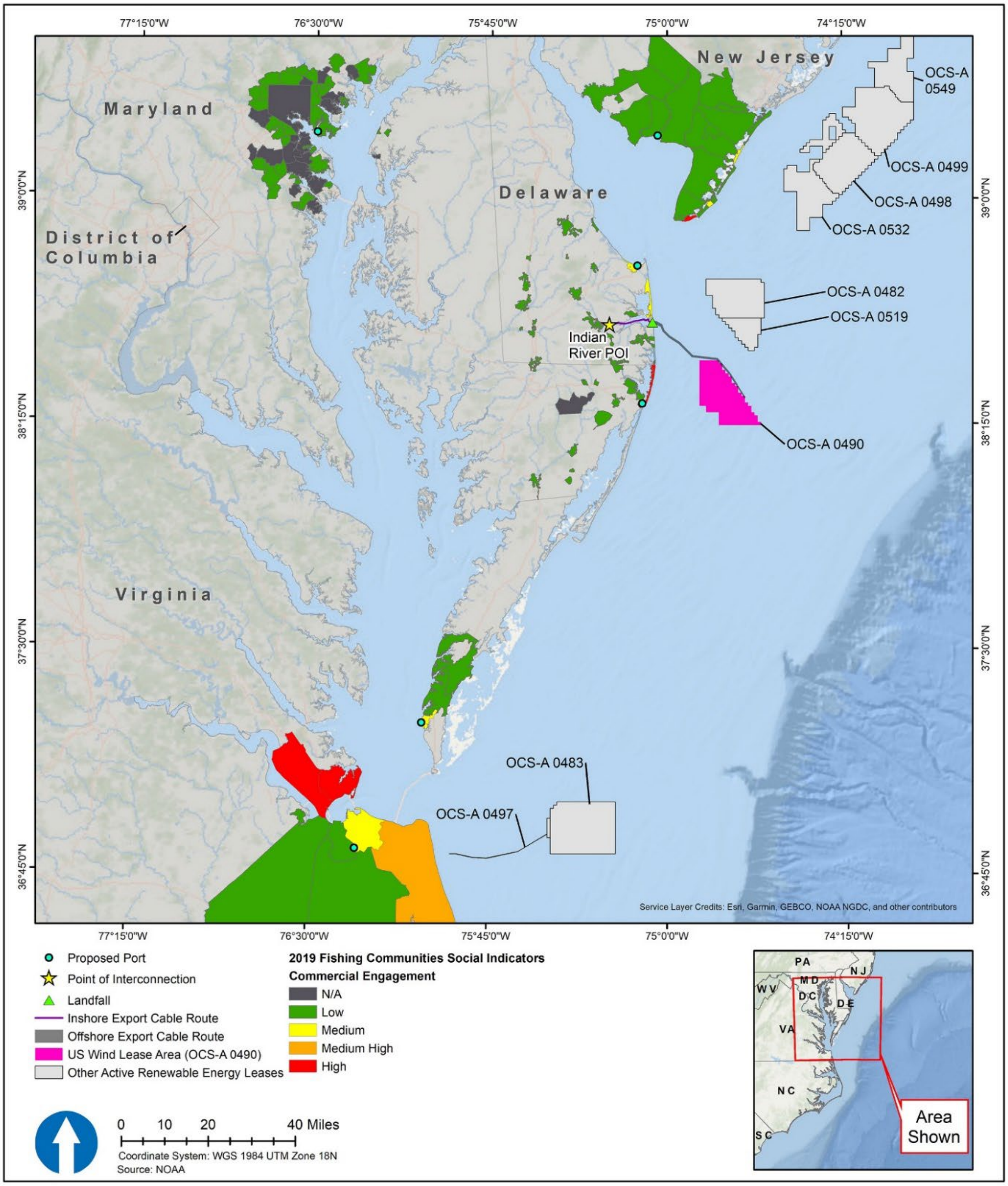


Figure 3.6.4-13. Commercial and recreational fishing engagement in the Project area

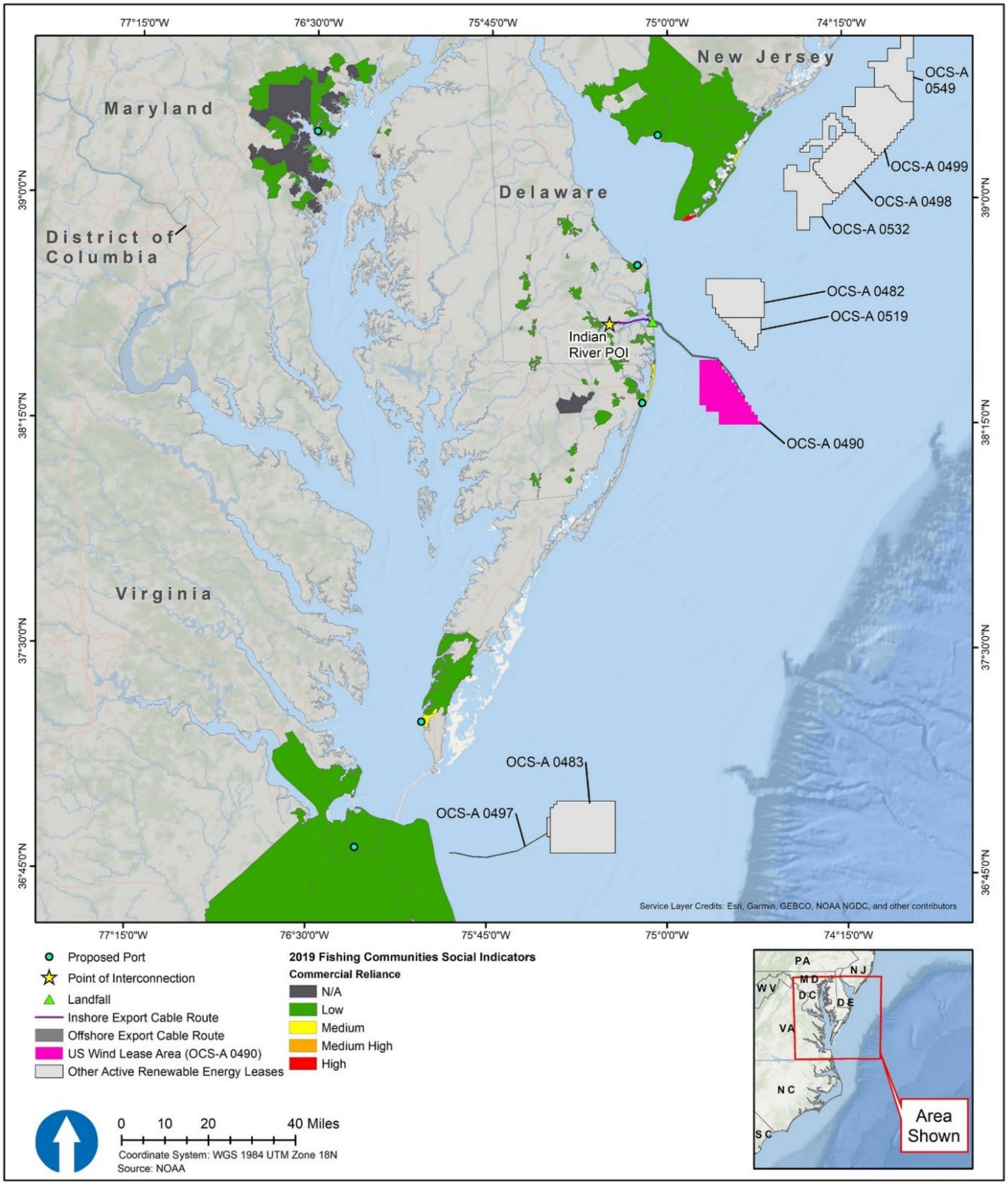


Figure3.6.4-14. Commercial and recreational fishing reliance in the Project area

Mapping for gentrification indices show medium high to high levels of housing disruption and retiree migration in coastal communities near ports in Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; Cape Charles, Virginia; and Port Norris, New Jersey. Urban sprawl across the same area exhibits low to medium pressure, except for higher pressure near Sparrows Point. Overall, mapping identifies higher gentrification pressure near ports in Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; Cape Charles, Virginia; and Port Norris, New Jersey, compared to other nearby coastal areas.

The NOAA Marine Recreation Information Program (MRIP) database (NOAA 2023b) catalogs sites that provide water access for recreational fishing. In addition to MRIP sites outside of environmental justice communities, the MRIP database identifies 3 sites in portions of Baltimore County near Sparrows Point, 5 sites in or near Cape Charles, 1 in Portsmouth, and 7 in or near Port Norris (NOAA 2023b). The MRIP database does not specifically identify whether or the degree to which these sites serve environmental justice populations or subsistence activities.

Environmental justice analyses must also address impacts on Native American tribes. Federal agencies should evaluate “interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action,” and “recognize that the impacts within…Indian tribes may be different from impacts on the general population due to a community’s distinct cultural practices” (CEQ 1997). Factors that could lead to a finding of significance for environmental justice populations include loss of significant cultural or historical resources and the impact’s relation to other cumulatively significant impacts (USEPA 2016).

As part of its ongoing stakeholder engagement, US Wind is actively working with the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Lenape Tribe of Delaware as well as thirteen additional Tribes with potential cultural linkage to the Project area in order to better understand how the Proposed Action may impact the natural and physical environmental resources, as well as the social and cultural resources, used by these communities (COP, Volume II, Section 17.4.1; US Wind 2023). Although the Nanticoke Tribe is no longer a state or federally recognized tribal nation, the Nanticoke Indian Tribe State Designated Tribal Statistical Areas (SDTSA) (U.S. Census Bureau 2020c) is on the north side of the Indian River from the Proposed Action’s onshore substation site. In addition to the coordination between BOEM and the tribes, US Wind has communicated and will continue to communicate with the tribes directly throughout the Project. Section 3.6.2 and the COP (Volume II, Section 17.4.1; US Wind 2023) list the tribes contacted and describes the tribal outreach process by BOEM and US Wind.

3.6.4.2 Impact Level Definitions for Environmental Justice

To define the scope of the environmental justice analysis, BOEM reviewed the impact conclusions for each resource analyzed in other sections of Chapter 3 to assess whether the Proposed Action and action alternatives would result in major impacts on environmental justice populations that would be considered “disproportionately high and adverse,” based on the geographic extent of the impact relative to the locations of environmental justice populations. Major impacts that could affect environmental justice populations were further analyzed to determine if the impact would be disproportionately high and adverse. Although the environmental justice analysis considers impacts of other ongoing and planned activities, including other future offshore wind projects, determinations as to whether impacts on environmental justice populations would be disproportionately high and adverse are made for the Proposed Action and action alternatives alone.

Project infrastructure including cable landfalls, Inshore and Onshore Export Cable Routes, onshore substations, and points of interconnection are not in areas where environmental justice populations have been identified and would therefore not affect environmental justice populations. Because onshore construction would not affect environmental justice populations identified in the geographic analysis area, impacts associated with construction, O&M, and decommissioning of Inshore and Onshore Project components are not carried forward for further analysis of disproportionately high and adverse effects within the environmental justice analysis. Based on the geographic extent of onshore construction impacts relative to the location of environmental justice populations, BOEM concludes that environmental justice populations would not experience disproportionately high and adverse effects related to construction, O&M, and decommissioning of onshore infrastructure.

The following ports would support construction and operation of the Project: Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; Portsmouth (Hampton Roads area) and Cape Charles, Virginia; and Port Norris, New Jersey. As shown on Figures 3.6.4-1 through 3.6.4-8, many of these ports are within or near environmental justice communities. Therefore, port utilization is carried forward for analysis of disproportionately high and adverse effects in this environmental justice analysis under the port utilization and air emission IPFs.

Construction, O&M, and decommissioning of offshore structures (WTGs and OSSs) could have major impacts on some commercial fishing operations that use the Lease Area, with potential for indirect impacts on employment in related industries that could affect environmental justice populations (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*). The long-term presence of offshore structures (WTGs and OSSs) would also have major impacts on visual resources and viewer experience from some onshore viewpoints that could affect environmental justice populations (Section 3.6.9, *Visual Resources*). Therefore, impacts of construction, O&M, and decommissioning of Offshore Project components is carried forward for analysis of disproportionately high and adverse effects in this environmental justice analysis under the IPFs for presence of structures, cable emplacement and maintenance, and noise.

Construction of offshore wind foundations and cables could result in major impacts on ancient, submerged landforms if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction (Section 3.6.2, *Cultural Resources*). BOEM has committed to working with the lessee, consulting parties, Native American tribes, and the Maryland and Delaware SHPO to develop specific treatment plans to address impacts on ancient, submerged landforms that cannot be avoided. Development and implementation of Project-specific treatment plans, agreed to by all consulting parties, would likely reduce the magnitude of unmitigated impacts on ancient, submerged landforms; however, the magnitude of these impacts would remain major due to the permanent, irreversible nature of the impacts, unless these ancient, submerged landforms can be avoided. The tribal significance of ancient submerged landforms identified in the Lease Area and cable route has not yet been determined, and consultation with Native American tribes via NHPA Section 106 consultation and government-to-government consultation is ongoing. No other tribal resources such as cultural landscapes, traditional cultural properties, burial sites, archaeological sites with tribal significance, treaty-reserved rights to usual and accustomed fishing or hunting grounds, or other potentially affected tribal resources have been identified to date. BOEM will continue to consult with Native American tribes throughout development of the EIS and will consider impacts on tribal resources identified through consultation in the environmental justice analysis if they are discovered.

Other resource impacts that concluded less-than-major impacts for the Proposed Action and action alternatives or were unlikely to affect environmental justice populations were excluded from further analysis of environmental justice impacts. This includes impacts related to bats; benthic resources; birds; coastal habitat and fauna; finfish, invertebrates, and EFH; land use and coastal infrastructure; marine mammals; navigation and vessel traffic; recreation and tourism; sea turtles; water quality; and wetlands and other waters of the U.S.

Definitions of impact levels for environmental justice are provided in Table 3.6.4-2. For purposes of evaluating environmental justice impacts, “measurable” impacts could include, for example, changes in air emissions, water quality, employment, income, vehicle or vessel traffic, or other impacts evaluated in Chapter 3. Table F-14 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on environmental justice.

Table 3.6.4-2. Impact level definitions for environmental justice

Impact Level	Impact Type	Definition
Negligible	Adverse	Adverse impacts on environmental justice populations would be small and unmeasurable.
Negligible	Beneficial	Beneficial impacts on environmental justice populations would be small and unmeasurable.
Minor	Adverse	Adverse impacts on environmental justice populations would be small and measurable but would not disrupt the normal or routine functions of the affected population and would not disproportionately affect environmental justice communities.
Minor	Beneficial	Environmental justice populations would experience a small and measurable improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.
Moderate	Adverse	Environmental justice populations would have to adjust to account for disruptions due to notable and measurable adverse impacts but would not experience disproportionate and adverse impacts.
Moderate	Beneficial	Environmental justice populations would experience a notable and measurable improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.
Major	Adverse	Environmental justice populations would have to adjust to significant disruptions due to notable, measurable, and disproportionate and adverse impacts. The affected population may experience measurable long-term effects.

3.6.4.3 Impacts of Alternative A – No Action on Environmental Justice

When analyzing the impacts of the No Action Alternative on environmental justice, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, baseline conditions for environmental justice would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities that could affect environmental justice populations include onshore development and land uses; utilization of ports, marinas, and working waterfronts; port improvements or expansions; and commercial fishing operations. These activities support beneficial employment and also generate sources of air emissions, noise, lighting, and vehicle and vessel traffic that can adversely affect the quality of life in affected communities.

Coastal development that leads to gentrification of coastal communities may create space-use conflicts and reduce access to coastal areas and working waterfronts that communities rely on for recreation, employment, and commercial or subsistence fishing. Gentrification can also lead to increased tourism and recreational boating and fishing that provide employment opportunities in recreation and tourism. As described in Section 3.6.4.1, mapping of gentrification indices shows higher gentrification pressure near ports in Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; Cape Charles, Virginia; and Port Norris, New Jersey, compared to other nearby coastal areas due to housing disruption and retiree migration.

Planned non-offshore wind activities that may affect environmental justice populations include port utilization and expansion, construction and maintenance of coastal infrastructure (marinas, docks, and bulkheads), and onshore coastal development that can lead to gentrification of coastal communities and working waterfronts (Appendix D, Section D.2 contains a description of ongoing and planned activities).

Planned non-offshore wind activities would have impacts similar to those of ongoing non-offshore wind activities and would range from minor to moderate adverse and minor beneficial. BOEM expects most impacts of ongoing and planned activities would be minor because while they would be measurable, they would not disrupt the normal or routine functions of the affected population. Impacts of gentrification are expected to be moderate because low-income populations would have to adjust somewhat in response to housing disruptions caused by rising home values and rents. These changes would be long term, but the intensity would vary across the geographic analysis area, with higher intensity in coastal communities with waterfront access and lower intensity in more inland areas. BOEM expects improvements related to employment for ongoing and planned activities would be measurable but small and minor beneficial.

Appendix D, Table D1-10 provides a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for environmental justice.

3.6.4.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM expects future offshore wind activities to affect environmental justice populations through the following primary IPFs.

Air emissions: Increased port activity would generate short-term, variable increases in air emissions. The largest emissions for regulated air pollutants would occur during construction from diesel construction equipment, vessels, and commercial vehicles. Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice populations. However, environmental justice populations near ports could experience disproportionate air quality impacts depending on the ports that are used, ambient air quality, and the increase in emissions at any given port.

EJScreen was used to examine the existing environmental burdens in each of the port cities. Baltimore, Maryland, and Portsmouth and Cape Charles, Virginia, each had Pollution and Sources variables relating to air quality in the 80th percentile and above. Baltimore is experiencing high air quality burden, with Particulate Matter 2.5, Ozone ppb, 2017 Diesel Particulate Matter, 2017 Air Toxics Cancer Risk, 2017 Air Toxics Respiratory Hazard Index, and Traffic Proximity in the 80th percentile and above for Maryland. Likewise, Portsmouth, Virginia, is in the 80th percentile and above, compared to Virginia, in 2017 Air Toxics Cancer Risk, 2017 Air Toxics Respiratory Hazard Index, and Traffic Proximity. Also, Cape Charles, Virginia, is in the 83rd percentile for Ozone ppb compared to the rest of Virginia (COP, Volume II, Section 17.4.1; US Wind 2023).

The other three port cities—Ocean City, Maryland; Port Norris, New Jersey; and Lewes, Delaware—are experiencing significantly less air quality burdens at present. In Ocean City, the highest percentile for Pollution and Sources relating to air quality is Traffic Proximity in the 36th percentile compared to the state of Maryland. In Port Norris, the highest percentile is Particulate Matter 2.5 in the 13th percentile compared to the state of New Jersey. In Lewes, Ozone ppb, in the 57th percentile compared to the state of Delaware, is the highest Pollution and Sources percentile relating to air quality (COP, Volume II, Section 17.4.1; US Wind 2023).

There are two planned offshore wind projects (other than the Project) within the air quality geographic analysis area: Skipjack Wind (Phases I and II) and GSOE. Construction periods as estimated in Appendix D, *Planned Activities Scenario,* Table D-2-1 could result in concurrent construction of the Project and both of these other projects in 2024. The ports and O&M facilities used for construction, O&M, and decommissioning of other offshore wind projects are not known but could include some of the ports identified for use as part of the Proposed Action.

As stated in Section 3.4.1, *Air Quality*, during the construction phase, the total emissions of criteria pollutants and O_3 precursors from offshore wind projects in the air quality geographic analysis area, summed over all construction years, are estimated to be 1,271 tons of CO, 5,740 tons of NO_x, 189.8 tons of PM_{10}, 187.6 tons of $PM_{2.5}$, 42.65 tons of SO_2, 141.4 tons of VOCs, and 370,372 tons of CO_2e (Appendix D, Table D2-4). The air quality geographic analysis area is larger than the environmental justice geographic analysis area and a large portion of the emissions would be generated along the vessel transit routes and at the offshore work areas. Emissions of NO_x and CO are primarily due to diesel construction equipment, vessels, and commercial vehicles. Emissions would vary spatially and temporally during construction phases. Emissions from vessels, vehicles, and equipment operating in ports could affect environmental justice populations adjacent or close to ports at Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; Portsmouth (Hampton Roads area) and Cape Charles, Virginia; and Port Norris, New Jersey. Environmental justice populations are not adjacent or close to potential ports in Ocean City, Maryland, or Lewes, Delaware. Emissions attributable to the No Action Alternative affecting any single neighborhood have not been quantified; however, it is assumed that emissions from the No Action Alternative at high-volume ports at Sparrows Point (Port of Baltimore), Maryland, and Portsmouth (Hampton Roads area), Virginia, would contribute a small proportion of total emissions from those facilities. Therefore, air emissions during construction would have small, short-term, variable impacts on environmental justice populations due to temporary increases in air emissions. The air emissions impacts would be greater if multiple offshore wind projects simultaneously use the same port for construction staging. If construction staging is distributed among several ports, the air emissions would not be concentrated near certain ports and impacts on proximal environmental justice populations would be lower.

As explained in Section 3.4.1, *Air Quality*, operational activities under the No Action Alternative within the air quality geographic analysis area would generate 78.48 tons per year of CO, 332.9 tons per year of NO_x, 10.91 tons per year of PM_{10}, 10.44 tons per year of $PM_{2.5}$, 0.92 tons per year of SO_2, 6.06 tons per year of VOCs, and 22,330 tons per year of CO_2e (Appendix D, Table D2-4). Operational emissions would overall be intermittent and widely dispersed throughout the vessel routes from the onshore O&M facilities and would generally contribute to small and localized air quality impacts. Emissions would largely be due to vessel traffic-related to O&M and operation of emergency diesel generators. These emissions would be intermittent and widely dispersed, with small and localized air quality impacts. Only the portion of those emissions resulting from ship engines and equipment operating within and near ports in Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; and Portsmouth (Hampton Roads area), Virginia, would affect environmental justice populations. Therefore, during operations of offshore wind projects, the air emissions volumes resulting from O&M activities are not anticipated to be large enough to have impacts on environmental justice populations.

The power generation capacity of offshore wind development could lead to lower regional air emissions by displacing fossil fuel plants for power generation, resulting in a potential reduction in regional GHG emissions, as analyzed in further detail in Section 3.4.1, *Air Quality*. A 2019 study found that nationally, exposure to fine particulate matter from fossil fuel electricity generation in the U.S. varied by income and by race, with average exposures highest for Black individuals, followed by non-Hispanic white individuals. Exposures for other groups (i.e., Asian, Native American, and Hispanic) were somewhat lower. Exposures were higher for lower-income populations than for higher-income populations, but disparities were larger by race than by income (Thind et al. 2019). Specific to New Jersey, a 2016 study found a higher percentage increase in mortality associated with $PM_{2.5}$ in census tracts with more Black individuals, lower home values, or lower median incomes (Wang et al. 2016).

Exposure to air pollution is linked to health impacts, including respiratory illness, increased health care costs, and mortality. A 2016 study for the Mid-Atlantic region found that offshore wind could produce measurable benefits related to health costs and reduction in loss of life due to displacement of fossil fuel power generation (Buonocore et al. 2016). Environmental justice populations tend to have disproportionately high exposure to air pollutants, likely leading to disproportionately high adverse health consequences. Accordingly, offshore wind generation analyzed under the No Action Alternative would have potential benefits for environmental justice populations through reduction or avoidance of air emissions and concomitant reduction or avoidance of adverse health impacts.

Cable emplacement and maintenance: Cable emplacement and maintenance for future offshore wind projects would result in seafloor disturbance and temporary increases in turbidity. Cable emplacement and maintenance could displace other marine activities temporarily within work areas. As described in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, cable emplacement and maintenance would have localized, temporary, short-term impacts on the revenue and operating costs of commercial and for-hire fishing businesses. Commercial fishing operations may temporarily be less productive during cable installation or repair, resulting in reduced income and also leading to short-term reductions in business volumes for seafood processing and wholesaling businesses that depend on the commercial fishing industry. Although commercial and for-hire fishing businesses could temporarily adjust their operating locations to avoid revenue loss, impacts would be greater if multiple cable installation or repair projects are underway offshore at the same time. Business impacts could affect environmental justice populations due to the potential loss of income or jobs by low-income or minority workers in the commercial fishing industry. In addition, cable installation and maintenance could temporarily disrupt subsistence fishing, resulting in short-term, localized impacts on individuals who rely on subsistence fishing as a food source. While there are no localized studies on subsistence fishing in the Project area (COP, Volume II, Section 17.4.1; US Wind 2023), more generalized studies have shown that subsistence fishing is vitally important to many environmental justice communities and indigenous peoples as a means of subsidizing diets and are an intrinsic part of their culture (NEJAC 2002).

Noise: As described in greater detail in Section 3.6.3, *Demographics, Employment, and Economics*, noise from G&G survey activities, pile-driving, trenching, and vessels is likely to result in temporary revenue reductions for commercial fishing and for-hire recreational fishing businesses that are based in the geographic analysis area. Construction noise, especially site assessment G&G surveys and pile-driving, would affect fish populations, with impacts on commercial and for-hire fishing. The severity of impacts would depend on the proximity and temporal overlap of offshore wind survey and construction activities, and the location of noise-generating activities in relation to preferred locations for commercial and for-hire fishing. The localized impacts of offshore noise on fishing could also affect subsistence fishing. In addition, noise would affect some for-hire recreational fishing businesses, as these visitor-oriented services are likely to avoid areas where noise is being generated due to the disruption for customers.

Impacts of offshore noise on marine businesses would be short term and localized, occurring during surveying and construction, with no noticeable impacts during operations and only periodic, short-term impacts during maintenance. Noise impacts during surveying and construction would be more widespread when multiple offshore wind projects are under construction at the same time. The impacts of offshore noise on marine businesses could be short term and localized on low-income and minority workers in communities with a high level of commercial or recreational fishing engagement or reliance as well as residents who practice subsistence fishing.

Port utilization: Offshore wind project construction would require port facilities for berthing, staging, and loadout. Future offshore wind development would also support planned expansions and improvements at ports in the geographic analysis area. For example, as discussed in Section 3.6.3, *Demographics, Employment, and Economics* as part of the Proposed Action, US Wind would develop a WTG manufacturing facility at Sparrows Point to support the Atlantic offshore wind industry. Offshore wind projects that utilize these and other ports near environmental justice populations may contribute to adverse impacts on these populations from increased air emissions, lighting, noise, and vessel and vehicle traffic generated by port utilization or expansion.

Air emissions and noise from vessels, vehicles, and equipment operating in ports; lighting of port facilities; and vessel and vehicle traffic to and from port locations could affect environmental justice populations adjacent or close to those ports. Baseline levels of air emissions, noise, lighting, and traffic at port locations and increases associated with planned offshore wind construction and decommissioning have not been quantified; however, BOEM expects future offshore wind projects would contribute to small increases in these IPFs relative to baseline operations at major ports such as Sparrows Point, Portsmouth (Hampton Roads area), Virginia, along with larger proportional increases in IPFs at smaller ports (Ocean City, Maryland; Lewes, Delaware; Cape Charles, Virginia; and Port Norris, New Jersey). Increases in air emissions, noise, lighting, and vessel and vehicle traffic from increases in port utilization would occur during all phases of activity for each planned offshore wind project but would likely be higher during construction and decommissioning. Impacts at ports would be greater if multiple offshore wind projects use the same port(s) for construction and decommissioning simultaneously and would be reduced at each port location if construction and decommissioning for each planned offshore wind project is distributed among several ports.

Offshore wind construction and decommissioning would generate increased vessel traffic. Ocean City, Maryland, and Portsmouth (Hampton Roads area), Virginia, have medium to high levels of recreational or commercial fishing engagement or reliance (Section 3.6.4.1), and Portsmouth also contains environmental justice communities. Nonetheless, future offshore wind vessel traffic would incrementally contribute to space-use conflicts with commercial fishing operations near major high-volume ports.

Port use and expansion would have beneficial impacts on employment at ports. Future offshore wind projects would contribute to small increases in employment in the area surrounding Sparrows Point (the site of US Wind's offshore wind manufacturing and assembly hub), and could also contribute to new or ongoing employment at ports used for construction, O&M, and decommissioning, including Ocean City, Maryland; Portsmouth (Hampton Roads area) and Cape Charles, Virginia; and Port Norris, New Jersey, all of which are located in environmental justice communities.

O&M of future offshore wind projects would generate vessel trips and air emissions from vessels transiting between the O&M facility and the offshore wind lease area for each planned project. Operational emissions associated with vessels would be intermittent and widely dispersed along the vessel routes and would generally contribute to small and localized air quality impacts. BOEM does not expect that O&M facilities would generate levels of air emissions, noise, lighting, or vessel and vehicle traffic that would be disruptive to nearby communities. Operation of O&M facilities would also have long-term, incremental beneficial employment and economic impacts, creating employment opportunities and spending in the Ocean City area.

Presence of structures: Construction, decommissioning, and, to a lesser extent, O&M of future offshore wind projects could affect employment and economic activity generated by commercial fishing and marine-based businesses. Commercial fishing vessels would need to adjust routes and fishing grounds to avoid offshore work areas during construction and to avoid WTGs and OSSs during operations. Concrete cable covers and scour protection could result in gear loss and would make some fishing techniques unavailable in locations where the cable coverage exists. Future offshore wind activities would generate increased vessel traffic, which would increase navigational complexity in offshore construction areas during construction and within each project's offshore wind lease area long term due to the presence of WTGs and OSSs. For-hire recreational fishing businesses would also need to avoid construction areas and offshore structures. A decrease in revenue, employment, and income within commercial fishing and marine industries could affect low-income and minority workers in communities with a high level of commercial fishing engagement or reliance. The impacts during construction would be short term and would increase in magnitude if multiple offshore construction areas are being used at the same time. Impacts during operations would be long term but may lessen in magnitude as business operators adjust to the presence of offshore structures and as any temporary marine safety zones needed for construction are no longer needed.

In addition to the potential impacts on commercial and for-hire recreational fishing activity and supporting businesses, WTGs are anticipated to provide new opportunities for recreational fishing through fish aggregation and reef effects, and to provide attraction for recreational sightseeing businesses, potentially benefitting for-hire recreational fishing and low-income employees of fishing-dependent businesses.

The long-term presence of WTGs associated with future offshore wind could also cause adverse impacts on visual resources in coastal communities that are within the viewshed of future offshore wind projects. The level of impact on onshore viewers would depend on the distance to the WTGs offshore, the number and height of the WTGs associated with each future offshore wind project, and the design of the aviation warning lighting system, which could introduce continuous nighttime lighting. Lighting impacts would be reduced if the emerging technology of ADLS is used. ADLS lighting would be activated only when an aircraft approaches (Section 3.6.9, *Visual Resources*). Depending on the exact location and layout of offshore wind projects, ADLS would likely limit the frequency of WTG aviation warning lighting use. This technology, if used, would significantly reduce the impacts of lighting.

3.6.4.3.2 Conclusions

Under the No Action Alternative, environmental justice populations within the geographic analysis area would continue to be influenced by regional environmental, demographic, and economic trends. While the Project would not be built under the No Action Alternative, BOEM expects ongoing activities to have continuing impacts on environmental justice populations through the following trends: ongoing coastal development and gentrification of coastal communities; ongoing commercial fishing, seafood processing, and tourism industries that provide job opportunities for low-income residents; and air emissions, noise, lighting, and traffic associated with onshore construction and land uses when these occur near environmental justice populations. BOEM anticipates the environmental justice impacts of these ongoing activities would range from **minor** to **moderate** adverse and **minor beneficial**. Reasonably foreseeable trends affecting environmental justice populations, other than offshore wind, include continued operation of commercial fishing and supporting marine businesses; growing recreational and tourism industries for coastal economies; new development that would result in increased construction and vehicle emissions; and gentrification of industrial waterfront locations and coastal communities. BOEM anticipates the impacts of these trends and planned activities on environmental justice populations would range from **minor** to **moderate** adverse and **minor beneficial**.

Under the No Action Alternative, existing environmental trends and activities would continue, and environmental justice populations would continue to be affected by natural and human caused IPFs. The No Action Alternative would result in impacts on environmental justice populations that range from **minor** to **moderate** adverse and **minor beneficial**. BOEM anticipates the impacts on environmental justice populations resulting from the No Action Alternative combined with all planned activities (including other offshore wind activities) in the geographic analysis area would be **moderate** because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. This reflects **moderate** impacts on environmental justice populations from gentrification and potential loss of income for low-income and minority workers in communities with a high level of commercial fishing engagement or reliance; **minor** adverse impacts from air emissions, noise, lighting, and traffic associated with onshore construction, land uses, and port utilization; and **minor beneficial** employment benefits associated with future offshore wind construction and O&M, increased port utilization, and improved opportunities for for-hire recreational fishing.

3.6.4.4 Relevant Design Parameters and Potential Variances in Impacts

Effects on environmental justice populations would occur when the action alternative's adverse effects on other resources, such as air quality, commercial and for-hire recreational fishing, or visual resources, are felt disproportionately within environmental justice populations due either to the location of these communities in relation to the action alternatives or to their higher vulnerability to impacts.

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) would influence the magnitude of environmental justice impacts:

- Overall size of the Project (up to 2,000 MW, of which 1,100 MW have been awarded State of Maryland Offshore Renewable Energy Credits) and number of WTGs;
- The Project layout including the number, height, and placement of the WTGs and OSSs and the location of export cable routes;
- The extent to which US Wind hires local residents and obtains supplies and services from local vendors;

- The port(s) selected to support construction, installation, and decommissioning and the port(s) selected to support O&M;
- Arrangement of WTGs and accessibility of the Lease Area to commercial and for-hire recreational fishing; and
- The time of year during which offshore and nearshore construction occurs and the duration of the offshore and nearshore construction activities.

Variability of the Project design exists as outlined in Appendix C. Below is a summary of potential variances in impacts on environmental justice populations:

- WTG number and layout: More WTGs and closer spacing could increase space-use conflicts with commercial and for-hire recreational fishing vessels.
- Utilization of ports that are near or within low-income and minority populations would have greater impacts.

US Wind has committed to measures to minimize impacts on other resource areas that would reduce the potential for effects on environmental justice populations (Appendix G, Table G-1). Examples include measures to minimize impacts on the commercial and for-hire recreational fishing industry and reduce impacts on local tourism and businesses from onshore construction.

3.6.4.5 Impacts of Alternative B – Proposed Action on Environmental Justice

The Proposed Action would affect low-income and minority populations in the geographic analysis area through the primary IPFs of air emissions, cable emplacement and maintenance, noise, port utilization, and presence of structures.

3.6.4.5.1 Construction and Installation

3.6.4.5.1.1 Onshore Activities and Facilities

Air emissions: Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice populations. Environmental justice populations near construction ports and onshore construction sites (particularly the landfall site and onshore substation site) could experience disproportionate air quality impacts, depending on the ports that are used. The Proposed Action's contributions to increased air emissions at Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; Portsmouth (Hampton Roads area) and Cape Charles, Virginia; and Port Norris, New Jersey (Figures 3.6.4-1 through 3.6.4-8), are not quantitatively evaluated; however, as stated in Section 3.6.4.3, overall air emissions impacts would be minor during Proposed Action construction, with the greatest quantity of emissions produced in the Lease Area and by vessels transiting between ports and the Lease Area. Increased short-term and variable emissions from Proposed Action construction would have negligible to minor disproportionate, adverse impacts on the communities near Sparrows Point, Maryland; Portsmouth (Hampton Roads area) and Cape Charles, Virginia; and Port Norris, New Jersey.

As noted in Appendix D, *Planned Activities Scenario,* construction of other offshore wind projects using ports within the geographic analysis area would result in short-term air quality impacts during the construction phase and would be likely to vary from minor to moderate. The impacts at specific ports close to environmental justice populations cannot be evaluated because port usage for future projects have not been identified; however, most air emissions during construction would occur at offshore locations rather than at the ports. In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the combined air quality impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely be negligible to minor, due to short-term emissions near ports during construction.

Port utilization: The Proposed Action would require port facilities for berthing, staging, fabrication, assembly, and loadout of Project components. Air emissions, lighting, noise, and vessel and vehicle traffic generated by the Proposed Action's activities at ports would affect communities near ports that may be used for Project pre-assembly, load out, and cable staging. As part of the Proposed Action, US Wind would develop a WTG manufacturing facility at Sparrows Point (the former site of a major steel manufacturing facility) in Baltimore County (CBS Baltimore 2021). In addition, the Proposed Action would use a location in Ocean City, Maryland, as a construction management base and long-term O&M facility.

Port facilities with high levels of activity related to fabrication, staging, and assembly of WTG components could have moderate impacts on surrounding communities due to disruptions and notable adverse impacts associated with port operations (i.e., due to air emissions, noise, lighting, and vessel and vehicle traffic). The new Sparrows Point facility would provide employment and local spending, resulting in a beneficial impact on environmental justice communities, through direct employment of members of environmental justice communities as well as indirect effects resulting from overall increased employment in the Baltimore area.

The Port of Virginia (which includes Portsmouth) and the Port of Baltimore (which includes Sparrows Point) were among the top 20 ports in the U.S. for total tons of cargo shipped in 2020. The Port of Virginia was the tenth busiest port in the U.S., with 58.0 million tons of cargo shipped, while the Port of Baltimore was eighteenth, with 35.2 million tons (USACE 2021). Sparrows Point, Maryland and Portsmouth (Hampton Roads area), Virginia (as well as lower-volume ports in Cape Charles, Virginia, and Port Norris, New Jersey), are in areas where environmental justice populations have been identified and environmental justice populations would be affected by use of vessels, vehicles, and equipment at ports that generate air emissions, noise, light, and vessel and vehicle traffic. Increased port utilization would also have beneficial impacts due to greater economic activity and increased employment at ports. The impact of Proposed Action port utilization cannot be quantitatively evaluated because port usage has not been quantified for each of the ports that could be used during construction of the Proposed Action. However, given the scale of ongoing operations at these ports, BOEM expects the Proposed Action's contribution to both adverse and beneficial impacts near Sparrows Point, Maryland, and Portsmouth, Virginia, would be minor.

Overall, BOEM expects that the Proposed Action's use of Sparrows Point, Maryland, and Portsmouth, Virginia, would affect environmental justice populations; however, the Proposed Action's contribution to overall impacts at these major ports would be minor given the high volume of cargo shipped through these ports. Use of ports in Cape Charles, Virginia, and Port Norris, New Jersey, for Proposed Action activities would likely also generate small-scale impacts at these facilities (although the Proposed Action's air emissions could make up a larger share of total emissions at those ports than at Sparrows Point, Maryland, or Portsmouth, Virginia). As described in Section 3.6.4.3, overall air emissions impacts would be minor during Proposed Action construction, with the greatest quantity of emissions produced in the Lease Area and by vessels transiting between ports and the Lease Area. Increased short-term and variable emissions from Proposed Action construction would have negligible to minor disproportionate, adverse impacts on the communities near Sparrows Point, Cape Charles, Portsmouth, and Port Norris. Therefore, BOEM determined that port utilization would not result in "disproportionately high and adverse" impacts for environmental justice populations. Furthermore, BOEM concludes that impacts related to use of other ports (Ocean City, Maryland, and Lewes, Delaware) would not disproportionately affect environmental justice populations because those ports are not in areas with environmental justice populations. Given these findings, BOEM has determined that port utilization would not result in disproportionately high and adverse effects on environmental justice populations.

3.6.4.5.1.2 Offshore and Inshore Activities and Facilities

Cable emplacement and maintenance: The Proposed Action would install up to 125.6 miles (204.2 kilometers) of inter-array cables, 142.5 miles (229.3 kilometers) of offshore export cables, and 42.2 miles (68 kilometers) of inshore export cable (Appendix C, *Project Design Envelope and Maximum Case Scenarios*). Offshore cable emplacement for the Proposed Action would temporarily affect commercial and for-hire recreational fishing businesses, marine recreation, and subsistence fishing during cable installation and infrequent maintenance. As noted in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, and Section 3.6.3, *Demographics, Employment, and Economics*, installation of the Proposed Action's cables would have short-term, localized, minor impacts on commercial and for-hire recreational fishing businesses. Cable installation could affect fish of interest for commercial, recreational, or subsistence fishing through dredging and turbulence, although fish species would recover upon completion of installation activities (Section 3.5.2, *Benthic Resources*, and Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). Installation and construction of offshore components for the Proposed Action could therefore have a short-term, minor impact on low-income and minority workers in businesses that support commercial and recreational fishing and on individuals that rely on subsistence fishing.

In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the combined offshore cable emplacement impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely be short term and minor, resulting from the impact on subsistence fishing and reduced employment and income of workers employed in industries supporting commercial fishing. Because impacts of Proposed Action cable emplacement on environmental justice populations would be short term and minor, BOEM has determined that impacts of this IPF on environmental justice populations would not be "disproportionately high and adverse" for the purpose of the environmental justice analysis.

Noise: Noise from Proposed Action construction (primarily pile-driving) could temporarily affect fish near construction activity within the Lease Area and discourage some fishing businesses from operating in these areas during pile-driving (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, and Section 3.6.3, *Demographics, Employment, and Economics*). This would result in a localized, short-term, negligible impact on jobs supported by these businesses, as well as on subsistence fishing.

Ongoing activities and future non-offshore wind activities would occasionally generate additional pile-driving noise near ports and marinas, some of which may be near environmental justice populations. Future offshore wind activities would have similar contributions as the Proposed Action over a wider area and longer time period. The increased impacts would affect commercial and for-hire recreational fishing and supporting marine businesses, resulting in impacts on employment and income (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, and Section 3.6.3, *Demographics, Employment, and Economics*). In the context of reasonably foreseeable trends, the incremental impacts contributed by the Proposed Action to the combined pile-driving impacts on environmental justice populations from ongoing and planned activities including future offshore wind would be negligible to minor, based on the assessment of potential impacts of pile-driving on boating, fisheries, and supporting marine businesses. Because impacts of Proposed Action noise on environmental justice populations would be negligible to minor, BOEM has determined that impacts of this IPF on environmental justice populations would not be “disproportionately high and adverse” for the purpose of the environmental justice analysis.

3.6.4.5.2 Operations and Maintenance

3.6.4.5.2.1 Onshore Activities and Facilities

Air emissions: Environmental justice populations near O&M ports and the onshore substation site could experience disproportionate air quality impacts. The Proposed Action’s contributions to increased air emissions at the ports of Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; and Portsmouth, Virginia (Figures 3.6.4-1, 3.6.4-2, 3.6.4-3, and 3.6.4-5, respectively), are not quantitatively evaluated. However, as stated in Section 3.6.4.3, overall air emissions impacts would be minor during Proposed Action O&M (and lower than during construction), with the greatest quantity of emissions produced in the Lease Area and by vessels transiting between ports and the Lease Area. Increased short-term and variable emissions from Proposed Action construction would have negligible disproportionate, adverse impacts on the communities near Sparrows Point and Ocean City, Maryland; Lewes, Delaware; and Portsmouth, Virginia.

Because port usage for future projects has not been identified, O&M of other offshore wind projects using ports within the geographic analysis area cannot be evaluated, nor can any accompanying air quality impacts on environmental justice populations in the ports’ vicinities; however, most air emissions during construction would occur at offshore locations rather than at the ports. In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the combined air quality impacts on environmental justice populations from ongoing and planned activities including future offshore wind O&M would likely be negligible to minor, due to short-term emissions near ports during construction.

Port utilization: Most O&M activity for the Proposed Action would be based at the Project’s O&M facility in Ocean City, although some vessel trips may originate from Sparrows Point, Maryland; Lewes, Delaware; or Portsmouth, Virginia. The environmental justice impacts of port utilization during O&M

would be similar in character to, but less intense than those described for this IPF in Construction and Installation. The O&M facility in Ocean City, Maryland, would provide employment and local spending. Use of the O&M facility would involve activities consistent with working waterfronts in the area (e.g., vessel berthing, crew transfers, vessel loading and unloading) and would not disrupt the normal or routine functions of the affected community, resulting in negligible adverse impacts and negligible beneficial impacts on environmental justice communities through direct employment of members of environmental justice communities as well as indirect effects resulting from overall increased employment in the Ocean City area. Port activity at Sparrows Point, Maryland; Lewes, Delaware; and Portsmouth, Virginia, could also have incremental impacts on environmental justice communities near these sites.

Ongoing activities and future non-offshore wind activities could generate additional activity at Sparrows Point and Ocean City, Maryland; Lewes, Delaware; and Portsmouth, Virginia, resulting in additional impacts on environmental justice communities. To the degree that future offshore wind activities use the same ports, they would have similar contributions as the Proposed Action. In context of reasonably foreseeable trends, the incremental impacts contributed by the Proposed Action to the combined port utilization impacts on environmental justice populations from ongoing and planned activities including future offshore wind would be negligible to minor. As a result, BOEM has determined that impacts of this IPF on environmental justice populations would not be “disproportionately high and adverse” for the purpose of the environmental justice analysis.

3.6.4.5.2.2 Offshore and Inshore Activities and Facilities

Air emissions: Net reductions in air pollutant emissions resulting from operations of the Proposed Action alone would result in long-term benefits to communities (regardless of environmental justice status) by displacing emissions from fossil-fuel-generated power plants. As explained in Section 3.4.1, *Air Quality*, by displacing fossil fuel power generation, once operational, the Proposed Action would result in more than 139 million tons of annual avoided emissions of CO_2. Additionally, the Proposed Action will result in more than 183 thousand tons of annual avoided emissions of NO_x, $PM_{2.5}$, and SO_2 combined. Estimates of annual avoided health effects would range from over $6 to almost $16 million in health benefits and 631 to 1,429 avoided deaths (Section 3.4.1.3). Environmental justice populations are disproportionately affected by emissions from fossil fuel power plants nationwide and by higher levels of air pollutants. Therefore, the Proposed Action alone could benefit environmental justice populations by displacing fossil fuel power-generating capacity within or near the geographic analysis area. The Proposed Action could have minor beneficial effects for environmental justice populations, due to long-term reduction in air emissions from fossil fuel power generation.

Generation of offshore wind energy within offshore wind lease areas for future offshore wind projects would result in greater potential displacement of fossil fuel power generation than the Proposed Action alone. In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by the operations of the Proposed Action to the combined air quality impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely result in minor beneficial impacts.

Cable emplacement and maintenance: O&M of the Proposed Action's offshore cables would have similar types of impacts as construction but would involve substantially smaller impact magnitudes. Vessel traffic and seafloor disturbance associated with cable maintenance would be limited to the segment of cable being maintained. Cable maintenance for the Proposed Action would therefore have a long-term, localized, intermittent, negligible impact on low-income and minority workers in businesses that support commercial and recreational fishing and on individuals that rely on subsistence fishing.

BOEM expects cable maintenance activities for other offshore wind projects would have similar impacts as the Proposed Action. In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the combined offshore cable maintenance impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely be long term and negligible. As a result, BOEM has determined that impacts of this IPF on environmental justice populations would not be "disproportionately high and adverse" for the purpose of the environmental justice analysis.

Presence of structures: The Proposed Action's establishment of offshore structures, including up to 121 WTGs (PDE), 4 OSSs, 1 Met Tower, and hardcover for cables, would result in both adverse and beneficial impacts on marine businesses supporting commercial and for-hire recreational fishing. Beneficial impacts would be generated by the reef effect of offshore structures, providing additional opportunity for tour boats and for-hire recreational fishing businesses. Adverse impacts would result from navigational complexity within the Lease Area, disturbance of customary routes and fishing locations, and the presence of scour protection and cable hardcover, leading to possible equipment loss and limiting certain commercial fishing methods.

As discussed in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, BOEM anticipates the adverse impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing would vary by fishery and fishing operation due to differences in target species abundance in the Offshore Project area, gear type, and predominant location of fishing activity. It is possible that some of the small number of fishing operations that derive a large percentage of their total revenue from areas where Project facilities would be located would choose to avoid these areas once the facilities become operational. In the event that these specific fishing operations are unable to find suitable alternative fishing locations, they could experience long-term, major disruptions. However, it is estimated that most fishing vessels would adjust somewhat to account for disruptions due to impacts associated with the presence of structures. In addition, the impacts of the Proposed Action could include long-term, minor beneficial impacts for some for-hire recreational fishing operations due to the artificial reef effect. Therefore, BOEM expects impacts of the Proposed Action on commercial fishing and for-hire recreational fishing would range from negligible to major, depending on the fishery and fishing operation.

Impacts of the Proposed Action on commercial fishing and for-hire recreational fishing would have a greater impact on communities that have a high level of commercial or recreational fishing engagement or reliance. Ocean City, Maryland has a high level of commercial fishing engagement (Figure 3.6.4-7); however, Ocean City is not identified as an environmental justice community (Figure 3.6.4-2). Other affected communities in the geographic analysis area generally have lower levels of commercial fishing engagement and reliance or are not near identified environmental justice populations. Therefore, BOEM has determined that commercial fishing impacts associated with Proposed Action structures would not have disproportionate impacts on environmental justice populations near O&M ports. Impacts of the Proposed Action on commercial fishing landings and secondary impacts for employment at onshore seafood processors and distributors would vary depending on the specific fisheries and fishing operations affected by the presence of structures in the Offshore Project area. Because onshore seafood processors and distributors process catch from a broad geographic area and because the impact on specific fishing operations would vary and would not be industry wide, BOEM expects that secondary impacts for employment on fishing vessels and at onshore seafood processing and distribution facilities would be moderate overall and would not be "disproportionately high and adverse" for environmental justice populations.

Many coastal communities have a high level of recreational fishing engagement (Figure 3.6.4-7) and most of these communities do not contain an environmental justice population (Figures 3.6.4-1 through 3.6.4-6). Impacts on for-hire recreational fishing are also not "disproportionately high and adverse" for environmental justice populations because impacts of the Proposed Action could include long-term, minor adverse and minor beneficial impacts for some for-hire recreational fishing operations due to space-use conflicts and the artificial reef effect, respectively.

As well, BOEM anticipates the Proposed Action's impacts on recreation and tourism could have a beneficial or adverse impacts on recreation and tourism depending on a viewer's orientation, activity, purpose for visiting the area, and attitude toward offshore wind energy. While most visitors would be unaffected (or even attracted) by views of offshore WTGs, some may choose to visit other beaches without visible WTGs (although few such beaches would exist between Ocean City, Maryland, and central New Jersey by 2030, when numerous offshore wind projects along those coasts are likely to be complete) (Section 3.6.8.5).

Presence of structures would have both beneficial impacts, such as by providing sightseeing opportunities and fish aggregation that benefit recreational businesses, and adverse effects, such as viewshed impacts that could affect business operations and income. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts on demographics, employment, and economics from other ongoing and planned activities including offshore wind, which would be long term and moderate due to impacts on commercial and for-hire recreational fishing, for-hire recreational boating, and associated businesses (Section 3.6.3.5).

Proposed Action WTGs would have negligible to major impacts on viewer experience within the geographic analysis area, depending on the viewing location. Views of WTGs would be sustained from many coastal communities in the geographic analysis area, but would not disproportionately affect environmental justice populations, because all coastal communities with views of WTGs would be similarly affected. Therefore, BOEM has determined that impacts of the Proposed Action on viewer experience would not be "disproportionately high and adverse" for environmental justice populations. Likewise, the presence of structures would not have a "disproportionately high and adverse" impact on environmental justice populations, as effects will be mixed beneficial and adverse, and are likely to be minimal.

The Proposed Action in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts on environmental justice populations from ongoing and planned activities, which are anticipated to range from minor to moderate adverse and minor beneficial.

3.6.4.5.3 Conceptual Decommissioning

The impacts of onshore and Offshore Proposed Action decommissioning on environmental justice communities would be similar to the impacts described in construction. Onshore and offshore traffic, air emissions, noise, port usage, and cable removal would have negligible to minor impacts on environmental justice areas. For the expected impacts of conceptual decommissioning activities, it is likely that a portion, possibly a majority, of such impacts from planned actions would not overlap temporally or spatially with Alternative B. Decommissioning impacts are expected to be the same as described previously and would be negligible to minor.

3.6.4.5.4 Conclusions

During construction and operation of the Proposed Action, impacts on commercial fishing from IPFs including the presence of structures, cable emplacement, and noise would vary depending on the fishery and fishing operation. The long-term presence of structures in the offshore environment and resulting space-use conflict with commercial fishing vessels could have long-term impacts on employment on fishing vessels that utilize the Lease Area and at onshore seafood processing and distribution facilities where commercial fishermen land their catch. Environmental justice populations with a high level of commercial fishing engagement have been identified in Portsmouth, Virginia. BOEM expects the effect of reduced employment in commercial fishing would be **moderate** because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. Potentially small and measurable **minor beneficial** impacts on environmental justice populations could result from port utilization and the resulting employment and economic activity at ports as well as from enhanced opportunities for for-hire recreational fishing due to the artificial reef effect.

Because environmental justice populations in Portsmouth, Virginia, could be disproportionately affected by adverse impacts on commercial fishing due to high levels of commercial fishing engagement (and lower levels of engagement throughout most of the geographic analysis area), BOEM has determined that commercial fishing impacts on environmental justice populations in Portsmouth, Virginia, would be disproportionate. However, because impacts are expected to be **moderate**, BOEM determined that impacts on for-hire recreational fishing would not be disproportionately high and adverse for environmental justice populations due to expected **minor** impacts and high levels of recreational fishing engagement across the geographic analysis area.

The presence of offshore structures (WTGs and OSSs) would have **negligible** to **major** impacts on viewer experience within the geographic analysis area; viewer experience would be affected from many locations in the geographic analysis area and would not be concentrated in areas with environmental justice populations. Therefore, BOEM has determined that impacts of the Proposed Action on viewer experience would not be disproportionately high and adverse for environmental justice populations.

Overall, BOEM expects impacts of the Proposed Action on environmental justice populations would be **moderate** because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. The Proposed Action in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas, and additional onshore construction and port utilization within the geographic analysis area. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts on environmental justice populations from ongoing and planned activities, which are anticipated to be **moderate** overall, with **minor beneficial** impacts.

3.6.4.6 Impacts of Alternatives C, D, and E on Environmental Justice

The action alternatives would have incrementally different impacts on environmental justice populations. Alternative C-1 would use a different landfall site (Towers Beach instead of 3R's Beach), Onshore Export Cable Route (route 2), but still use the Indian River substation included in the Proposed Action). Alternative C-2 would use the same landfall and substation sites as the Proposed Action but would use different Onshore Export Cable Routes (routes 1a, 1b, or 1c). Construction along these routes and at these sites could affect environmental justice populations; however, because the Onshore Export Cable Routes would be installed within DelDOT ROWs (Section 2.1.3), the construction of these routes would not have disproportionately high and adverse impacts on environmental justice communities.

Alternative D would exclude all WTGs and OSSs within 14 miles (22.5 kilometers) of the shoreline, resulting in the exclusion of 32 WTGs and 1 OSS. This would incrementally reduce impacts on environmental justice communities from the presence of structures. Specifically, the exclusion of WTGs would reduce visual impacts, as well as impacts on members of environmental justice in the commercial fishing and for-hire recreational fishing industry, although the visual assessment indicates that Alternative D would have seascape/landscape and visual impacts similar to Alternative B (Section 3.6.9). Alternative E would result in exclusion of 11 WTG foundations within the Lease Area and would thus reduce impacts in the same way as (but to a lesser degree than) Alternative D. The changes described above would incrementally reduce impacts on environmental justice communities, but would not result in different impact magnitudes compared to Alternative B.

3.6.4.6.1 Conclusions

Implementation of the action alternatives would have similar impacts on environmental justice communities as Alternative B: **moderate** overall, with **minor beneficial** impacts. The action alternatives would each contribute similar increments to the combined impacts on environmental justice communities from ongoing and planned activities including offshore wind. In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the action alternatives would be similar to Alternative B: **moderate** overall, with **minor beneficial** impacts. BOEM determined that the action alternatives would not have disproportionately high and adverse impacts on environmental justice populations.

In the context of reasonably foreseeable environmental trends, these action alternatives would contribute a noticeable increment to the combined impacts on environmental justice populations from ongoing and planned activities, which are anticipated to be **moderate** overall.

3.6.4.7 Comparison of Alternatives

As described in Section 3.6.4.5, the Proposed Action in combination with ongoing and planned activities would have similar environmental justice impacts as the No Action Alternative. The Proposed Action would affect environmental justice primarily through cable emplacement and maintenance, lighting, and the physical and visual effects of the presence of structures (i.e., effects on the commercial and recreational fishing industry, as well as visual effects). Under the No Action Alternative, these impacts would not occur.

The action alternatives could reduce or change the extent of environmental justice impacts, compared to Alternative B. Alternatives C-1 and C-2 could affect different onshore environmental justice communities due to different Onshore Export Cable Routes and substation sites. Alternatives D and E could reduce (but would not completely avoid) impacts on commercial and recreational fisheries and sand resources. These differences notwithstanding, the action alternatives would not result in meaningfully different environmental justice impacts compared to Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **moderate** overall, with **minor beneficial** impacts. In the context of reasonably foreseeable environmental trends and planned actions, the overall environmental justice impact of the action alternatives when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **moderate** overall, with **minor beneficial** impacts. BOEM determined that the environmental justice impacts of the action alternatives would not have “disproportionately high and adverse” impacts on environmental justice populations.

If BOEM requires mitigation measures beyond the design features described in Section 3.6.4.4, adverse Proposed Action impacts on environmental justice communities could be further reduced and beneficial impacts could be increased; however, overall impact magnitudes would remain the same as described in this section.

3.6.5 Land Use and Coastal Infrastructure

This section discusses potential impacts on land use and coastal infrastructure from the Proposed Action, action alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area (Figure 3.6.5-1) includes Worcester County, Maryland, and Sussex County, Delaware, as well as municipalities surrounding the ports that would be used to support Project construction and O&M: primary port facilities at Sparrows Point (Port of Baltimore) and Ocean City, Maryland; and alternate port facilities in Portsmouth (Hampton Roads area) and Cape Charles, Virginia; Port Norris, New Jersey; and Lewes, Delaware (COP, Volume I, Section 3.1; US Wind 2023). These areas encompass locations where BOEM anticipates direct and indirect impacts associated with proposed onshore facilities and ports.

3.6.5.1 Description of the Affected Environment and Future Baseline Conditions

Land use (which describes the actual or intended purpose of lands) is diverse within the geographic analysis area, ranging from agricultural and forest land to dense urban and industrial areas, and including a variety of residential, commercial, and tourist-oriented uses. Land cover (which describes the physical features of the landscape) includes water, coastal wetlands and beaches, inland wetlands, forest, urban, and agricultural land uses. Figure 3.6.5-2 shows land use/land cover (a combination of land use and land cover) within Sussex County, Delaware, and Worcester County, Maryland, as mapped by the Multi-Resolution Land Characteristics (MRLC) consortium. Table 3.6.5-1 summarizes land use/land cover acreages within these two counties. Important landscape features near the proposed landfall locations, Inshore and Onshore Export Cable Routes, and substations include a combination of natural views such as beaches, shorelines, and scenic vistas, and man-made views such as buildings, landscaping, parks, and other cultural features.

3.6.5.1.1 Sussex County Delaware

The Project would be interconnected to the onshore electric grid in Sussex County. The interconnection location for the Proposed Action is at the existing Delmarva Power and Light Indian River substation adjacent to the Indian River Power Plant, an existing, coal-fired power plant near Millsboro, Delaware. Alternative C includes possible use of two other Delmarva Power and Light substations: the Cool Spring substation in Milton, Delaware, and the Milford substation in Milford, Delaware. In addition to the use of existing substations, US Wind may construct new substations adjacent to the existing Indian River substation, adjacent to one of the two other Delmarva Power and Light substations, or on several properties of sufficient size within 0.5 miles (0.8 kilometers) of the Indian River substation. All proposed substations are located within Sussex County, Delaware (COP, Volume I, Section 2.6; US Wind 2023).

Land surrounding the Indian River substation and adjacent potential substation sites in Sussex County is forested, wetlands, or agriculture/farmland, except for the Indian River Power Plant and electrical transmission ROWs that serve it. The Cool Spring substation is adjacent to residential subdivisions and forested stream valleys. Land adjacent to the Milford substation is primarily rural residential and agricultural, in addition to multiple existing substations.

The Proposed Action landfall location is on a barrier island in Sussex County approximately 1 mile (1.6 kilometers) south of the Indian River Inlet, within a parking area associated with 3R’s Beach. A second landfall option that would be used for Alternative C-1 is at Tower Road approximately 5 miles (7.7 kilometers) north of the Indian River Inlet, also on the coast of Sussex County, within a parking area for Towers Beach. Both beaches and parking areas are within Delaware Seashore State Park (DNREC 2014). There are no amenities at 3R’s Beach other than the parking area. The beach is popular for surf fishing. Towers Beach has lifeguards, restrooms, picnic facilities and other amenities. Based on Delaware land cover data, land use is classified as Recreational at Towers Beach and Inland Natural Sandy Area at 3R’s Beach (State of Delaware 2021).

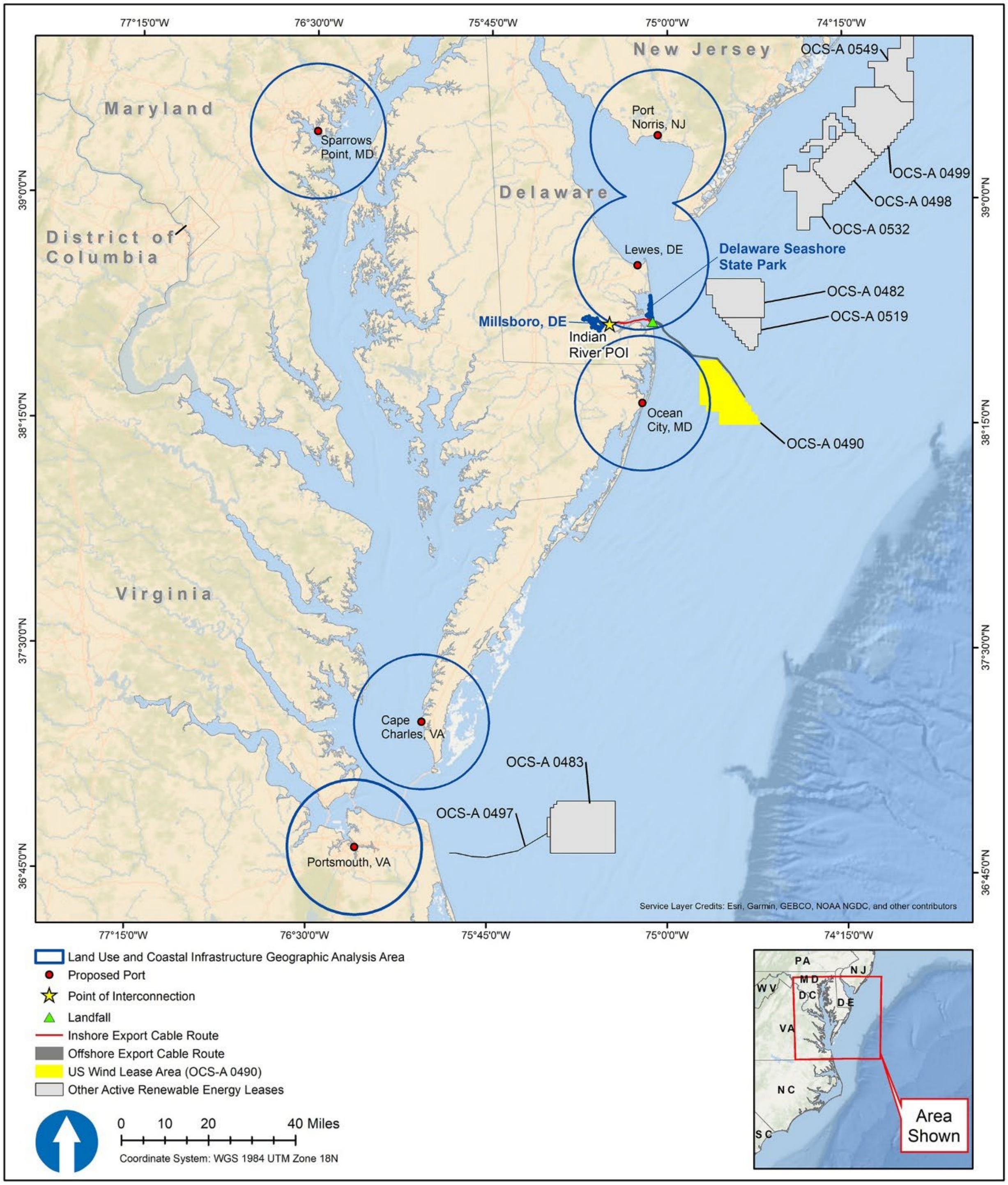


Figure 3.6.5-1. Land use and coastal resources geographic analysis area

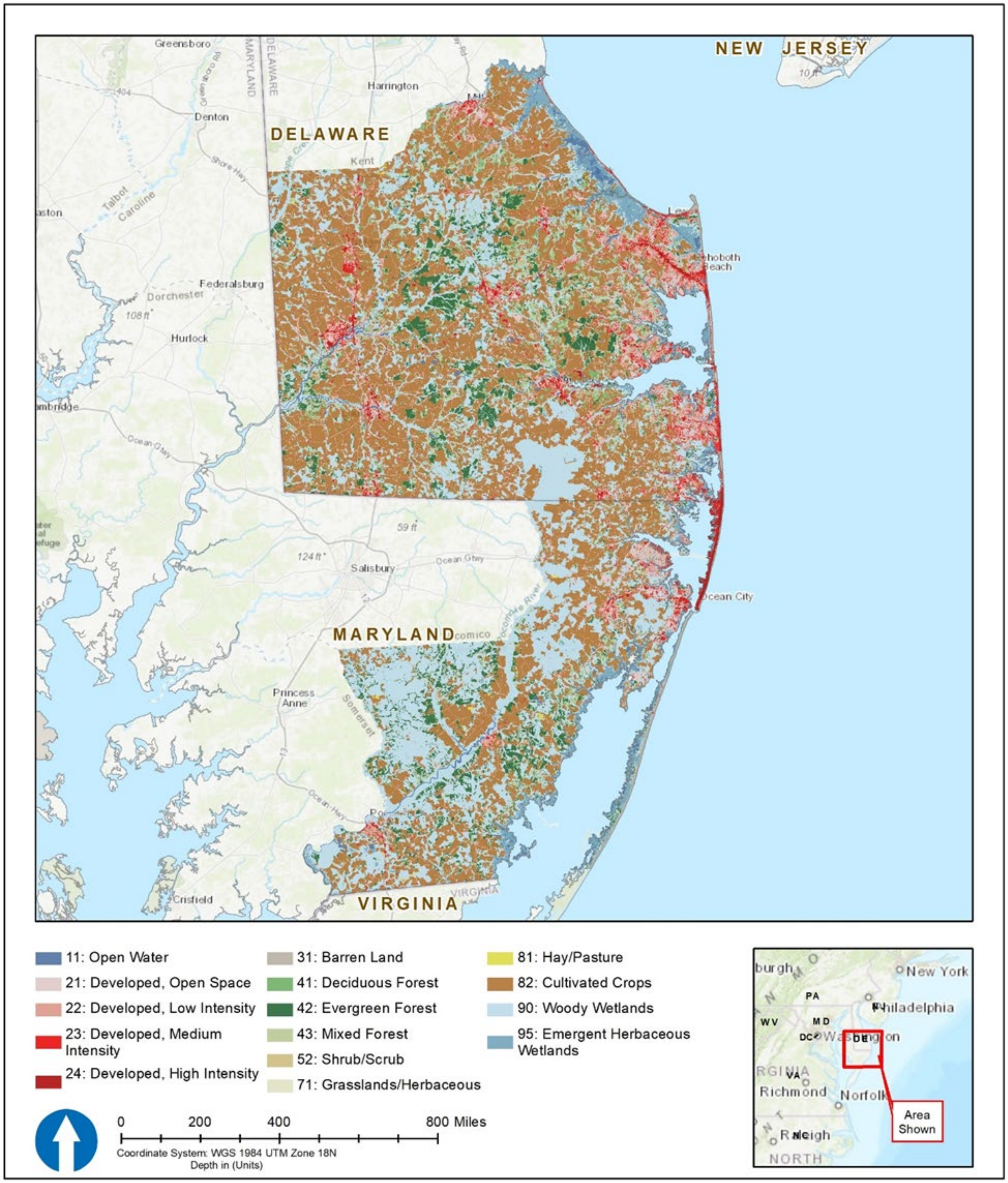


Figure 3.6.5-2. Land use/land cover types within the geographic analysis area

Source: MRLC 2021

Table 3.6.5-1. Land use/land cover acreage within the geographic analysis area

Land Use/Land Cover Category	Sussex County, Delaware		Worcester County, Maryland	
	Acres	Percent of Total	Acres	Percent of Total
Open Water	8,102.0	1%	5,043.6	2%
Developed, Open Space	43,377.3	7%	14,764.4	5%
Developed, Low Intensity	31,463.8	5%	6,938.5	2%
Developed, Medium Intensity	19,346.3	3%	4,388.9	1%
Developed, High Intensity	5,010.0	1%	2,591.6	1%
Barren Land	2,568.9	0%	2,987.5	1%
Deciduous Forest	15,727.1	3%	2,274.6	1%
Evergreen Forest	36,936.2	6%	24,912.1	8%
Mixed Forest	36,923.1	6%	12,245.9	4%
Shrub/Scrub	3,159.2	1%	1,195.6	0%
Grasslands/Herbaceous	1,624.2	0%	562.0	0%
Hay/Pasture	1,638.3	0%	932.0	0%
Cultivated Crops	254,786.2	42%	86,839.6	28%
Woody Wetlands	124,757.5	21%	123,467.0	41%
Emergent Herbaceous Wetlands	21,862.6	4%	15,650.6	5%
Total	607,282.7	100%	304,793.9	100%

Source: MRLC 2021

The Sussex County Zoning Ordinance defines the permitted and intended uses of land in the county (outside of incorporated municipalities, which have their own zoning). Land use along the Indian River on either side of the proposed Inshore Export Cable Route is zoned for agricultural and residential use, including Agricultural Residential, Medium Residential, General Residential, High Density Residential (HR-1), (HR-2), and Vacation, Retire, Resident (VRP). The existing power station, substation and surrounding land is zoned Heavy Industrial (H-I-1); small areas zoned Marine (M), General Commercial (C-1) and Neighborhood Business (B-1), (B-2) are located along nearby roads and the riverfront (Sussex County 2022).

3.6.5.1.2 Worcester County, Maryland

The Project O&M Facility would be located in Worcester County, Maryland, in Ocean City or an unincorporated area on the mainland of Worcester County known as West Ocean City. The O&M Facility will be comprised of onshore office, crew support, and warehouse spaces with associated parking in the Ocean City commercial harbor and will include quayside and berthing areas for four or more crew transfer vessels (CTVs). The proposed O&M facility location is likely to be located on two adjacent sites on the waterfront in West Ocean City, Maryland. The waterfront sites together are approximately 1.5 acres in size.

The Ocean City Inlet, which divides Fenwick Island (which contains the Town of Fenwick Island, Delaware, and Ocean City, Maryland) from Assateague Island, allows ocean-going vessels to access marinas in Ocean City and West Ocean City. Bayside marinas offer hundreds of boat slips with access to power hook-ups and fueling stations approximately 0.25 miles (0.4 kilometers) from the Atlantic Ocean.

Outside of Ocean City and the immediate surrounding area, land cover in Worcester County is primarily forest, wetlands, and agriculture (Table 3.6.5-1). Assateague Island contains about 22 miles (35.4 kilometers) of the county's Atlantic coast, while Fenwick Island/Ocean City contains about 10 miles (16.1 kilometers). U.S. Routes 13, 50, and 113 provide the primary land-based access in and out of Worcester County. The Bay Coast Railroad, Maryland & Delaware Railroad, and the Norfolk Southern Railway also serve Worcester County. The small Ocean City Municipal Airport and the larger Salisbury-Ocean City Wicomico Regional Airport (in neighboring Wicomico County) offer air service a few miles outside of Ocean City and Snow Hill, respectively.

3.6.5.1.3 Port Facilities

The US Wind anticipates using Sparrows Point in Baltimore County, Maryland, as the primary staging and marshaling facility for offshore construction. Sparrows Point is an unincorporated community in Baltimore County built around the 3,300-acre (1,335-hectare) former Sparrows Point steel manufacturing facility. The steel facility began operation in 1891 and was operated from 1916 until 2012 by Bethlehem Steel. A portion of the Sparrows Point retired steel manufacturing site is being redeveloped by TPA as a multi-modal industrial complex. Sparrows Point has berths and an access channel within the Port of Baltimore and is also directly accessible by major highways, such as I-695, I-95, and I-70, and by rail, with direct connections to CSX and Norfolk Southern (TPA 2020). The proximity to multiple offshore wind lease areas, coupled with the multi-modal transportation resources at this site, allows TPA to be advantageous for offshore wind development, including component manufacture, assembly, staging, loading, and shipping (TPA 2021). US Wind has entered into an agreement with TPA for site control of more than 90 acres (36.4 hectares) at Sparrows Point; within this site, US Wind plans to facilitate funding of, and form a new venture to operate, a facility for the production of monopiles and other steel components for the offshore wind industry (US Wind 2021).

The Ocean City Harbor, reached via the Ocean City Inlet, would be the primary port for support and crew vessels during construction. Ocean City Harbor is used by recreational vessels, charter vessels and commercial fishing vessels (Town of Ocean City 2018). Worcester County's planning policies call for supporting and retaining marine commercial activities at Ocean City Harbor (Worcester County 2006). Alternate locations for construction-related support services and crew vessels are Port Norris, New Jersey, and Lewes, Delaware (Sussex County). Lewes has marinas and harbor facilities used primarily for recreational boating and commercial fishing. Port Norris is used primarily by barges and the commercial shellfish industry.

Alternative ports that may support construction-related fabrication, assembly, storage, and shipping are located in Portsmouth (Hampton Roads area) and Cape Charles, Virginia. The waterfront in the Hampton Roads area has multiple industrial terminals including five Port of Virginia facilities: Portsmouth Marine Terminal, Virginia International Gateway, Norfolk International Terminals, Portsmouth Chassis Yard, and Newport News Marine Terminal (Virginia Port Authority 2023). The Cape Charles Port is a busy commercial port that is utilized by tugboats, barges, charter and commercial fishing boats, and recreational boaters (World Port Source, n.d.; Arrington 2021).

During O&M, US Wind plans to use the port facilities in Ocean City Harbor as well as Lewes, Delaware, in Sussex County for routine maintenance (support and crew transfer vessels). Major maintenance requiring deep-draft vessels would use the ports at Sparrows Point (Port of Baltimore), Maryland, and Portsmouth (Hampton Roads area), Virginia.

3.6.5.2 Impact Level Definitions for Land Use and Coastal Infrastructure

Definitions of potential impact levels for land use and coastal infrastructure are provided in Table 3.6.5-2. Table F-15 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on land use and coastal infrastructure.

Table 3.6.5-2. Impact level definitions for land use and coastal infrastructure

Impact Level	Impact Type	Definition
Negligible	Adverse	Adverse impacts on area land use would not be detectable.
Negligible	Beneficial	Beneficial impacts on area land use would not be detectable.
Minor	Adverse	Adverse impacts would be detectable but would be short term and localized.
Minor	Beneficial	Beneficial impacts would be detectable but would be short term and localized.
Moderate	Adverse	Adverse impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
Moderate	Beneficial	Beneficial impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
Major	Adverse	Adverse impacts would be detectable, long term, and extensive, and result in permanent land use change.
Major	Beneficial	Beneficial impacts would be detectable, long term, and extensive, and result in permanent land use change.

3.6.5.3 Impacts of Alternative A – No Action on Land Use and Coastal Infrastructure

When analyzing the impacts of Alternative A (No Action Alternative) on land use and coastal infrastructure, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, land use and coastal infrastructure in the geographic analysis area would continue to be affected by ongoing and planned activities, especially onshore and coastal regional trends, development projects, and port expansion. The geographic analysis area includes rural and developed communities that would experience ongoing commercial and residential development in accordance with established land use patterns and regulations. Ports in the geographic analysis area would continue to serve marine traffic that supports recreational boating, commercial fishing, and industries, and experience periodic dredging and improvement projects to meet ongoing needs. A channel-deepening project at the Port of Virginia in Portsmouth is currently underway and is anticipated to be completed in 2024 (Virginia Port Authority 2022). Dredging and port improvements would allow larger vessels to use the port and may result in increased port use and conversion of surrounding land use if the ports are expanded. Ongoing beach replenishment programs are important to protect waterfront properties and maintain beaches (Town of Ocean City 2023).

Following is a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for land use and coastal infrastructure.

3.6.5.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM has reviewed available information regarding the potential for other offshore wind activities to result in coastal and onshore infrastructure within the geographic analysis area for land use and coastal infrastructure. Ørsted proposes an offshore wind project (Skipjack) to be located 20 miles (32.2 kilometers) off the coast of the Delmarva peninsula. The Project's first phase would connect to the PJM grid in Delaware, via a newly constructed interconnection facility in Fenwick Island State Park (Ørsted 2020). The first phase of the Skipjack project is expected to begin commercial operations in 2024 (Appendix D, *Planned Activities Scenario,* Table D2-1). Similar to US Wind, Ørsted has proposed use of an O&M facility in West Ocean City and identified that the Sparrows Point site may be used during construction (Ørsted 2021).

BOEM expects other offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs.

Accidental releases: Accidental releases of fuel, fluids, or hazardous materials may increase due to onshore construction for the substations and Onshore Export Cable Routes of offshore wind activities. Accidental release risks would be highest during construction but would still exist during operation and decommissioning of offshore wind facilities. BOEM assumes all projects and activities would comply with laws and regulations to minimize releases. Accidental releases could result in temporary restrictions on use of adjacent properties and coastal infrastructure during the cleanup process; however, the impacts would be localized and short term. The exact extent of impacts would depend on the locations of landfall sites, substations, and cable routes, as well as the ports that support offshore wind energy projects. The impacts of accidental releases on land use and coastal infrastructure would be localized and negligible, except in the case of very large spills that affect a large land or coastal area.

Land Disturbance: Offshore wind development would result in localized onshore ground disturbance during construction and installation of landfall sites, Onshore Export Cable Routes, and substations. Impacts on surrounding land uses would be adverse, short term, localized, and negligible (except where land is permanently converted to substations). BOEM assumes any such activity would be consistent with zoning or other land development regulations.

Lighting: As described in Section 3.6.9, *Visual Resources*, aviation hazard lighting from up to 187 WTGs and 6 OSS from offshore wind projects other than the Proposed Action could be visible from beaches and coastal areas in the geographic analysis area. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles (24.1 kilometers) from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). Most WTG positions associated with other offshore wind activities would be approximately 13 to 26 miles (20.9 to 41.8 kilometers) from the closest coastal locations with views of the WTGs. For the Proposed Action, use of ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS (Capitol Airspace Group 2023). BOEM assumes that the use of ADLS on offshore wind projects other than the Proposed Action would result in similar limits on the frequency of WTG and OSS aviation warning lighting use.

Nighttime lighting from onshore electrical substations could affect the ability to use nearby properties or decisions about where to establish permanent or temporary residences. Nighttime lighting impacts would be localized, constant, and long term. However, it is likely that other offshore wind projects would expand or construct new substations near existing substations or would construct new substations in areas where land development regulations (i.e., zoning and land use plan designations) allow such uses. For new or expanded substations in business or industrial areas, lighting would have no adverse impacts on land uses. Lighting impacts would depend on the proposed substation locations but would generally be localized and negligible.

Noise: Noise from offshore wind construction activities is not expected to reach the geographic analysis area. Onshore construction would result in localized, temporary noise typical of construction projects. Therefore, increased noise resulting from other offshore wind activities would not affect land use and coastal infrastructure and would have a negligible impact.

Port utilization: Offshore wind energy projects would make use of port facilities for shipping, berthing, and staging throughout construction, operations, and decommissioning. This use would be similar to existing activities at ports and is consistent with the zoning and land use plan designations of these areas. Offshore wind would likely increase port utilization, and ports would experience beneficial impacts such as greater economic activity and increased employment due to demand for vessel maintenance services and related supplies, vessel berthing, loading and unloading, warehousing and fabrication facilities for offshore wind components, and other activity related to offshore wind.

Planned offshore wind use of facilities at Sparrows Point in Baltimore County would support beneficial re-use of a vacated industrial facility. For larger ports, such as the ports at Portsmouth (Hampton Roads area), Virginia, offshore wind-related activities would make up a small portion of the total activities at the port; therefore, offshore wind activities would have a negligible impact on land use through port utilization at these ports. For smaller ports in the geographic analysis area, such as Ocean City, Maryland; Lewes, Delaware; Port Norris, New Jersey; and Cape Charles, Virginia, port expansion or renovation of underused facilities may be necessary to accommodate the increased activity, resulting in changes to surrounding land use and coastal infrastructure as described below.

If multiple offshore wind energy projects are constructed at the same time and rely on the same ports, this simultaneous use could stress port resources and could increase the marine and road traffic, noise, and air pollution in the area. Overall, offshore wind projects would have constant, long-term, beneficial impacts on port utilization due to the productive use of ports designated for offshore wind activity, as well as localized, short-term, minor adverse impacts in cases where individual ports are stressed due to simultaneous project activity.

Presence of structures: As described in Section 3.6.9, *Visual Resources*, portions of 187 WTGs from offshore wind projects other than the Proposed Action could be visible from some shorelines depending on vegetation, topography, and atmospheric conditions. Visibility would vary with distance from shore, topography, and atmospheric conditions and impacts would generally be localized, constant, and long term. While WTGs could be visible from some shoreline locations in the geographic analysis area, WTGs would not result in changes to land use or zoning designations and would be unlikely to meaningfully change land use patterns.

Substations and above ground Onshore Export Cable Routes (if any) for multiple offshore wind projects would affect individual properties, depending on their location, but would result in only localized minor impacts on land use, because such structures would be constructed consistent with zoning and other land development regulations.

3.6.5.3.2 Conclusions

BOEM expects ongoing and planned activities, including offshore wind activities, to have continuing temporary and permanent impacts on land use and coastal infrastructure. The identified IPFs relevant to land use and coastal infrastructure are accidental releases, nighttime lighting of onshore construction activity and structures, port utilization and expansion, viewshed impacts of offshore structures, presence of onshore infrastructure, and land disturbance, noise, and traffic from construction.

BOEM anticipates the impacts of ongoing activities, especially onshore and coastal commerce, industry, and construction projects, would have both **minor beneficial** and **negligible** adverse impacts in the geographic analysis area. Accidental releases and land disturbance could have temporary adverse impacts on local land uses but, overall, ongoing activity and development sustains the region's diverse mix of land uses and provides support for continued maintenance and improvement of coastal infrastructure.

Planned activities other than offshore wind—primarily increased port maintenance and expansion and construction activity—would have impacts similar to those of offshore wind activities, with **minor beneficial** and **negligible** adverse impacts. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in **minor beneficial** and **negligible** adverse impacts on the IPFs affecting land use and coastal infrastructure. Under the No Action Alternative, existing environmental trends and activities would continue, and land use and coastal infrastructure would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **negligible** adverse and **minor beneficial** impacts on land use and coastal infrastructure.

BOEM anticipates the No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor** adverse impacts and **minor beneficial** impacts. Offshore wind would adversely affect land use through land disturbance (during installation of onshore export cable and substations) and accidental releases during onshore construction, as well as through the presence of offshore lighting on wind energy structures and views of the structures themselves that could affect the use and value of onshore properties. Beneficial impacts on land use and coastal infrastructure would result because the development of offshore wind would support the productive use of ports and related infrastructure designed or appropriate for offshore wind activity (including construction and installation, O&M, and decommissioning).

3.6.5.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) would influence the magnitude of the impacts on land use and coastal infrastructure:

- The time of year during which construction occurs. Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). If Project construction were to occur during this season, impacts on roads and land uses during the busy tourist season would be exacerbated.
- Changes to the turbine design capacity would not alter the maximum potential impacts on land use and coastal infrastructure for the Proposed Action and other action alternatives because the capacity or number of turbines would not affect onshore infrastructure or port utilization.

3.6.5.5 Impacts of Alternative B – Proposed Action on Land Use and Coastal Infrastructure

The Proposed Action would likely result in localized impacts that would not alter the overall character of land use and coastal infrastructure in the geographic analysis area. The most impactful IPFs would likely include land disturbance during cable installation and substation construction; the visual impact of offshore WTGs; and the utilization of ports. The Proposed Action would not directly require any upgrades to port infrastructure but would make productive use of existing ports and the planned redevelopment project at Sparrows Point. Other IPFs would likely contribute impacts of lesser intensity and extent and would occur primarily during construction but may also occur during operations and decommissioning.

BOEM expects the proposed offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs.

3.6.5.5.1 Construction and Installation

All land use construction and installation impacts would be associated with onshore activities. While some IPFs associated with offshore activities (such as accidental releases) could affect land uses, those impacts are discussed as part of the associated offshore resource, such as water quality (Section 3.4.2, *Water Quality*).

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage and installation of the inshore export cables and substations. As described in Section 3.4.2, *Water Quality*, accidental releases in the offshore environment would be unlikely to affect land. Potential contamination may occur from unforeseen spills or accidents onshore or in port areas. Any such occurrence would be reported and addressed in accordance with the local authority. Accidental releases on land use and coastal infrastructure could result in temporary restriction on use of adjacent properties and coastal infrastructure during the cleanup process. Accordingly, accidental releases from the Proposed Action alone would have localized, short-term, negligible to minor impacts on land use.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined accidental release impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. The increased risk of and thus the potential impacts from accidental releases of fuel/fluids/hazardous materials in the geographic analysis area would result in localized, short-term, negligible to minor impacts on land use and coastal infrastructure.

Land Disturbance: The Proposed Action's land-disturbing activities would include construction of landfall site, interconnection cables, and substation sites. The Project schedule would minimize adverse impacts on recreational land use. US Wind proposes concentrating construction activities for landfalls outside of the summer recreation season (Memorial Day to Labor Day) (COP, Volume II, Section 17.3.2; US Wind 2023). The Proposed Action landfall location is within the parking lot that serves the 3R's Beach public recreational site. HDD operations would make portions of the parking lot inaccessible during a period of up to 12 months when HDD operations, cable and transition vault installation and site restoration are ongoing (US Wind 2023). HDD operations could extend into a second year depending on weather and other unforeseen circumstances (US Wind 2023). Off-season beachgoers who would typically drive to 3R's Beach in Delaware Seashore State Park would have to temporarily find alternate parking, use alternate transportation, or use an alternate beach. Typical beach activities in this area include fishing, and beachcombing (COP, Volume II, Section 17.3.1; US Wind 2023).

The Inshore Export Cable Route would require cable installation within Indian River Bay, as described in Section 2.1.2.1.2. Cable ducts would be installed via HDD between the Atlantic Ocean and the landfall within the 3R's Beach parking lot; from the 3R's Beach parking lot into Indian River Bay; and from the Indian River to the onshore substation. Trenching would be used to install the cables within Indian River Bay and the Indian River. The in-water cable installation would generate vessel and equipment movements, noise, vibration, and emissions that would have temporary effects on the commercial, recreational, and residential land uses bordering Indian River. HDD installation from the Indian River to the substation would occur within the industrially zoned land area that surrounds the existing power station and substation (US Wind 2023).

Installation of the cable landfall sites and Inshore Export Cable Route would temporarily disturb neighboring land uses. These impacts are anticipated to last for the duration of construction; following construction, the cable route would be returned to its previous condition and use.

Construction of the substations would convert undeveloped land adjacent to the Indian River Power Station into impervious surface but would not alter overall land use patterns. The Proposed Action includes the expansion of the existing Indian River substation at 1.84 acres (0.74 hectares) and three proposed substations totaling 10.3 acres (4.2 hectares) and a permanent access road of 1.43 acres (0.58 hectares). Construction of the interconnection facilities also includes the temporary construction laydown area of 4.02 acres (1.63 hectares), and a temporary access road of 0.76 acres (0.31 hectares).

No new port or dock facilities are proposed to be constructed as part of the Project. US Wind would work with local officials to develop a traffic management plan to reduce impacts on local traffic during construction. Accordingly, land disturbance from Proposed Action construction would have short-term, adverse, and minor impacts on land use and coastal infrastructure.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the land disturbance impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, due to construction-related disturbance along the Inshore Export Cable Route and at the onshore substation and landfall sites. However, impacts on land use and coastal infrastructure would be additive only if land disturbance associated with one or more other projects occurs in close spatial and temporal proximity. Impacts would be localized, short term, and minor.

Noise: The Proposed Action would be required to comply with DNREC and local noise regulations (Delaware Administrative Code Title 7 Section 1149). The State of Delaware limits construction activities to the following hours: 7:00 a.m. until 10:00 p.m., Monday through Saturday, with no work on Sundays. Delaware regulations also limit construction noise levels at the boundary with residential areas to 65 A-weighted decibels during the day and 55 A-weighted decibels during the night. Sussex County has no construction noise regulations. Construction would also occur within the towns of Bethany Beach and Dagsboro. Bethany Beach limits construction to 8:00 a.m. until 5:30 p.m. Monday through Friday and 8:00 a.m. until 4:00 p.m. on Saturdays, while Dagsboro prohibits machines producing unreasonably loud noise at a distance greater than 25 feet (7.5 meters) (TRC 2023b).

US Wind has provided a preliminary Construction Noise Management Plan and will finalize the plan prior to construction to ensure that construction noise is within the limits (temporal and noise levels) required by state and local noise regulations (TRC 2023b). The Construction Noise Management Plan estimates the maximum construction noise level at the noise source for both cable installation and substation construction at 100 to 110 dB (TRC 2023b). US Wind will implement mitigations such as planning truck routes and parking areas to avoid proximity to residential areas, careful positioning of trucks and equipment, avoiding idling, using mufflers and noise shielding on equipment, using landforms or installing noise barriers, worker training, and periodic noise monitoring (Appendix G, Table G-1). Temporarily increased noise levels during construction may affect local sensitive receptors (such as religious locations, recreational areas, schools, and other places that are particularly sensitive to construction noise) but would not change existing land uses. Given the statutory noise limits and implementation of US Wind's Construction Noise Management Plan (TRC 2023b), Proposed Action construction noise would have short-term, localized, minor impacts on land use and coastal infrastructure.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined noise impacts on land use and coastal infrastructure from ongoing and planned activities, which would be short term, localized, and minor.

Port utilization: The Project would be only one of many users for the ports expected to be used during construction. Proposed uses at existing port facilities would be consistent with the current land uses occurring at these locations and are not expected to result in changes to land use or zoning. Activities associated with Proposed Action offshore construction would generate noise, vibration, and vehicular traffic at the ports temporarily used for construction. These impacts are typical for industrial ports and would not hinder other nearby land uses or use of coastal infrastructure. Overall, the construction and installation of offshore components for the Proposed Action alone would have minor beneficial impacts on land use and coastal infrastructure by supporting designated uses and infrastructure improvements at ports.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which would be minor beneficial impacts. Offshore wind development, including the Proposed Action, would require port facilities for shipping, berthing, and staging, and development activities would support ongoing or new activity at authorized ports.

3.6.5.5.2 Operations and Maintenance

3.6.5.5.2.1 Onshore Activities and Facilities

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage, maintenance of the inshore export cables and substation, and substation operation. Potential contamination may occur from unforeseen spills or accidents, and any such occurrence would be reported and addressed in accordance with the local authority. The impact of accidental releases on land use and coastal infrastructure could result in temporary restriction on use of adjacent properties and coastal infrastructure during the cleanup process. Accordingly, accidental releases from the Proposed Action alone would have localized, short-term, negligible to minor impacts on land use.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined accidental release impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. The increased risk of and thus the potential impacts from accidental releases of fuel/fluids/hazardous materials in the geographic analysis area would result in localized, short-term, negligible to minor impacts on land use and coastal infrastructure.

Land disturbance: O&M would not result in land disturbance except in the event that substation repairs or cable maintenance or replacement is required. If no alternative exists, US Wind may construct a new administrative building on commercial land (COP, Volume I, Section 2.7; U.S. Wind 2022). BOEM assumes any such administrative building would be consistent with applicable zoning and other land development regulations. Therefore, Proposed Action O&M would have localized, short-term, and negligible impacts on land use and coastal infrastructure.

The Proposed Action would contribute a negligible increment to the combined land disturbance impacts of onshore infrastructure on land use and coastal infrastructure from ongoing and planned activities including offshore wind. Impacts on land use and coastal infrastructure would be additive only if maintenance of onshore infrastructure (cables or substations) associated with one or more other projects occurs in close spatial and temporal proximity. In the context of reasonably foreseeable environmental trends, impacts of the Proposed Action and other ongoing or planned activities from land disturbance would be long term, localized, and minor.

Lighting: Nighttime lighting of the onshore substations could affect the use of adjacent properties; however, the onshore substations would be constructed in locations where zoning and other land development regulations permit such uses and would be subject to local requirements for shielding the lighting and avoiding spillover to adjoining land uses. As a result, lighting during onshore O&M for the

Proposed Action alone would have a long-term, continuous**, minor** impact on land use and coastal infrastructure in the geographic analysis area.

In the context of reasonably foreseeable environmental trends, the onshore lighting for Proposed Action O&M would contribute a noticeable increment to the combined impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. These impacts would be localized and minor.

Noise: Onshore operational noise would result from port activity and substation operation. The Proposed Action O&M activities would comply with DNREC and local noise regulations to minimize impacts on nearby communities. Impacts would be localized, short term, and negligible.

In the context of reasonably foreseeable environmental trends, the contribution of the Proposed Action would contribute a negligible increment to the combined noise impacts on land use and coastal infrastructure from ongoing and planned activities, which would be localized, short term, and negligible.

Port utilization: Proposed Action O&M would require frequent activity at the O&M facility in the Ocean City Harbor. Project operations would require an average of 4 daily vessel round trips during summer months and 1 to 2 round trips daily during other seasons (US Wind 2023). Vessel trips from Sparrows Point (Port of Baltimore) would be less frequent, occurring when larger vessels are needed. This vessel traffic is typical for Ocean City Harbor and would not hinder other nearby land uses or use of coastal infrastructure. Overall offshore O&M for the Proposed Action alone would have minor beneficial impacts on land use and coastal infrastructure by supporting designated uses and infrastructure improvements at ports.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts from port utilization due to ongoing and planned activities including offshore wind and would have minor beneficial impacts on land use and coastal infrastructure.

Presence of structures: Construction of the substations would convert undeveloped land into impervious surface but would have a minimal impact on land use. The onshore substations would require permanent sites, including area for the substation equipment and buildings, equipment yards, energy storage, stormwater management, a parking area, an access road, and landscaping. Upgrades to the electrical transmission grid may be needed for interconnection; however, those upgrades would be consistent with the existing land use. Based on the potential substation locations and associated zoning described in Section 3.6.5.1, the presence of substation structures would have long-term, localized, minor impacts on land use.

The Proposed Action's onshore infrastructure would contribute a noticeable increment to the combined impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. Impacts on land use and coastal infrastructure would be additive only if onshore structures (such as substations) associated with one or more other projects occurs in close spatial and temporal proximity. In the context of reasonably foreseeable environmental trends, impacts of the Proposed Action and other ongoing or planned activities from the presence of structures would be long term, localized, and minor.

3.6.5.5.2.2 Offshore and Inshore Activities and Facilities

Lighting: The Proposed Action would include the use of aviation hazard lighting mounted on top of the WTG nacelles and approximately midway up each WTG tower (COP, Volume II, Section 16.4 and Appendix K2; US Wind 2023). Each WTG, OSS, and Met Tower foundation would also have marine navigation lighting. The lighting is designed to be visible to distances ranging from 2 to 5 nautical miles (3.7 to 9.3 kilometers) during low-visibility conditions and would be visible from farther away under clear conditions. The Met Tower would have lighting visible at up to 10 nautical miles (18.5 kilometers) (COP, Volume II, Appendix K2; US Wind 2023). Aviation and navigation lighting would likely be visible from some coastal vantage points in the geographic analysis area depending on vegetation, topography, weather, and atmospheric conditions (Section 3.6.9, *Visual Resources*). US Wind has committed to implementing an ADLS; with ADLS, FAA warning lights for the Proposed Action would be illuminated approximately 0.1 percent of nighttime hours (Section 3.6.9, Visual Resources). This would greatly reduce the nighttime visibility of Proposed Action structures from shore (compared to traditional systems with constantly flashing lighting). While WTG and OSS lighting would be visible in some conditions, this lighting would not affect existing land uses and land development regulations onshore, due to the existing development patterns and limited remaining development potential within coastal portions of the geographic analysis area. The Proposed Action alone would have a long-term, continuous, negligible impact on land use and coastal infrastructure.

Offshore nighttime operational aviation hazard and navigation lighting for portions of the Proposed Action in combination with other offshore wind projects would be visible from shorelines depending on vegetation, topography, weather, and atmospheric conditions. The land use impacts from the Proposed Action in the context of other offshore wind development would be similar to, but more extensive than, the impacts for the Proposed Action alone. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined WTG lighting impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which would be continuous, long term, and negligible to minor.

Presence of structures: Portions of all the Proposed Action WTGs and OSS could be visible from coastal and elevated areas of the geographic analysis area, depending on vegetation, topography, and atmospheric conditions. The closest Proposed Action WTGs would be approximately 10.5 miles (16.9 kilometers) from the coastal viewers. These WTGs would be plainly visible and could be the dominant feature in offshore views (Section 3.6.9, *Visual Resources*). As described in Section 3.6.3, *Demographics, Employment, and Economics*, and Section 3.6.8, *Recreation and Tourism*, views of WTGs and their presence in an area used for commercial fishing and (to a lesser extent) recreational boating could impact coastal businesses as well as recreation and tourism activities. As a result, the presence of structures could also impact long-term land use patterns, although the long-established nature of coastal development makes extensive changes unlikely, and meaningful changes to zoning and other underlying land development regulations are unlikely. As a result, the Proposed Action alone would have a long-term, continuous, moderate impact on land use and coastal infrastructure.

WTGs and OSSs from the Proposed Action and other offshore wind projects would be visible from shorelines depending on vegetation, topography, weather, and atmospheric conditions. The land use impacts from the Proposed Action in the context of other offshore wind development would be similar to, but more extensive than, the impacts for the Proposed Action alone, and would affect a wider extent of the geographic analysis area. In the context of reasonably foreseeable environmental trends, the combined impacts on land use and coastal infrastructure from ongoing and planned activities including the presence of offshore wind turbines, which would be long term, continuous, and moderate.

3.6.5.5.3 Conceptual Decommissioning

The impacts of Onshore and Offshore Proposed Action decommissioning would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Decommissioning would require onshore traffic and equipment usage, as well as port usage for removal of onshore and offshore structures. Land and water disturbance from removal of the export cables could be negligible if export cables are retired in place rather than removed.

Proposed Action decommissioning would contribute a negligible increment to the combined onshore infrastructure impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. Impacts on land use and coastal infrastructure would be additive only if onshore structures (such as substations) associated with one or more other projects occurs in close spatial and temporal proximity. In the context of reasonably foreseeable environmental trends, impacts of decommissioning of the Proposed Action and other ongoing or planned activities from land disturbance would be long term, localized, and minor.

3.6.5.5.4 Conclusions

Overall, BOEM anticipates Proposed Action’s impacts on land use and coastal infrastructure would be **minor** to **moderate** adverse with **minor beneficial** impacts. Minor **beneficial** impacts would result from port utilization. The **moderate** adverse impacts would be due to the potential for land use change due to the visibility of Proposed Action WTGs and OSSs from coastal and elevated locations. Other IPFs would contribute negligible to **minor** impacts.

In the context of other reasonably foreseeable environmental trends, the incremental contribution by the Proposed Action to the overall impacts on land use and coastal infrastructure would be noticeable. BOEM anticipates the overall impacts on land use and coastal infrastructure in the geographic analysis area associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** adverse and **minor beneficial**. The main drivers for this impact rating are the **minor beneficial** impacts of port utilization, as well as **moderate** impacts from the presence of structures. The Proposed Action would contribute to the overall impact rating primarily through long-term impacts from the presence of structures, as well as **beneficial** impacts due to the use of port facilities designated for offshore wind activity.

3.6.5.6 Impacts of Alternatives C, D, and E on Land Use and Coastal Infrastructure

The impacts associated with the Proposed Action (as described in Section 3.6.5.5) would not change substantially under the other action alternatives. Alternative C would include an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route) and could have marginally larger construction impacts from land disturbance; however, because the construction impacts are short term, and Onshore Export Cable Routes would primarily be installed within roadways or existing ROWs, these differences would not change the impact ratings compared to Alternative B. The potential substations identified for Alternatives C-1 and C-2 are the same as the Proposed Action and are established uses; expansion of these substations could affect adjacent uses but would not alter overall land use patterns.

Under Alternative D, the closest WTGs would be 14 miles rather than 10.5 miles from the coastline and a total of 33 offshore structures would be excluded (32 WTGs and 1 OSS). Alternative D would incrementally reduce the impact on land uses, including recreation and tourism facilities and coastal businesses; however, the degree of change is not anticipated to be sufficient to change overall level of impact on land use. Alternative E would reduce the number of WTGs by 11 but would not meaningfully change the views of WTGs from the coast or the impacts on businesses and therefore would have the same level of impact as Alternative B.

3.6.5.6.1 Conclusions

While Alternatives C and D would have marginally different impacts, they would have the same impact magnitudes as Alternative B. Alternative E would have the same impacts as Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **moderate** and **minor beneficial**. In the context of reasonably foreseeable environmental trends and planned actions, the action alternatives would occur under the same scenario (Appendix D) as Alternative B. As stated previously, the action alternatives would all have the same impact magnitudes as Alternative B. The overall impact of the action alternatives on land use and coastal infrastructure when combined with past, present, and reasonably foreseeable activities would therefore be **moderate** and **minor beneficial**.

3.6.5.7 Comparison of Alternatives

As described in Section 3.6.5.5, the impacts of the Proposed Action in combination with ongoing and planned activities would likely be slightly larger (**moderate** adverse as well as **minor beneficial**) when compared to the impacts expected under the No Action Alternative (**minor** to **moderate** adverse and **minor beneficial**). The Proposed Action would impact land use and coastal infrastructure primarily through land disturbance and the visual effects of the presence of structures (i.e., changes in land use that could occur due to the visibility of the Proposed Action’s WTGs, OSSs, and Met Tower). Under the No Action Alternative, these impacts would not occur.

As stated in Section 3.6.5.6, compared to Alternative B, Alternatives C and D would have incrementally different impacts on land use and coastal resources, while Alternative E would have the same impacts. These differences notwithstanding, the impacts of the action alternatives would likely remain the same as Alternative B: **minor** to **moderate** adverse and **minor beneficial** impacts on land use and coastal infrastructure. In the context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternatives on land use and coastal infrastructure when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **moderate** adverse and **minor beneficial**.

3.6.6 Navigation and Vessel Traffic

This section discusses navigation and vessel traffic characteristics and potential impacts on waterways and water approaches from the Proposed Action, action alternatives, and ongoing and planned activities in the navigation and vessel traffic geographic analysis area. The navigation and vessel traffic geographic analysis area (Figure 3.6.6-1) includes coastal and marine waters within a 12-nautical mile (22.2-kilometer) buffer of the Lease Area, as well as waterways leading to ports that may be used by the Project. These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning. Information presented in this section primarily draws from US Wind's Navigation Safety Risk Assessment (NSRA) (COP, Volume II, Appendix K1; US Wind 2023) which was conducted per the guidelines in USCG Navigation and Vessel Inspection Circular 01-19 (USCG 2019).

3.6.6.1 Description of the Affected Environment and Future Baseline Conditions

3.6.6.1.1 Regional Setting

Project facilities would be approximately 10.5 miles (16.9 kilometers) off the Coast of Maryland. The entrance to Delaware Bay is approximately 27 nautical miles (50 kilometers) northwest of the Lease Area, marked by a line drawn between Cape May Light and Harbor of Refuge Light offshore of Lewes. Figure 3.6.6-2 shows the location of the Lease Area and adjacent waterways.

Several routing measures[21] regulate vessel traffic to help ships avoid navigational hazards in the vicinity of the Lease Area. Vessel traffic in and out of Delaware Bay is regulated by a TSS, which is 0.4 nautical miles (0.7 kilometers) from the closest proposed structure in the Lease Area. The TSS within the approach to Delaware Bay consists of an Eastern Approach, a Southeastern Approach, a Two-way Traffic Route, and a Precautionary Area (33 CFR 167.170). The Southeastern Approach of the TSS is adjacent to the northeastern boundary of the Lease Area and is primarily a shipping route for deep-draft vessels (COP, Volume II, Appendix K1; US Wind 2023).

3.6.6.1.2 Vessel Traffic

Traffic patterns, traffic density, and statistics in and around the Lease Area were developed from 1 year of AIS data for 2019; data from the Mid-Atlantic Ocean Data Portal (MARCO 2022) for commercial fishing transits; and ongoing dialogue with organizations representing or serving different types of waterborne traffic in the area (such as recreational boating, fishing, and towing industry organizations, pilot organizations, and NMFS, NOAA and BOEM fisheries surveys) (COP, Volume II, Appendix K1; US Wind 2023).

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[21] The term routing measure originates from the International Maritime Organization. The International Convention for the Safety of Life at Sea, Chapter V, recognizes the International Maritime Organization as the only international body for establishing routing measures (https://www.imo.org/en/OurWork/Safety/Pages/ShipsRouteing.aspx). The USCG submits and obtains approval for routing measures within U.S. navigable waters to the International Maritime Organization. Areas to Be Avoided, Inshore Traffic Zones, No Anchoring Areas, Precautionary Areas, Roundabouts, and Traffic Separation Schemes are all routing measures (USCG 2021, Section H).

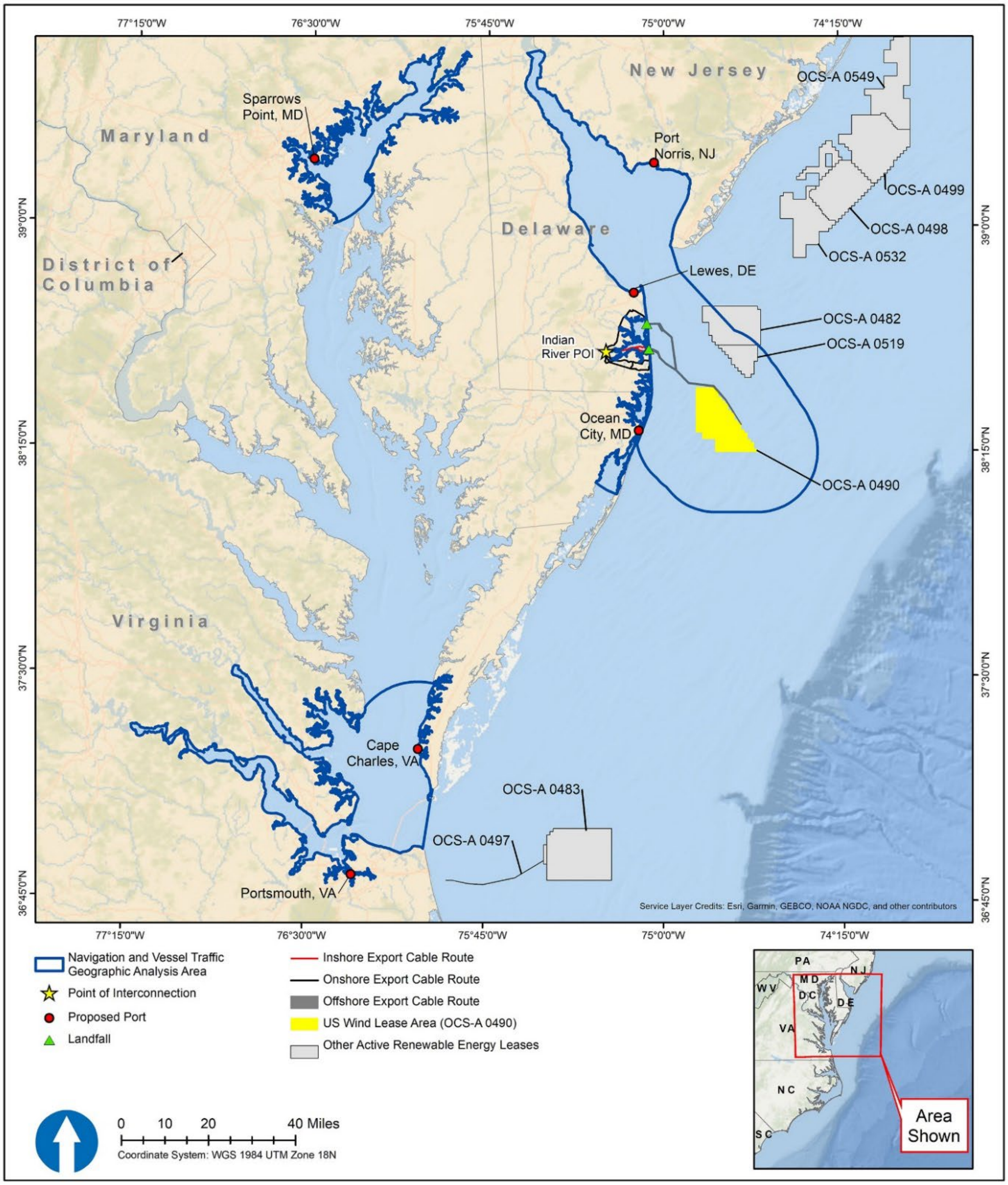

Figure 3.6.6-1. Navigation and vessel traffic geographic analysis area

The highest vessel traffic density in the geographic analysis area was in the vicinity of Cape May, Delaware Bay, the Ocean City Inlet, and the TSS (Delaware Bay Eastern Approach and Southeastern Approach) (COP, Volume II, Appendix K1; US Wind 2023). The NSRA for the Project analyzed vessel traffic activity as transit counts (one-way crossing) per transect (COP, Volume II, Appendix K1; US Wind 2023). Transect locations were selected to evaluate the areas of heaviest vessel traffic in the vicinity of the Lease Area. Most of the transects in the survey area have fewer than five transits per day (COP, Volume II, Appendix K1, Table 2-23; US Wind 2023). The most heavily travelled transects include (COP, Volume II, Appendix K1, Figure 2-23; US Wind 2023):

- Vessels entering and leaving Delaware Bay had the highest density of vessel traffic in the NSRA study region. This transect had approximately 8,942 total transits in 2019 (COP, Volume II, Appendix K1, Figure 2-24; US Wind 2023), equivalent to approximately 24.5 transits per day;
- The vessels transiting the inbound and outbound lanes of the Delaware Bay Southeastern Approach TSS north of the Lease Area. These two transects had 3,991 total transits in 2019 (COP, Volume II, Appendix K1, Figure 2-22; US Wind 2023), equivalent to approximately 10.9 transits per day; and
- The tracks of vessels transiting from or to the Ocean City Inlet form a fan-like pattern originating in Ocean City and crossing the Lease Area predominantly in the east-west direction. This transect had 2,245 total transits in 2019 (COP, Volume II, Appendix K1, Figure 2-22; US Wind 2023), equivalent to approximately 6.2 transits per day.

In addition, there were 244 AIS transits through the Indian River Inlet (COP Volume II, Appendix K1, Figure 2-23; US Wind 2023). This is part of the federally designated, state-maintained Indian River Inlet & Bay navigation channel through the bay and along the Indian River to Millsboro and does not include AIS transits within Indian River Bay (USACE 2023).

Traffic near the Lease Area predominantly consists of large commercial deep-draft vessel transits. Traffic within the broader NSRA survey area includes a more even distribution between fishing, pleasure, and deep-draft transits. There are no ferry routes in the Lease Area. The closest ferry route (Cape May, New Jersey, to Lewes, Delaware) is 25 nautical miles (46.3 kilometers) from the Lease Area. The COP (Volume II, Appendix K1; US Wind 2023) provides detailed information on vessel traffic.

Figure 3.6.6-2 shows commercial vessel transit counts and Table 3.6.6-1 summarizes the distribution, type of vessel, and vessel characteristics of AIS-equipped vessels recorded in the vicinity of the Project. AIS is required on commercial vessels with a length of 65 feet (19.8 meters) or longer, as well as certain other cargo and passenger vessels regardless of length. “Other/undefined” vessel types in Table 3.6.6-1 include research, military, law enforcement, and unspecified vessels (COP, Volume II, Appendix K1; US Wind 2023). While some smaller recreational and fishing vessels carry AIS, Table 3.6.6-1 excludes most vessels less than 65 feet (19.8 meters) long that traverse the Lease Area (COP, Volume II, Appendix K1; US Wind 2023). Therefore, AIS tracks for fishing and pleasure vessels in Table 3.6.6-1 and shown on Figure 3.6.6-3 are underrepresented.

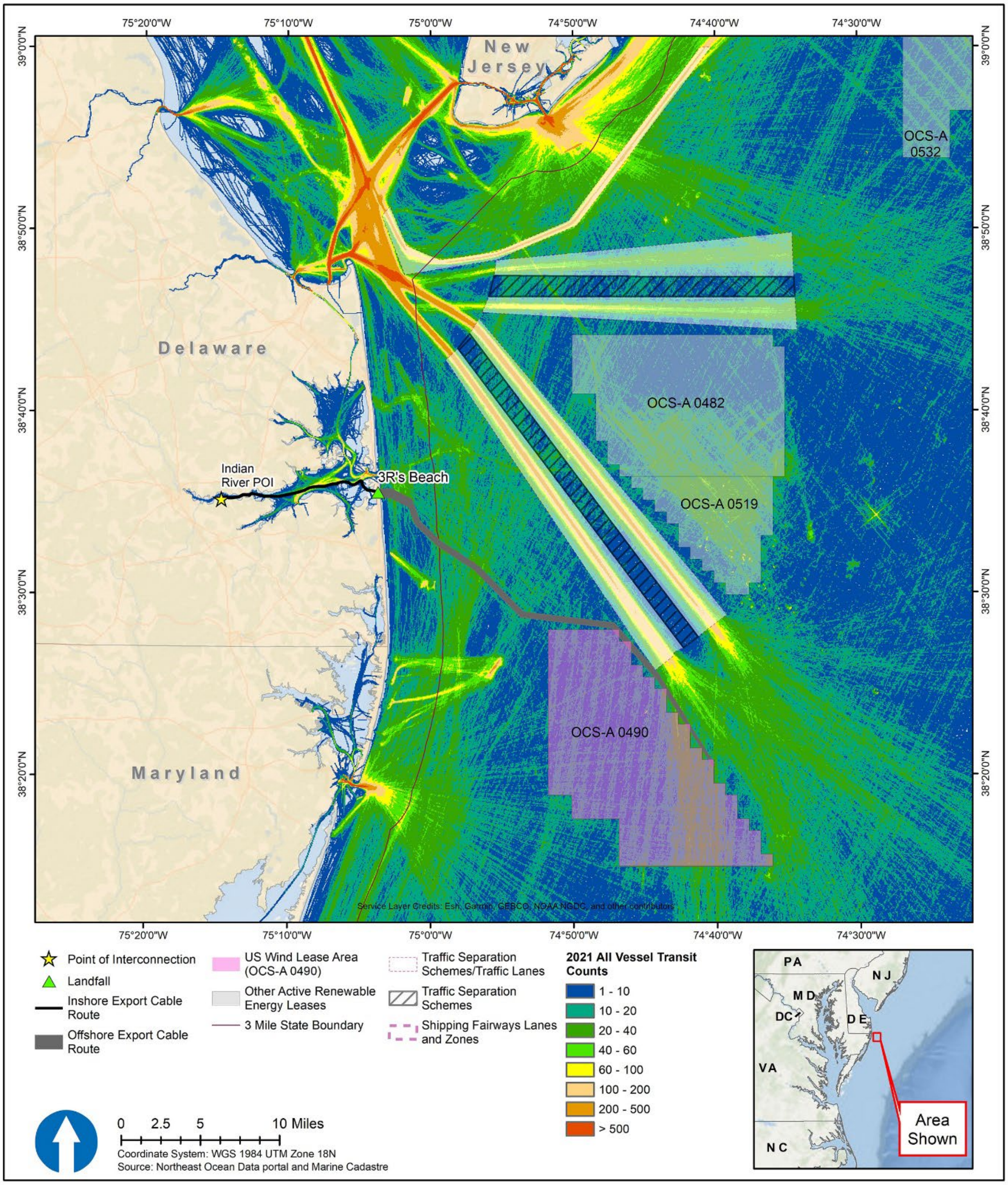

Figure 3.6.6-2. Vessel transit counts in 2021 for vessels that carry Automatic Identification System (AIS) transponders within the Project area

Source: Mid-Atlantic Ocean Data Portal

Table 3.6.6-1. Vessels within 5 miles (8 kilometers) of the Project area

Vessel Type	Unique Vessel Tracks	Deadweight Tonnage (metric tons)[1]	Average Width (meters)	Average Length (meters)
Cargo/tanker	895	40,994	31	203
Cruise ships and large ferries	5	8,452	24	163
Other	289	5,123	10	43
Tug	134	40[2]	10[2]	32
Fishing	193 [3]	9	7	22
Passenger	27	7	6	22
Pleasure	762 [3]	4	5	15

Source: DNV Navigational Safety Risk Assessment 2022

[1] Table 3-4 provides Low, Medium, and High DWT figures. Medium was used here.

[2] Tug DWT are the values reported in the AIS data, which do not include the tonnage of a towed barge.

[3] AIS track counts for fishing and pleasure vessels underrepresent these vessel types, because USCG regulations do not require all vessels of this type to carry AIS.

Commercial fishing vessel traffic using vessel monitoring system (VMS) data is further described in the COP (Volume II, Appendix K1; US Wind 2023). Polar histograms using VMS data (Figure 3.6.6-3), show that 319 VMS-enabled commercial fishing vessels transited the Lease Area from January through August 2019, while 78 vessels were actively fishing. The predominant orientation of travel was from east to west, with a secondary operating pattern of southwest to northeast.

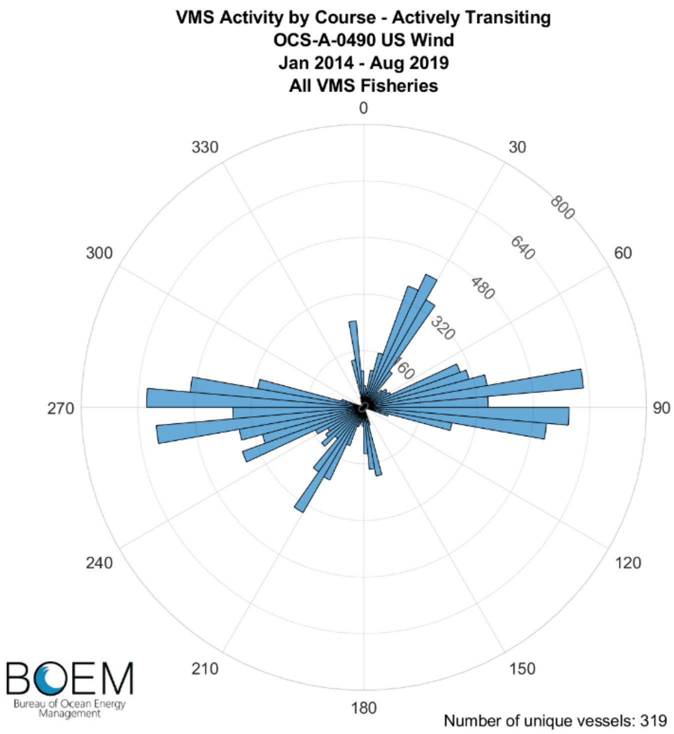

Figure 3.6.6-3. Vessel monitoring system (VMS) tracks in the Lease Area, January to August 2019

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

Consistent with the patterns of fishing vessel traffic, the primary traffic patterns in the Lease Area are east-west direction, between Ocean City and fishing grounds farther east. The closest major commercial fishing ports are Ocean City and Cape May. Most vessels transiting from Ocean City were fishing vessels for scallops or surfclam/ocean quahog (COP, Volume II, Appendix K1, Section 2.1.1.2; US Wind 2023) (Figures 3.6.6-4 and 3.6.6-5). Most vessels transiting in the Lease Area did so at a speed faster than 5 knots (9.3 km/h). Most vessels transiting slower than 5 knots (9.3 km/h) were heading west towards Ocean City, consistent with laden transit back to port. Current levels of fishing activity in this area are lower compared to fishing areas east of the Lease Area. Only the pots and traps records show a "medium" level of activity at the eastern boundary of the Lease Area. Gillnet fishing occurs in the Lease Area, at a level defined as "less" than other areas in the Atlantic (COP, Volume II, Appendix K1, Section 2.1.1.2; US Wind 2023).

Large ferries and cruise ships in the region primarily followed routes in Delaware Bay, and between Cape May, New Jersey, and Lewes, Delaware (i.e., the Cape May-Lewes Ferry), approximately 30 nautical miles (55.6 kilometers) north of the Lease Area (COP, Volume II, Appendix K1, Section 2.1.1.3; US Wind 2023). Most vessels that enter the Lease Area are Cargo/Tanker vessels. Pleasure boat activity in the Lease Area varies seasonally, peaking at 15 trips per day from May through September (COP, Volume II, Appendix K1, Section 2.1.1.5; US Wind 2023). Section 3.6.1 discusses commercial fisheries and for-hire recreational fishing and Section 3.6.8 discusses recreation and tourism.

3.6.6.1.3 Aids to Navigation

The closest federal aids to navigation are Delaware Lighted Buoy D, 2.8 nautical miles (5.2 kilometers) from the lease area, and Fenwick Shoal Lighted Buoy, 4.3 nautical miles (8 kilometers) from the Lease Area. Two private aids to navigation (yellow buoys with flashing lights) are within the Lease Area boundary, including one at the approximate centroid of the Lease Area and another near the southeastern corner of the Lease Area.

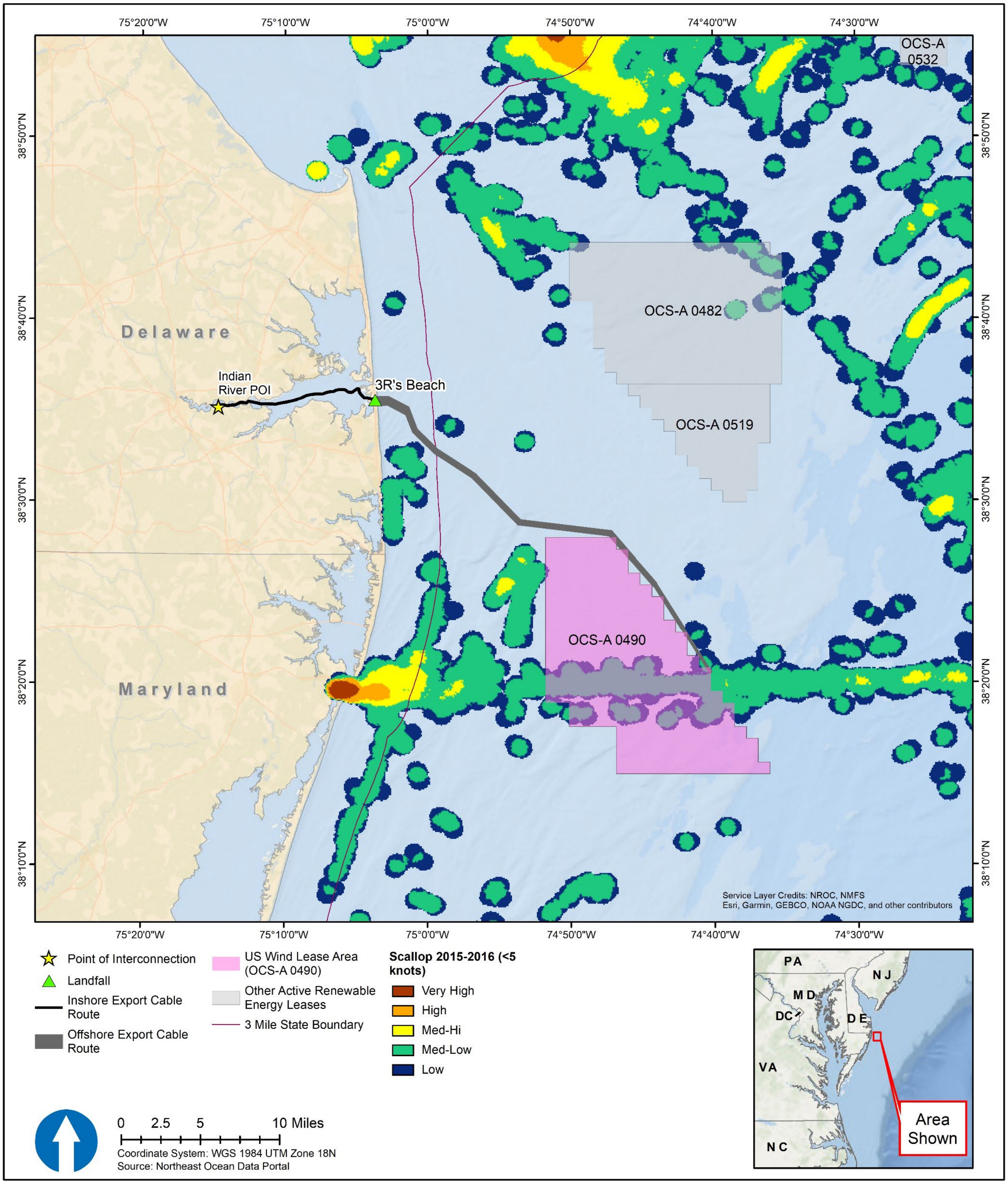

Figure 3.6.6-4. Scallop commercial fishing vessel activity in the Project area based on Vessel Monitoring System (VMS) data

Source: Mid-Atlantic Ocean Data Portal

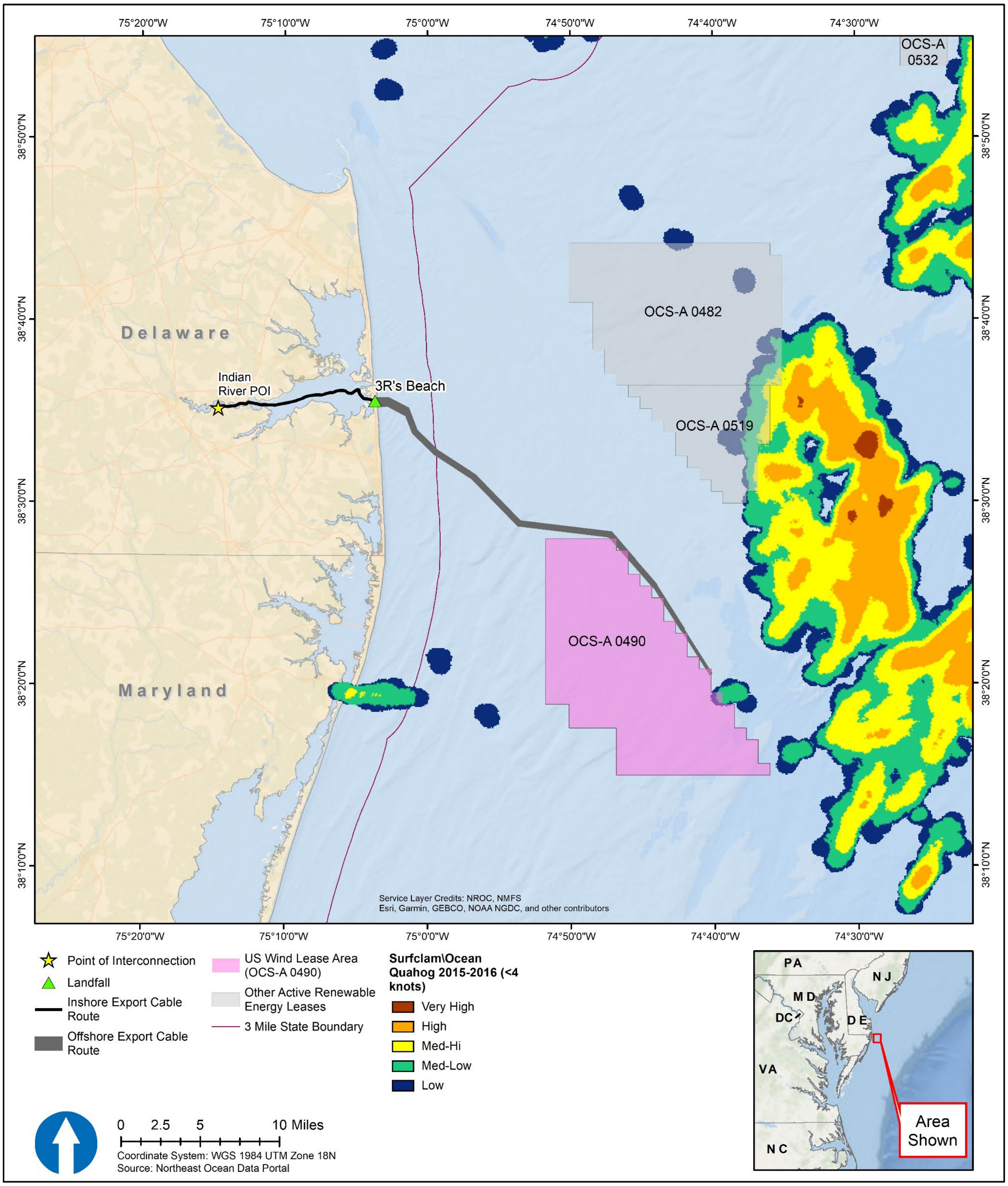

Figure 3.6.6-5. Surfclam commercial fishing vessel activity in the Project area based on Vessel Monitoring System (VMS) data

Source: Mid-Atlantic Ocean Data Portal

3.6.6.1.4 Ports, Harbors, and Navigation Channels

The major navigable waterway within the analysis area is Delaware Bay and River. Delaware Bay and River offer access to Wilmington, Delaware, Philadelphia, and other ports for large commercial deep-draft ships and tug/barge units, as well as smaller commercial and non-commercial shallower-draft vessels (COP, Volume II, Appendix K1; US Wind 2023). Ocean City and Lewes are also in the NSRA survey; however, those ports have shallow depths and accommodate primarily recreational, fishing, and passenger vessels with overall lengths of less than 75 feet (23 meters). Most cargo/carrier and tank vessels follow the Delaware Bay TSS lanes; however, some traffic exiting the outbound lane of the TSS and heading south, and traffic entering the northbound TSS lane from the south passes through the Lease Area (COP, Volume II, Appendix K1; US Wind 2023). A BOEM review of potential navigational impacts within the Lease Area concluded that none of the Mid-Atlantic Lease Areas overlapped with a TSS, but that under the Ports and Waterways Safety Act, the "USCG must reconcile the need for safe access routes with other reasonable uses of the area involved" (46 U.S.C. 470003). A subsequent Atlantic Coast Port Access Route Study (ACPARS) was published in April 2017 (Final ACPARS Report, 82 *Federal Register* 64 [April 5, 2017], pages 16510 to 16512; USCG 2016), and resulted in a new Port Access Route Study (PARS) for the seacoast of New Jersey and southward through the Lease Area (86 *Federal Register* 183 [September 24, 2021], pages 53089-53091; USCG 2021). In the New Jersey PARS, the USCG recommended a 5.9-nautical mile (11-kilometer) southeast extension of the existing TSS along the eastern side of the Lease Boundary (USCG 2021). The 2022 Consolidated Port Approaches Port Access Route Studies (CPAPARS) Report provides findings related to port access route studies in the northern New York Bight; seacoast of New Jersey, including offshore approaches to the Delaware Bay; approaches to the Chesapeake Bay; and the seacoast of North Carolina, including approaches to the Cape Fear River and Beaufort Inlet (USCG 2022). The CPAPARS provides a summary of recommendations for shipping safety fairways and routing measures. The Indian River Inlet & Bay navigation channel is an important navigation feature for recreational vessel activity and provides access between the open ocean and the inland waters of Indian River Bay and Rehoboth Bay (COP, Volume II, Appendix K1; US Wind 2023).

3.6.6.1.5 Vessel Incidents

As summarized in the NSRA, existing accident frequencies in the Lease Area for allision are nearly zero, due to the absence of WTGs and other structures in the Lease Area. The accident frequency for collisions in the Lease Area is one collision every 67 years, the frequency of drift groundings is 1 per 2.6 years, and the frequency of groundings under power is 1 per 3.1 years (COP, Volume II, Appendix K1, Table 11-1; US Wind 2023). An annual average of 0.8 search and rescue (SAR) missions were flown in the Lease Area, and an annual average (based on 10 years of data) of 103 SAR missions were flown within 20 nautical miles (37 kilometers) of the Lease Area.

3.6.6.2 Impact Level Definitions for Navigation and Vessel Traffic

Definitions of impact levels for navigation and vessel traffic are provided in Table 3.6.6-2. Table F1-16 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on navigation and vessel traffic.

Table 3.6.6-2. Impact level definitions for navigation and vessel traffic

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Impacts would be avoided. Normal or routine functions associated with vessel navigation would not be disrupted.
Moderate	Adverse	Impacts would be unavoidable. Vessel traffic would have to adjust somewhat to account for disruptions due to impacts of the Project.
Major	Adverse	Vessel traffic would experience unavoidable disruptions to a degree beyond what is normally acceptable, including potential loss of vessels and life.

3.6.6.3 Impacts of Alternative A – No Action on Navigation and Vessel Traffic

When analyzing the impacts of the No Action Alternative on navigation and vessel traffic, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, baseline conditions for navigation and vessel traffic would continue to follow regional current trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities within the geographic analysis area that contribute to impacts on navigation and vessel traffic are generally associated with marine transportation, military use, NMFS activities and scientific research, and fisheries use and management. Impacts from these activities increase vessel traffic in the area, adding to congestion in waterways and increasing the potential for maritime accidents. Impacts associated with global climate change could require modifications to existing port infrastructure and aids to navigation, with the former adding to port congestion and limited berths during construction activities.

Planned non-offshore wind activities that may affect navigation and vessel traffic in the geographic analysis area include port improvement projects, dredging projects, and installation of new structures on the OCS (Appendix D, Section D.2 provides a description of ongoing and planned activities). These activities may result in a moderate increase in port maintenance activities, port upgrades to accommodate larger deep-draft vessels, and temporary increases in vessel traffic for offshore cable emplacement and maintenance. Appendix D, Table D1-14 provides a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for navigation and vessel traffic.

3.6.6.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind activities to affect navigation and vessel traffic through the following primary IPFs.

Anchoring: Offshore wind developers are expected to coordinate with the maritime community and the USCG to avoid laying export cables through any traditional or designated lightering/anchorage areas, meaning that any risk for deep-draft vessels would come from anchoring in an emergency scenario, specifically near Delaware Bay. In recognition of the need for additional identified anchorages, the

CPAPARS proposed three anchorage areas (USCG 2022), two of which (Anchorage C, located east of the inbound TSS lane and Anchorage D, located west of the outbound TSS lane and north of the US Wind Lease Area) have been established (87 *Federal Register* 132 [July 12, 2022], pages 41248 to 41250). Generally, larger vessels accidentally dropping anchor on top of an export cable (buried or mattress protected) to prevent drifting in the event of vessel power failure would result in damage to the export cable, damage to the vessel anchor or anchor chain, and risks associated with an anchor contacting an electrified cable. The USCG may consider establishing temporary safety zones around WTG construction sites within the lease area on a case-by-case basis. Vessels not involved in construction would be required to avoid these safety zones (COP, Volume II, Appendix K1, Section 5.1; US Wind 2023)

Smaller commercial or recreational vessels anchoring in the offshore wind lease areas may have issues with anchors failing to hold near foundations and any scour protection. Considering the small size of the geographic analysis area compared to the remaining area of open ocean, as well as the low likelihood that any anchoring risk would occur in an emergency scenario, it is unlikely that offshore wind activities would affect vessel-anchoring activities. Impacts on navigation and vessel traffic would likely be minor because impacts would be temporary and localized, and navigation and vessel traffic would be expected to fully recover following the disturbance.

Cable emplacement and maintenance: The 65 foundations (62 WTGs and 3 OSSs) in the geographic analysis area would require about 274 miles (441 kilometers) of inter-array, and offshore export cables. Emplacement and maintenance of cables for these offshore wind projects would generate vessel traffic and would specifically add slower-moving vessel traffic above cable routes. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes during installation and maintenance activities. BOEM anticipates simultaneous cable-laying activities from three projects (Skipjack Wind I and II and GSOE) could occur in 2024 based on the estimated construction timeline. While simultaneous cable-laying activities may disrupt vessel traffic over a larger area than if activities occurred sequentially, the total time of disruption would be less than if each project were to conduct cable-laying activities sequentially. The impacts of this IPF on vessel traffic and navigation under the No Action Alternative would be minor to moderate because impacts would be short term, localized, and most disruptive during peak construction activity of the offshore wind projects from 2023 through 2030.

Port utilization: In addition, development of other offshore wind projects would support planned expansions and modifications at ports in the geographic analysis area, including the Port of Baltimore, Port of Paulsboro, New Jersey, New Jersey Wind Port and Portsmouth (Hampton Roads area), Virginia. Simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity and resources and could concentrate vessel traffic in port areas. Such concentrated activities could lead to increased risk of allision, collision, and vessel delay.

Under the No Action Alternative, three offshore wind projects in the analysis area, (Skipjack Wind I, Skipjack Wind II, and GSOE), would generate vessel traffic during construction. Skipjack Wind I and GSOE could be under construction simultaneously in 2024. BOEM assumed vessel traffic for these projects would be similar to that of the Proposed Action: up to 39 vessels operating simultaneously during construction, depending on the activity (COP, Volume II, Appendix C1; US Wind 2023).

The increase in port utilization due to offshore wind vessel activity would vary across ports and would depend on the specific port or ports supporting each offshore wind project. It is unlikely that all projects would use the same ports; therefore, the total increase in vessel traffic would be distributed across multiple ports in the region. Port utilization in the geographic analysis area would occur primarily during construction. Offshore wind construction activities may result in competition with non-offshore wind activities for berthing space and port services, potentially causing short- to medium-term adverse impacts on commercial shipping. During peak activity, impacts on port utilization would be moderate, short term, and continuous at the ports and their maritime approaches.

After offshore wind projects are constructed, related port utilization would decrease. During operations, project-related port utilization would have minor, long-term, intermittent, localized impacts on overall vessel traffic and navigation. Port utilization would increase again during decommissioning at the end of the operating period of each project, which BOEM anticipates to be approximately 30 years, with magnitudes and impacts similar to those described for construction.

Presence of structures: Under the No Action Alternative, approximately 110 WTGs and 3 OSSs would be constructed in the geographic analysis area. Structures in this area would pose navigational hazards to vessels transiting within and around offshore wind lease areas. The presence of WTGs and OSSs would increase navigational complexity and ocean space use conflicts in areas where no such structures currently exist, cause potential compression of vessel traffic both outside and within offshore wind lease areas, and cause potential difficulty seeing other vessels due to a cluttered view field. The additional fairways and extended TSS included as recommended measures in the CPAPARS could mitigate this complexity somewhat (USCG 2022). Under certain atmospheric conditions, wind energy facilities could contribute to fog formation (Hasager et al. 2017).

Another potential impact of offshore wind structures is interference with marine vessel radars. A study by the University of Texas (Ling et al. 2013) used modeling (but not studies of operational offshore wind facilities) to simulate the electromagnetic scattering and propagation over ocean surfaces to provide a baseline evaluation of simulated electromagnetic and acoustical challenges to sea surface, subsurface, and airborne electronic systems presented by offshore wind energy facilities. This study indicated a potential for MVR interference from offshore wind turbines. Specifically, using modeling, Ling et al. (2013) concluded that:

- Communications systems in the marine environment are unlikely to experience interference as the result of typical offshore wind development configurations, except under extreme proximity or operating conditions;
- MVR and ocean monitoring high-frequency sensors may experience interference under certain proximity and operating conditions as the result of typical offshore wind development configurations;
- Sensitive airborne radars may experience serious interference; however, the degree of interference may be system-specific and dependent on whether offshore wind developments are located within the operational area of the radar; and

- Due to the virtual absence of noise exceeding background levels radiated underwater by wind turbines at frequencies above 1 kilohertz, interference with underwater acoustical systems is deemed to be unlikely at such frequencies. At frequencies below 1 kilohertz, the tones radiated by wind turbines may cause interference with certain acoustical systems when placed near a wind development.

A 2022 National Academies of Sciences, Engineering, and Medicine (NAS) study found adverse impacts on MVR from offshore WTGs (NAS 2022). Specifically, the study found that offshore WTGs affect MVR in some situations, most commonly through a substantial increase in strong reflected energy cluttering the operator's display, leading to complications in navigation decision-making (NAS 2022). The sizes of anticipated offshore WTGs and projects would exacerbate these impacts (NAS 2022). This decreased efficacy applies to both traditional, magnetron-based MVRs and as-fielded, solid-state MVRs. Degraded effectiveness of MVR could lead to lost contact with smaller objects, such as recreational vessels and buoys (NAS 2022).

MVR have varying capabilities, and the ability of radar equipment to properly detect objects is dependent on radar type, equipment placement, and operator proficiency. General mitigation and monitoring measures such as properly trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS all would enable safe navigation with minimal loss of radar detection (USCG 2020). The NAS study also found that WTG-related MVR interference could be lessened through improved radar signal processing and display logic or signature-enhancing reflectors on small vessels to minimize lost contacts.

The fish aggregation and reef effects of offshore wind structures would also provide new opportunities for recreational fishing. The additional recreational vessel activity focused on aggregation and reef effects would incrementally increase vessel congestion and the risk of allision, collision, and spills near WTGs (Section 3.4.2, *Water Quality*, includes a discussion of the likelihood of spills). Overall, the impacts of this IPF on navigation and vessel traffic would be moderate, long term (as long as structures remain, approximately 30 years), regional (throughout the entire geographic analysis area for navigation and vessel traffic), and continuous.

Traffic: Offshore wind projects would generate vessel traffic in the geographic analysis area during construction, operation, and decommissioning. Other vessel traffic in the region (e.g., commercial fishing, for-hire and individual recreational use, shipping activities, military uses) would overlap with offshore wind-related vessel activity in the open ocean and near ports supporting the offshore wind projects. BOEM anticipates the total increase in vessel traffic would be distributed across multiple ports in the region.

The increase in vessel traffic (and therefore navigation risk) due to offshore wind projects would be at its peak in 2023, when 91 WTGs and 2 OSSs associated with the Skipjack Wind II and GSOE offshore wind projects other than the Proposed Action would be under simultaneous construction. During this peak construction period, a maximum of 74 vessels could be operating simultaneously in the geographic analysis area at any given time. Offshore wind project vessels traffic would add to the Atlantic Coast vessel traffic levels as each project is developed, leading to increased congestion and navigational complexity, which could result in crew fatigue, damage to vessels, injuries to crews, engagement of the

USCG SAR, and vessel fuel spills. Increased offshore wind-related vessel traffic during construction would have moderate, short-term, constant, localized impacts on overall (wind and non-wind) vessel traffic and navigation.

After offshore wind projects are constructed, related vessel activity would decrease. Vessel activity related to O&M would consist of scheduled inspection and maintenance activities with corrective maintenance as needed. BOEM assumes O&M vessel traffic for each offshore wind project would be the same as the Proposed Action estimates of four vessels per day. Combined, the three offshore wind projects in the geographic analysis area would generate 12 vessels at any given time during normal O&M. During operations, Project-related vessel traffic would have minor, long-term, intermittent, localized impacts on overall vessel traffic and navigation. Vessel activity would increase again during decommissioning at the end of the operating period of each project, which BOEM anticipates being approximately 30 years, with magnitudes and impacts similar to those described for construction.

3.6.6.3.2 Conclusions

BOEM expects ongoing and planned activities, including other offshore wind activities, to have continuing short- and long-term impacts on navigation and vessel traffic, primarily through the presence of structures, port utilization, and vessel traffic. BOEM anticipates the impacts of ongoing activities, especially port utilization and vessel traffic, would be **moderate**. In addition to ongoing activities, planned activities other than offshore wind may also contribute to impacts on navigation and vessel traffic. Planned activities other than offshore wind include port improvement projects, dredging projects, and offshore cable emplacement and maintenance. BOEM anticipates the impacts of planned activities other than offshore wind would be **minor** because while impacts would be measurable, they would not disrupt navigation and vessel traffic. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in **minor** to **moderate** impacts on navigation and vessel traffic. Other offshore wind projects would increase vessel activity, which could lead to congestion at affected ports, the possible need for port upgrades beyond those currently envisioned, and an increased likelihood of collisions and allisions, with resultant increased risk of accidental releases. In addition, the offshore wind projects other than the Proposed Action would lead to the construction of approximately 110 WTGs and 3 OSSs in areas where no such structures currently exist, also increasing the risk for MVR interference, collisions, allisions, and resultant accidental releases and threats to human health and safety. BOEM expects other offshore wind projects to result in long-term, regional, and **moderate** impacts on navigation and vessel traffic.

Under the No Action Alternative, existing environmental trends and activities would continue, and navigation and vessel traffic would continue to be affected by natural and human caused IPFs. The No Action Alternative would result in **moderate** impacts on navigation and vessel traffic. BOEM anticipates the No Action Alternative combined with all other planned activities (including other offshore wind activities) in the geographic analysis area would result in **moderate** impacts primarily due to the presence of structures.

3.6.6.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) would influence the magnitude of the impacts on navigation and vessel traffic characteristics:

- The Project layout including the number, type, and placement of the WTGs and OSSs, including the location, width, and orientation of the Lease Area rows and columns;
- The number of vessels utilized for construction and installation;
- The Offshore Export Cable Routes/locations;
- Time of year of construction;
- Ports selected to support construction and installation; and
- Ports selected to support O&M.

Variability of the Project design within the PDE that could affect navigation and vessel traffic includes the number of vessels that would be used during construction; the ports used to support Project construction, installation, and decommissioning; the exact placement and number of WTGs; and the construction schedule, as outlined in Appendix C. Variances in these factors could affect vessel traffic and navigation choices. This section has assessed the maximum-case scenario; therefore, variances from this scenario should lead to similar or reduced impacts. US Wind has committed to measures to minimize impacts on navigation and vessel traffic (COP, Volume II, Sections 1.5 and 16.7; US Wind 2023).

3.6.6.5 Impacts of Alternative B – Proposed Action on Navigation and Vessel Traffic

Impacts from the Proposed Action alone would include increased vessel traffic in and near the Lease Area and on the approach to ports used by the Proposed Action, as well as obstructions to navigation caused by Proposed Action activities. Construction vessel trips could originate or terminate at the Port of Baltimore (Sparrows Point), Portsmouth (Hampton Roads area), Virginia, Port Norris, New Jersey, Ocean City, Maryland, Lewes, Delaware or Cape Charles, Virginia (COP, Volume I, Table 2-6; US Wind 2023). O&M trips could originate and terminate at the Port of Baltimore (Sparrows Point), Ocean City, Maryland; Portsmouth (Hampton Roads area), Virginia; or Lewes, Delaware. Tables 3.6.6-3 and 3.6.6-4 summarize vessel transits related to the Proposed Action and applicable to IPFs discussed throughout Section 3.6.6.5.

Anticipated changes in traffic from the Project were estimated to include:

- Project-related vessel traffic related to construction, O&M, and decommissioning activities;
- Additional non-Project traffic that might be generated by the presence of the wind farm, for example, pleasure vessel trips for sightseeing or recreational fishing; and
- The modification of usual traffic routes for some ship types due to the presence of wind farm structures.

Table 3.6.6-3. Proposed Action vessel traffic by activity type

Vessel Transits[1]	Total Construction Transits[2]	Annual Average Transits	Monthly Average Transits	Maximum Monthly Transits (Month)	Average Vessels Present
Construction and Installation Vessels					
Offshore Export Cable Route	160	53	4	32 (April, Year 2)	7
Lease Area	4,526	1,509	125	186 (August, Year 2)	30
WTG component delivery transits from Sparrow's Point (excluding return trip)	206	69	5	19 (multiple months)	NA
Other vessel transits to or from Lease Area	4,320	1,440	120	167 (multiple months)	NA
Total	4,686	1,562	130	372 (June/July, Year 2)	37
Operations and Maintenance Vessel Transits					
Annual Operations and Maintenance Vessel Transits	--	822	69	139 (July)	4

Source: COP, Volume II; US Wind 2023

NA = not applicable

[1] "Transits" is defined as a single, one-way trip. The total number of vessel round trips is the number of transits divided by two.

[2] Includes all trips during the 36-month Proposed Action construction phase.

Impacts on navigation and vessel traffic would also include changes to navigational patterns and the effectiveness of marine radar and other navigation tools. This could result in delays within or approaching ports, increased navigational complexity, detours to offshore travel or port approaches, or increased risk of incidents such as collision and allision, which could result in personal injury or loss of life from a marine casualty, damage to boats or turbines, and oil spills (Section 3.4.2, *Water Quality*, includes a discussion of the likelihood of spills). Section 3.6.8 addresses the Proposed Action's impacts on recreation and tourism, while Section 3.6.1 addresses the Proposed Action's impacts on commercial fisheries and for-hire recreational fishing.

Table 3.6.6-4. Proposed Action vessel traffic by port

Transit Origin (Destination: Lease Area)	Proposed Action: Average Daily Transits[1]	Proposed Action: Average Daily Transits, Peak Month	Existing Average Daily Transits[2]
Construction and Installation Vessels			
Sparrows Point (Port of Baltimore)	0.5	1.5	23.9
Ocean City, Maryland[3]	3.6	10.6	6.8
Lewes, Delaware	0.1	1.9	n/a
Portsmouth (Hampton Roads area), Virginia[4]	0.1	0.4	22.7
Cape Charles, Virginia	<0.1	<0.1	0.1
Port Norris, New Jersey	<0.1	0.1	n/a
Europe/Offshore East Coast	<0.1	0.1	n/a
Total, Construction and Installation Vessels	4.2	14.65	53.5
Operations and Maintenance Vessels			
Sparrows Point (Port of Baltimore)	0.3	0.9	23.9
Ocean City, Maryland[3]	4.2	8.1	6.8
Cape Charles, Virginia	n/a	n/a	0.1
Lewes, Delaware	n/a	n/a	n/a
Portsmouth (Hampton Roads area), Virginia[4]	n/a	n/a	22.7
Total, Operations and Maintenance Vessels	4.5	9.0	53.5

Source: COP, Volume II, Appendix C1, Table 3 (US Wind 2023); Port of Virginia 2022; USACE 2020

[1] "Transits" is defined as a single, one-way trip. The total number of vessel round trips is the number of transits divided by two.

[2] Average of CY2016-CY2020, as reported by USACE (2020)

[3] Ocean City, Maryland, has a negligible number of cargo vessel trips. Pleasure vessel trips were taken from the COP (Volume II, Appendix K1, Table 2-4; US Wind 2023)

[4] The Port of Virginia, for the purpose of assessing existing average daily transits, includes ports in Norfolk, Newport News, Portsmouth, and other jurisdictions in the broader Hampton Roads area, Virginia. The Proposed Action only includes vessel transits to and from Portsmouth, Virginia.

The NSRA marine risk analysis modeled the frequency of non-Project vessel accidents that could result from installation of the Proposed Action wind farm structures by using the Marine Accident Risk Calculation System model. The model estimates frequencies for marine accidents accounting for Project- and location-specific environmental, traffic, and operational parameters. Detailed information about the risk analysis is included in COP, Volume II, Appendix K1 (US Wind 2023). The risk analysis calculated the frequency of accidents due to the following navigation hazards:

- Collision between two ships underway;
- Powered grounding, where a ship grounds due to human error (steering and propulsion not impaired);
- Drift grounding, where a ship strikes the ground line due to mechanical failure (steering or propulsion failed);
- Powered allision, where a ship strikes a human-made structure (e.g., WTG) due to human error (steering and propulsion not impaired); and
- Drift allision, where a ship strikes a human-made structure (e.g., WTG) due to mechanical failure (steering or propulsion failed).

Results of the NSRA risk modeling are described below under the IPFs for Presence of Structures and Traffic.

3.6.6.5.1 Construction and Installation

3.6.6.5.1.1 Onshore Activities and Facilities

Port utilization: As discussed in Section 3.6.3, *Demographics, Employment, and Economics*, as part of the Proposed Action, US Wind would develop a WTG manufacturing facility at Sparrows Point (Port of Baltimore) (the former site of a major steel manufacturing facility) in Baltimore County (CBS Baltimore 2021). Proposed Action construction would produce vessel traffic at multiple ports (Table 3.6.6-4). The largest number of trips is expected between the Lease Area and Ocean City, Maryland, with an average of 3.57 transits per day and up to 10.6 transits per day during the peak of construction activity. Based on existing vessel data, the Port of Baltimore (Sparrows Point) has the most concentrated daily traffic levels, with an average of 23.92 transits per day (Table 3.6.6-4). Regionally, peak traffic typically occurs from April to August, with an existing average of 53.5 daily transits, though the actual total number of existing transits may be significantly higher due to the numerous smaller vessels that do not utilize AIS.

Proposed Action construction would generate trips by various methods, including specialized equipment vessels (scour protection installation, survey, jack-up heavy lift, and transport vessels), crew transport vessels (crew change, accommodation vessels), and support vessels (tugboat and barge). Proposed Action construction would generate an average of 37 and a maximum of 39 vessels operating in the Lease Area or over the Offshore Export Cable Route at any given time (COP, Volume II, Appendix C1; US Wind 2023). This includes approximately 206 trips by tug-and-barge combination vessels carrying large WTG or OSS components such as WTG tower segments, blades, and nacelles. These movements may require moving safety zones and coordinated traffic management with USCG and/or applicable vessel pilot associations to safely navigate along channels and underneath the Chesapeake Bay Bridge.

Many construction vessels would remain at the Lease Area or Offshore Export Cable Route for days or weeks at a time, potentially making infrequent trips to port for bunkering and provisioning as needed. Therefore, although an average of approximately 37 vessels would be present in the Lease Area during construction of each phase, fewer vessels would transit to and from port each day.

For the maximum design scenario, approximately 4,686 total vessel transits (2,343 total vessel round trips) are expected during the offshore construction period, which equates to an approximate average of 4.2 vessel transits (2.1 vessel round trips) per day under a 36month offshore construction schedule.

During the single most active month of construction for the entire 36-month construction period, it is anticipated that an average of approximately 12.4 daily vessel transits (6.2 daily vessel round trips) could occur (COP, Volume II; US Wind 2023). The average Project-related traffic in Table 3.6.6-4 would correspond to less than a 0.08 percent increase in total transits and is within the level of day-to-day variability in number of transits. Near port facilities or adjacent waterways, Proposed Action construction vessels may require other vessels transiting navigation channels or other areas of confined navigation to adjust course, where possible, or adjust their departure/arrival times to avoid navigational conflicts. The presence of large, specialized equipment vessels and support vessels could cause delays for vessels not associated with the Proposed Action and produce a change in the port utilization and routes used by fishing or recreational vessel operators. As a result, the use of ports for Proposed Action construction would have short term, continuous, localized, and moderate impacts on navigation and vessel traffic.

Other offshore wind projects would generate comparable types and volumes of vessel traffic in ports and would require similar types of port facilities as the Proposed Action. Within the geographic analysis area, the Proposed Action is anticipated to overlap in construction with seven offshore wind projects (Skipjack Wind I, Maryland Offshore Wind, GSOE, Skipjack Wind II, Coastal Virginia Offshore Wind – Commercial, Kitty Hawk Wind North and Kitty Hawk Wind South) for 7 years from 2023 through 2030. The specific ports used by other projects are not known, and the total increase in vessel traffic would likely be distributed across multiple ports in the region. The Sparrows Point (Port of Baltimore) facility is being constructed to support multiple offshore wind projects, including the Skipjack Wind project within the geographic analysis area (Section 3.6.3, *demographics, Employment, and Economics*) and the New Jersey Wind Port in Lower Alloways Creek, Salem, New Jersey is a state-funded facility that was purpose-built to support the Atlantic offshore wind industry (State of New Jersey 2022). As a result, other offshore wind projects are likely to use the same ports as the Proposed Action. Simultaneous construction activities for multiple projects using the same ports could result in delays for vessels using those ports. Accordingly, in the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined port utilization impacts on navigation and vessel traffic from ongoing and planned activities including offshore wind, which would be continuous and moderate.

3.6.6.5.1.2 Offshore and Inshore Activities and Facilities

Anchoring: The nearest established anchorage is Anchorage A, approximately 30 nautical miles (55.6 kilometers) northwest of the Lease Area in Delaware Bay (COP, Volume II, Appendix K1, Section 5.3; US Wind 2023). Significant anchorage activity by deep-draft vessels has been observed north of the Lease Area and within the northern portion of the Lease Area. The USCG has established of two new anchorage areas in the vicinity of the Cape Henlopen to Delaware TSS to provide additional usable grounds to support port demands and enhance navigational safety in the area (87 *Federal Register* 132 [July 12, 2022], pages 41248 to 41250). The Project is not anticipated to affect routine vessel anchoring within the existing anchorage areas or the additional proposed anchorage grounds (COP, Volume II, Section 16.7; US Wind 2023). Smaller vessels anchoring in the Lease Area may have issues with anchors failing to hold near foundations and any associated scour protection, or anchors may become snagged and potentially lost. During construction and installation, smaller recreational and fishing vessels would most likely avoid the Lease Area and therefore not anchor within the Project area.

Deviations from “normal” anchorage activities, such as vessels anchoring in an emergency scenario, pose a potential hazard to subsea cables, including those in the Indian River Inlet & Bay navigation channel and other portions of Indian River Bay along the Inshore Export Cable Route. Depending on the anchor weight, vessels with a tonnage greater than 10,000 deadweight tons would be the most likely to carry anchors that could penetrate to the Project cable burial depth if anchoring in an emergency scenario in the vicinity of the export cable route (Sharples 2011).This is especially true in Indian River Bay, where burial depths of 3.3 to 6.6 feet (1 to 2 meters) would be shallower than the 3.3 to 9.8 foot (1 to 3 meter) burial depth for the Offshore Export Cable Route. However, anchor penetration depends on factors other than ship size and anchor weight such as the type of soil on the seafloor and whether the anchor is dragged after the initial drop (Sharples 2011).

If sufficient burial depth cannot be achieved, armoring or other cable protection would be used to protect cables from external damage. Cable protection methods may include concrete mattresses or similar protection measures (COP, Volume I, Section 3.6.1; US Wind 2023). In the event an anchor does make contact with a buried export cable, impacts could include damage to the export cable and potential damage to the vessel anchor or anchor chain. Depending on the extent of the damage to the export cable, the risks associated with an anchor contacting an electrified cable can pose issues to Project equipment (an overload and shutdown of converter or transformer stations) but is not anticipated to cause electrical shock to the ship involved because seawater is a good conductor of electricity (Sharples 2011). If the export cable is damaged to the point of requiring repair, there could be impacts associated with additional vessel activity to conduct damage assessment and repair. Secondary impacts would be repercussions on the vessel operator’s liability and insurance. Combined with the low likelihood that any anchoring risk would occur in an emergency scenario, impacts on navigation and vessel traffic would be minor, localized, and temporary to short term.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the anchoring impacts from ongoing and planned activities including offshore wind, which would be short term and minor due to the small size of the offshore wind lease areas in the geographic analysis area compared to the remaining area of open ocean, as well as the low likelihood that any anchoring risk would occur in an emergency scenario. In addition, the establishment of the anchorage areas described earlier would limit the potential impacts on routine anchorage operations across the geographic analysis area.

Cable emplacement and maintenance: The Proposed Action would require the installation of an inshore export cable through Indian River Bay (which would likely affect the Indian River Inlet & Bay navigation channel), offshore export cables and inter-array and substation interconnector cables. The presence of slow-moving (or stationary) installation or maintenance vessels would increase the risk of collisions and spills. Offshore export cable installation activities include route clearance activities including a pre-installation survey and grapnel run (to remove marine debris that could impact cable lay and burial that could impact cable lay and burial). Vessels engaged in cable emplacement are, by definition, restricted in their ability to maneuver and other power-driven vessels must give way. Cable-laying vessels would display lights at nighttime or day shapes during the daytime to communicate to other vessels that they are restricted in their ability to maneuver. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes or avoid installation or maintenance areas entirely during installation and maintenance activities. The presence of installation or maintenance vessels would have minor to moderate, localized, short-term-, intermittent impacts on navigation and vessel traffic.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts from ongoing and planned activities including offshore wind, which would be localized, intermittent, and minor to moderate. Cable installation and maintenance for other offshore wind activities would generate comparable types of impacts on those of the Proposed Action for each Offshore Export Cable Route and inter-array and interconnector cable system. As shown in Appendix D, Table D2-1, offshore export cable and inter-array cables for the Proposed Action and up to three other offshore wind projects could be under construction simultaneously in the geographic analysis area. Simultaneous construction of inter-array and interconnector cables for adjacent projects could have a combined effect, although it is assumed that installation vessels would only be present above a portion of a project's cable routes at any given time. Substantial areas of open ocean are likely to separate simultaneous cable installation activities for other offshore wind projects.

Presence of structures: Impacts of the Proposed Action's WTGs, OSSs, and Met Tower are discussed as part of the O&M phase. Proposed Action offshore construction would use stationary lift vessels in the Lease Area and cranes in ports during construction. These structures and vessels would add navigational complexity and increase the risk of allision or collision vessels, particularly in bad weather or low visibility. US Wind and the USCG would provide Notice to Mariners that describe Project-related activities (including the presence of these structures) that may be of interest to military and national security interests (COP, Volume II, Appendix K1; US Wind 2023).

While some non-Project vessel traffic may navigate through the Lease Area, many vessels would choose not to pass through the area during construction, due to the presence of construction related activities and the increasing number of WTG, OSS, and Met Tower foundations. The NSRA modeled the frequency of marine accidents under the Proposed Action assumed a rerouting of common vessel traffic routes around the Lease Area for cargo, passenger, tankers, and tugs (COP, Volume II, Appendix K1; US Wind 2023). Navigating around the Lease Area would allow these vessels to avoid the navigational risks and delays of transiting through the array of WTGs and OSSs in the Lease Area. This circumnavigation would result in relatively minor delays (compared to existing conditions) for most vessels. As a result, the presence of structures during Proposed Action construction would have localized, long-term, continuous, and minor impacts on navigation and vessel traffic.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an appreciable increment to the combined impacts from ongoing and planned activities including offshore wind. Structures from other offshore wind activities would generate comparable types of impacts as under the Proposed Action across the entire geographic analysis area. A total of 231 WTGs and 7 OSSs would be constructed under the Proposed Action and the other offshore wind projects in the geographic analysis area (Appendix D, *Planned Activities Scenario*). The presence of structures from all offshore wind projects in the geographic analysis area would further increase the navigational complexity in the region, resulting in an increased risk of collisions and allisions, which would result in moderate impacts, potentially including personal injury or loss of life from a marine casualty, damage to boats or turbines, and oil spills. The presence of neighboring offshore wind projects could also affect demand for resources associated with USCG SAR operations by changing vessel traffic patterns and densities.

Traffic: Construction of the Proposed Action could generate an average of 37 vessels and a maximum of 39 vessels operating in the Lease Area or along the Offshore Export Cable Route at any given time (Table 3.6.6-3). Various vessel types (scour protection, installation, cable-laying, support, transport/feeder, and crew vessels) would be deployed throughout the Offshore Project area and Inshore Project area traversing Indian River Bay during the construction and installation phase. The presence of these vessels would increase the risk of allisions, collisions, and spills. During Offshore Export Cable Route construction, non-Project vessels required to travel a more restricted (narrow) lane (e.g., the Chesapeake and Delaware Canal between Baltimore and the Lease Area) could experience greater delays waiting for cable-laying vessels to pass. Proposed Action vessel traffic in ports could result in vessel traffic congestion, limited maneuvering space in navigation channels, and delays in ports and could also increase the risk of collision, allision, and resultant spills in or near ports. Non-Project vessels transiting between the Proposed Action ports and the Lease Area would be able to avoid Proposed Action vessels, components, and any safety zones (where the USCG is authorized and elects to establish such zones) through routine adjustments to navigation. The Proposed Action's construction and installation vessel traffic would have moderate, localized, short-term impacts on overall navigation and vessel traffic in open waters and near ports.

Section 2.2 describes the non-routine activities associated with Proposed Action. Examples of such activities or events that could affect navigation and vessel traffic include non-routine corrective maintenance activities, collisions or allisions between vessels or vessels and WTGs or OSSs, cable displacement or damage by anchors or fishing gear, chemical spills or releases, and severe weather and other natural events. These activities, if they were to occur, would generally require intense, temporary activity to address emergency conditions. The occasional increased vessel activity in offshore locations near the Offshore Export Cable Route or within the Lease Area working on individual WTGs or OSSs could temporarily prevent or deter navigation and vessel traffic near the site of a given non-routine event. In addition, severe weather could temporarily prevent or deter vessel operators from approaching or crossing the Lease Area. Impacts on navigation and vessel traffic would be temporary, lasting only as long as severe storms or repair or remediation activities were necessary to address these non-routine events.

BOEM assumes that the three other offshore wind projects in the geographic analysis area would generate amounts of vessel traffic comparable to that of the Proposed Action. Two projects (Skipjack Wind I and GSOE) are anticipated to overlap construction with the Proposed Action during 2024. During that year, the three total projects may generate an average of 390 vessel transits per month and

111 vessels present within lease areas or over the Offshore Export Cable Route at any given time within the geographic analysis area.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to vessel traffic impacts from ongoing and planned activities including offshore wind during peak construction and installation activity, which would be moderate, localized, short term, and intermittent.

3.6.6.5.2 Operations and Maintenance

3.6.6.5.2.1 Onshore Activities and Facilities

Port utilization: US Wind would use existing buildings and docks in or near Ocean City as an onshore O&M facility (COP, Volume I, Section 2.7; US Wind 2023), and would also use Sparrows Point (Port of Baltimore), Maryland, and Portsmouth (Hampton Roads area), Virginia, for large vessel O&M activity. The presence of Project vessels in and near these ports could cause delays or limitations on berthing space for other vessels and could cause some fishing or recreational vessel operators to change routes or use an alternative port. Based on the Proposed Action vessel traffic volumes in Table 3.6.6-4 the Proposed Action's impacts on vessel traffic due to port utilization during O&M would be minor, long term, and intermittent.

Other offshore wind projects would generate comparable types and volumes of vessel traffic in ports and would require similar types of port facilities as the Proposed Action. The increase in port utilization due to other offshore wind project vessel activity would be limited O&M of the Proposed Action. Delays and limitations on berthing space at Sparrows Point (Port of Baltimore) and Ocean City, Maryland; Lewes, Delaware; and Portsmouth (Hampton Roads area), Virginia, could occur if other projects also use these ports for O&M. The Proposed Action would contribute a noticeable increment to the combined port utilization impacts on navigation and vessel traffic from ongoing and planned activities at Ocean City, Maryland, and Lewes, Delaware, and an imperceptible increment of activity at Sparrows Point (Port of Baltimore), Maryland, and Portsmouth (Hampton Roads area), Virginia. In the context of reasonably foreseeable environmental trends, these combined impacts would be continuous and moderate.

3.6.6.5.2.2 Offshore and Inshore Activities and Facilities

Anchoring: Proposed Action O&M is not anticipated to affect routine vessel anchorage operations within existing anchorage areas or additional proposed anchorage grounds. Smaller vessels anchoring in the Lease Area may have issues with anchors failing to hold near foundations and any associated scour protection, or, alternately, where the anchors may become snagged and potentially lost. These impacts would be minor, localized, and temporary to short term. During O&M, deviations from "normal" anchorage activities, as discussed previously, pose a potential hazard to subsea cables.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the anchoring impacts from ongoing and planned activities including offshore wind, which would be short term and minor due to the small size of the offshore wind lease areas in the geographic analysis area compared to the remaining area of open ocean, as well as the low likelihood of anchoring in a lease area in an emergency scenario. In addition, the establishment of the anchorage areas described earlier would limit the potential impacts on routine anchorage operations across the geographic analysis area.

Cable emplacement and maintenance: O&M of the offshore export cables and inter-array and substation interconnector cables could result in the presence of slow-moving (or stationary) maintenance vessels and could increase the risk of collisions and spills. Vessels not involved in cable maintenance would need to take additional care when crossing cable routes or avoid maintenance areas entirely during maintenance activities. The presence of maintenance vessels would have minor, localized, short-term, intermittent impacts on navigation and vessel traffic.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts from ongoing and planned activities including offshore wind, which would be localized, intermittent, and minor. Cable maintenance for other offshore wind activities would generate comparable types of impacts on those of the Proposed Action for each Offshore Export Cable Route and inter-array and interconnector cable system. As shown in Appendix D, *Planned Activities Scenario*, Table D2-1, offshore export cable and inter-array/interconnector cables for up to three other offshore wind projects in the geographic analysis area could be under construction simultaneously while the Proposed Action is in operation.

The cable emplacement and maintenance impacts of the Proposed Action could be larger if installation of the inshore cable does not achieve sufficient depth to allow for the ongoing dredging of the federally designated, state-maintained Indian River Inlet & Bay navigation channel.

Presence of structures: The presence of up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower in the Lease Area would place obstacles in locations where there are currently none, leading to increased congestion and navigational complexity within the Lease Area through factors such as turn radius limitations and crew fatigue. As shown in Figure 2-2, the Met Tower would be located in the southwestern corner of the Lease Area and would not be part of the grid of WTG and OSS positions. This “off-grid” location would further increase navigational complexity. This increased complexity which could increase the chance of vessel allision with structures or collisions with Project O&M vessels or other non-Project vessels. Allisions or collisions could result in damage to vessels, injury to crews, engagement of the USCG SAR, and vessel fuel spills. Vessels that exceed a height of 70 feet (21.6 meters) would be at risk of alliding with WTG blades at mean high water and would need to navigate around the Lease Area or navigate with caution through the Lease Area to avoid the WTGs (COP, Volume II, Appendix K1, Section 3.2; US Wind 2023). The layout of the Proposed Action, with east-west oriented rows of WTGs and would create a predictable pattern of foundations, somewhat mitigating this increased risk.

Smaller static and mobile gear fishing vessels, like all vessels, would be allowed to transit and fish within the array; however, vessel operators would need to take the WTGs and OSSs into account as they set their courses through the Lease Area and would need to take care when fishing near the WTGs and OSSs to avoid below water hazards such as foundation scour protection and cable hard protection.

Due to WTG spacing and minimum blade tip clearance above the ocean surface, USCG marine assets could safely navigate and maneuver within the Lease Area. However, the presence of the WTGs would affect USCG’s ability to conduct standardized/grided search patterns. Depending on weather conditions such as low visibility, sea state, strong winds, etc., Some USCG vessels may choose not to enter the Lease Area because of heightened riske caused by the presence of the WTGs. USCG aviation assets conducting SAR missions over the Lease Area would need to maneuver around WTGs, OSSs, and the Met Tower. The layout and density of Proposed Action structures could complicate SAR activities during operations and lead to abandoned SAR missions and resultant increased fatalities. The annual number of SAR missions would increase from 0.8 to 1.1 in the Lease Area during Proposed Action O&M, and from 103 to 209 within 20 nautical miles (37 kilometers) of the Lease Area (COP, Volume II, Appendix K1, Table 12-2; US Wind 2023).

While some non-Project vessel traffic may navigate through the Lease Area, many vessels (especially larger vessels with more limited maneuverability) would likely choose to avoid the Lease Area during the life of the Project due to the presence of fixed structures. The NSRA modeled the frequency of marine accidents under the Proposed Action assuming a rerouting of vessel traffic routes around the Lease Area for cargo, passenger, tanker, and tug vessels (COP, Volume II, Appendix K1, Attachment E; US Wind 2023). Navigating around the Lease Area would allow these vessels to avoid the navigational risks and delays of transiting through the WTGs and OSSs in the Lease Area.

Table 3.6.6-5 summarizes the change in accident frequency during Proposed Action O&M due to the presence of structures. The Proposed Action would nearly double the frequency of all incidents. Pleasure vessels would represent approximately 72 percent of drift allisions and 80 percent of powered allisions in the Lease Area (COP, Volume II, Appendix K1, Figures 11-2 and 11-3; US Wind 2023). This reflects both the presence of Project structures and a NSRA assumption that an increased number of recreational and pleasure vessels would visit the Lease Area during Proposed Action O&M sightseeing of the wind farm and recreational fishing.

Table 3.6.6-5. Change in vessel accident frequency in the Lease Area due to Project operations and maintenance (O&M) [1]

Incident Type	Existing	With Proposed Action	Change
Drift allision	<0.0005	0.147	0.147
Powered allision	<0.0005	0.141	0.141
Collision	0.015	0.040	0.024
Drift grounding	0.384	0.476	0.092
Grounding under power	0.325	0.595	0.270
All Incidents	0.724	1.399	0.675

Source: COP, Volume II, Appendix K1, Table 11-2; US Wind 2023

[1] Frequencies are expressed as the likelihood of the event happening in any single year.

The presence of WTGs, OSSs, and the Met Tower during Proposed Action O&M would likely affect MVR performance near or within the Lease Area, as described in Section 3.6.6.3 (NAS 2022). Larger vessels may have more experienced bridge personnel; however, there is no domestic or international requirement for radar training specific to WTGs and there is currently no standard system of active radar tailored to a WTG environment (NAS 2022). Smaller vessels operating in the vicinity of the Proposed Action may experience the same MVR challenges as larger vessels, such as clutter due to the WTGs or ambiguous detections, and may also be harder to identify as distinct targets or become lost contacts by larger vessels while in the proximity of WTGs (NAS 2022). While radar is one of several navigational tools available to vessel captains, including navigational charts, global positioning system, and navigation lights mounted on the WTGs, radar is the main tool used to help locate other nearby vessels that are not otherwise visible, particularly in adverse weather when visibility is limited. The navigational complexity of transiting through the Lease Area, including the potential effects of WTGs and OSSs on MVR, would increase risk of allisions and collisions.

Considering the factors discussed above, the presence of structures during Proposed Action O&M would have regional, long-term, continuous, and moderate impacts on navigation and vessel traffic.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a substantial increment to the combined impacts from ongoing and planned activities including offshore wind. Structures from other offshore wind activities would generate comparable types of impacts as under the Proposed Action across the entire geographic analysis area. A total of 231 WTGs and 7 OSSs would be constructed in the geographic analysis area. The presence of structures from all offshore wind projects in the geographic analysis area would further increase the navigational complexity in the region, resulting in an increased risk of collisions and allisions, which would result in moderate impacts, potentially including personal injury or loss of life from a marine casualty, damage to boats or turbines, and oil spills. The presence of neighboring offshore wind projects could also affect demand for and resources associated with USCG SAR operations by changing vessel traffic patterns and densities.

Traffic: Operation of the Proposed Action could generate up to seven vessels from ports used for O&M. The Proposed Action would generate an average of 1,644 annual transits (822 annual round trips), with most trips consisting of service operation vessels or crew transfer vessels to and from Ocean City (COP, Volume II, Appendix C1, Table 3; US Wind 2023). Vessel traffic generated by Proposed Action could restrict maneuvering room and cause delays accessing ports. Although vessel traffic within the Lease Area is expected to decrease once the WTGs and OSSs are in place, O&M of the Proposed Action could result in the same types of vessel traffic and navigation impacts as those described during construction. Operation of the Proposed Action would have minor, long-term, intermittent, and localized impacts on overall navigation and vessel traffic near ports and in open waters.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to vessel traffic impacts from ongoing and planned activities including offshore wind Proposed Action O&M, which would be minor, localized, long term, and continuous.

3.6.6.5.3 Conceptual Decommissioning

The impacts of onshore and Offshore Project decommissioning would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Impacts from cable removal could be negligible to minor if some offshore or inshore export cables are retired in place rather than removed.

3.6.6.5.4 Conclusions

BOEM anticipates the Proposed Action would have **moderate** impacts on navigation and vessel traffic in the analysis area. Impacts on non-Project vessels would include changes in navigation routes, delays in ports, degraded communication and radar signals, and increased difficulty of offshore SAR or surveillance missions within the Lease Area, all of which would increase navigational safety risks. Some commercial fishing, recreational, and other vessels would choose to avoid the Lease Area altogether, leading to some potential congestion of vessel traffic along the Lease Area borders. The layout and density of Proposed Action structures could complicate SAR activities during operations and lead to abandoned SAR missions and resultant increased fatalities. The increase in potential for marine accidents, could thus result in increased risk of injury, loss of life, and property damage, and could produce disruptions for ocean users in the geographic analysis area.

In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on navigation and vessel traffic would be substantial. The main IPF from which impacts are contributed is the presence of structures, which increase the risk of collision/allision and navigational complexity, particularly when adjoining offshore wind projects do not share a common WTG layout or spacing and do not include a separation between adjoining lease areas. Considering all the IPFs together, BOEM anticipates the overall impacts associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be **moderate**, due primarily to the increased possibility for marine accidents, which could produce significant disruptions for ocean users in the geographic analysis area.

3.6.6.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Navigation and Vessel Traffic

Alternatives C-1 and C-2 would not affect the number or placement of WTGs or OSSs for the Project compared to Alternative B. Alternative C-2 would not affect any Offshore Project components. Alternative C-1 would use a different Offshore Export Cable Route, which could result in different impacts on navigation and vessel traffic compared to Alternative B. Alternatives C-1 and C-2 would both avoid the impacts on the Indian River Inlet & Bay navigation channel resulting from the emplacement and maintenance of the Inshore Export Cable Route within Indian River Bay.

3.6.6.6.1 Conclusions

The differences previously described notwithstanding, Alternatives C-1 and C-2 would not result in different impact ratings compared to Alternative B. As a result, in the context of reasonably foreseeable environmental trends, Alternative C would have the same impacts on navigation and vessel traffic as Alternative B: **moderate**.

3.6.6.7 Impacts of Alternatives D – No Surface Occupancy to Reduce Visual Impacts and E – Habitat Impact Minimization Alternative on Navigation and Vessel Traffic

Alternative D would exclude all WTGs and OSSs within 14 miles (22.5 kilometers) of the shoreline, resulting in the exclusion of 32 WTGs and 1 OSS. Alternative E would exclude up to 11 WTG positions scattered throughout the Lease Area. The exclusion of WTG positions would incrementally reduce the impacts from the presence of structures (including factors such as navigation complexity, the risk of vessel accidents, and impacts on USCG SAR activities) compared to Alternative B.

3.6.6.7.1 Conclusions

While Alternatives D and E would marginally reduce some risks and impacts, they would not result in different impact ratings compared to Alternative B. As a result, in the context of reasonably foreseeable environmental trends Alternatives C would have the same impacts on navigation and vessel traffic as Alternative B: **moderate**.

3.6.6.8 Comparison of Alternatives

As described in Section 3.6.6.5, the Proposed Action in combination with ongoing and planned activities would likely have similar impact magnitudes as the No Action Alternative. The Proposed Action would impact navigation and vessel traffic primarily through port utilization, the presence of structures, and vessel traffic, all of which could result in increased navigational complexity, increased risk of vessel accidents, and adverse impacts on USCG SAR activities. Under the No Action Alternative, these impacts would not occur.

Alternatives C-1 and C-2 would not affect the number or placement of WTGs or OSSs for the Project, although Alternative C-1 would result in changes to the Offshore Export Cable Route. Alternatives D and E would result in changes to the total number of WTGs and OSSs, which could reduce some adverse impacts. Overall, none of the action alternatives would result in different impact magnitudes compared to Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **moderate**. In the context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternatives on navigation and vessel traffic when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **moderate**.

If BOEM requires the mitigation measures beyond the design features described in Section 3.6.6.4, especially measures that reduce impacts on MVRs, then adverse Project impacts on navigation and vessel traffic could be further reduced and beneficial impacts could be increased; however, overall impact magnitudes would remain the same as described in this section.

3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

This section discusses potential impacts of the Proposed Action on other uses not addressed in other portions of the EIS, including marine minerals, military use, aviation, cables and pipelines, radar systems, and scientific research and surveys, which would result from the Project, action alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis areas for these topics are described below and shown on Figure 3.6.7-1.

- Aviation and air traffic, military and national security, and radar systems: areas within 10 mi (16.1 kilometer) of the export cable route and Lease Area (Figure 3.6.7-1)
- Cables and pipelines: areas within 1 mi (1.6 kilometer) of the export cable route and Lease Area that could affect future siting or operation of cables and pipelines (Figure 3.6.7-1)
- Scientific research and surveys: same analysis area as finfish, invertebrates, and EFH (Figure 3.5.5-1)
- Marine minerals: areas within 0.3 mi (0.5 kilometer) of the export cable route and Lease Area that could affect marine minerals extraction (Figure 3.6.7-1)

These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning.

3.6.7.1 Description of the Affected Environment and Future Baseline Conditions

Marine Mineral Extraction

BOEM's Marine Mineral Program manages non-energy minerals (primarily sand and gravel) on the OCS and leases access to these resources to target shoreline erosion, beach renourishment, and restoration projects. The Marine Mineral Program identifies larger sand resource areas and then partners with the USACE, states, and localities on winnowing down these larger areas into sand borrow areas, based on need for beach renourishment. The USACE also identifies borrow areas within state waters for beach renourishment. There are no active OCS lease areas for marine minerals within the geographic analysis area.

BOEM's Marine Mineral Program has identified five potentially impacted sand resource areas off the coast of Delaware that were designated based on the likelihood that usable sand resources exist in the area (Unnamed Area, Area B, Area C, Central Region Shoal, and Fenwick Shoal). Many of the aforementioned sand resources are suitable sources for replenishing sand along the coast of Maryland and Delaware. It is estimated that there are more than 8,934 million cubic feet (253 million cubic meters) of sand with high resource potential and more than 3,521 million cubic feet (100 million cubic meters) of sand with moderate resource potential in the Maryland sand resource areas, and 1,236 million cubic feet (35 million cubic meters) of usable sand resources in the Delaware Sand Resource Area (Louis Berger Group Inc. 1999).

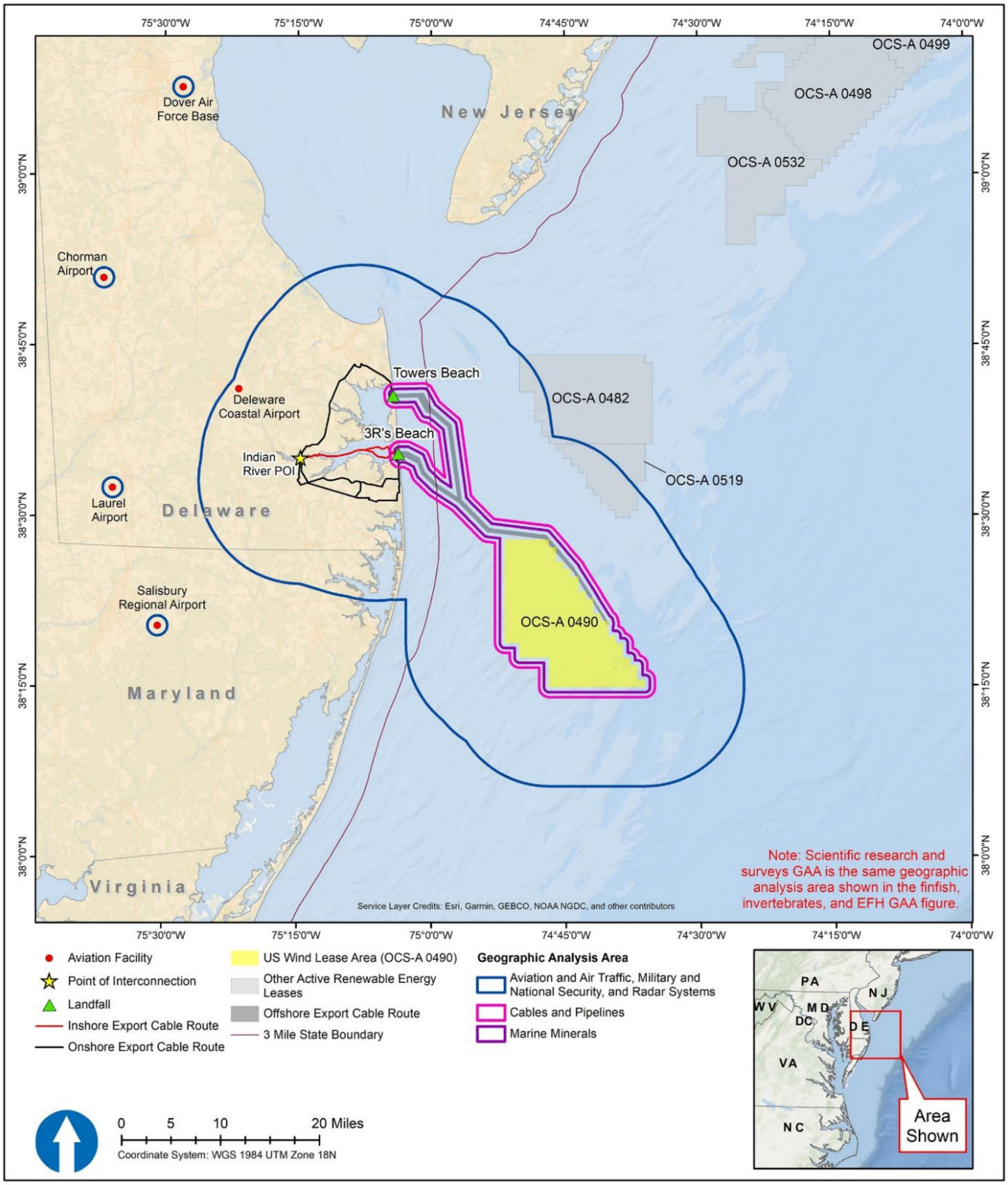

Figure 3.6.7-1. Other uses geographic analysis area

As of May 2019, the USACE North Atlantic Division indicated that the Bethany and South Bethany Beach nourishment project along the southeast Delaware coastline has a sand deficit of approximately 3.9 million cubic yards for full project lifecycle (last nourishment planned for 2057). Although the sand sources for these projects lie within state waters and there are no current plans to source material from the OCS, the depletion of local sand sources coupled with perpetual need for sand highlights the need for alternative sand sources such as those located on the OCS (Ramsey et al. 2019). Recent BOEM-funded research was conducted by the Delaware Geological Survey (DGS) to address future need as well as gain a better understanding of the stratigraphic framework in the region.

A small portion of Offshore Export Cable Route (Proposed Action) overlaps with the northeast corner of inactive Borrow Area C in federal waters, as well as the southwest portion of the Central Region Shoal (COP, Volume II, Figure 17-10; US Wind 2023) in state waters. A portion of alternative Offshore Export Cable Route (route 2) overlaps with active Borrow Area B in state and federal waters. The alternative Offshore Export Cable Route also borders USACE Proposed Sand Resource Areas P and N in federal waters; the Offshore Export Cable Route (Proposed Action) borders USACE Proposed Sand Resource Area M in federal waters and intersects the Fenwick Shoal.

National Security and Military Uses

The Lease Area is within the Virginia Capes (VACAPES) Range Complex, which is composed of the VACAPES Operating Area (OPAREA), located in the coastal and offshore waters of the western North Atlantic Ocean adjacent to Delaware, Maryland, Virginia, and North Carolina. The northernmost boundary of the VACAPES Range Complex is 37 nautical miles (68.5 kilometers) off the entrance to Delaware Bay at latitude 38°45’ N, the farthest point of the eastern boundary is 184 nautical miles (340.8 kilometers) east of Chesapeake Bay at longitude 72°41’ W, and the southernmost point is 105 nautical miles (194.5 kilometers) southeast of Cape Hatteras, North Carolina, at latitude 39°19’ N. The western boundary of the VACAPES OPAREA lies 3 nautical miles (5.6 kilometers) from the shoreline at the boundary separating state and federal waters (50 CFR 218.1). The total operational area encompasses approximately 27,661 square nautical miles (94,875 square kilometers) of surface waters (US Fleet Forces 2009). A figure showing the Project area in relationship to VACAPES, Military Training Routes (MTR) and Military Operating Areas (MOA) is provided in the COP (Volume II, Figure 16-4; US Wind 2023). This Range Complex is used for the U.S. Atlantic Fleet training and testing exercises and supports training and testing by other services, primarily the U.S. Air Force; the AEGIS Combat Systems Center (ACSC) is also located in this area. The Range Complex is controlled by the Fleet Area Control and Surveillance Facility Virginia Capes, Naval Air Station, Oceana. Subsurface, surface, and surface to air exercises are conducted in the VACAPES OPAREA. Naval operations include Naval Air Station Oceana and Naval Air Station Dam Neck Annex in the City of Virginia Beach and Naval Auxiliary Landing Field Fentress in the City of Chesapeake. The Project is located below a variety of U.S. territorial and international airspace classifications, including some controlled and special-use airspace. The Project area is entirely within the Air Defense Identification Zone (ADIZ), in which all aircraft are subject to ready identification in the interest of national security. Most of the Project area underlies both the Atlantic Low Control Area, which is designated as Class E controlled airspace above 1,700 feet (518 meters), and the Virginia Capes Operating Area (VACAPES) “W-386,” which is a National Defense Operating Area off the mid-Atlantic coast that is used for various surface, subsurface, and air-to-surface exercises.

Military activities are anticipated to continue to use onshore and offshore areas in the vicinity of the Project area into the future and may involve routine and non-routine activities.

Aviation and Air Traffic

The airport closest to the Project area is the Ocean City Municipal Airport (KOXB). This nontowered airport is located approximately 17 nautical miles (31.5 kilometer) west of the Lease Area. The Salisbury-Ocean City Wicomico Regional Airport offers air service a few miles outside Snow Hill. The NASA Goddard Space Flight Center’s Wallops Flight Facility (WFF) is located approximately 36 nautical miles (66.7 kilometer) from the Lease Area. NASA conducts science, technology, and educational flight projects from WFF aboard rockets, balloons, and UAV’s, using the Atlantic waters for operations on almost a daily basis (BOEM 2012).

Air traffic is expected to continue at current levels in and around the Wind Farm Area.

Cables and Pipelines

The Inshore Export Cable Route is within the Indian River Bay and does not overlap existing utilities such as electric and gas distribution and transmission lines, communications cables, and water and sewer pipelines. However, there are several sewer and stormwater pipelines and intake structures along the coast of Delaware that begin onshore and extend offshore in the vicinity of the Project area.

Offshore, there are no known or documented submerged cables, pipelines or military seafloor assets in the vicinity of the Project area. Two offshore wind energy lease areas are located to the north of US Wind’s Lease Area: OCS-A 0519, under Skipjack Offshore Energy, LLC, and OCS-A 0482 under GSOE I, LLC. US Wind is willing to coordinate with appropriate parties about future submarine cable crossings as needed. Submarine cables carry more than 95 percent of international communications (Xu et al. 2022). This critical infrastructure allows global communications and regional energy transfer.

BOEM has not identified any publicly noticed plans for additional submarine cables or pipelines in the geographic analysis area.

Radar Systems

The Lease Area is located within the range of a long-range land-based radar facility at Dover Air Force Base and the WFF land-based radar facility. Three of the four OSSs and associated WTGs are located within range of these facilities. The WFF land-based radar facility is used to track launch and flight activities conducted by NASA and its partners. The land-based radar may be used to track air-to-air, air—to-surface, surface-to-air, and surface-to-surface missile exercises, gunnery exercises, aircraft flights and Wallops Island land-based radar is not in use for range support activities, it may be released to the FAA (BOEM 2012).

Commercial air traffic control, national defense, and weather land-based radar systems currently operate in the region. Four DOD national defense and FAA air traffic control land-based radar sites are in the vicinity of the Project area:

- Atlantic City Airport Surveillance Radar-9 (ASR-9) and co-located Air Traffic Control Beacon Interrogator-5
- Dover Air Force Base (AFB) Digital Airport Surveillance Radar (DASR) and co-located Monopulse Surveillance Secondary Surveillance Radar
- Gibbsboro Air Route Surveillance Radar-4 (ARSR-4) and co-located Air Traffic Control Beacon Interrogator-6
- Naval Air Station (NAS) Patuxent River Airport Surveillance Radar model-11 (ASR-11
- Oceana ARSR-4
- Wallops Island Airport Surveillance Radar model-8 (ASR-8)

One DOD and one National Weather Service weather land-based radar sites are in the vicinity of the Project area:

- Weather Surveillance Radar-1988 Doppler (WSR-88D)
- National Weather Service Philadelphia WSR-88D

In addition to onshore facilities, several high-frequency radar stations along the Atlantic Coast from New Jersey through Virginia are part of regional and local high-frequency radar networks that make observations of ocean surface current and wave data (COP, Volume II, Appendix K3; US Wind 2023). These offshore high-frequency radar stations provide coverage from Cape Cod to Cape Hatteras.

An HF radar LOS analysis was conducted for the following nine radar sites:

- Assateague Island HF radar;
- Brigantine Long Range HF radar;
- Cape Henlopen HF radar;
- Cape May Point HF radar;
- Cedar Island HF radar;
- Loveladies HF radar;
- North Wildwood HF radar;
- Strathmere HF radar; and
- Wildwood HF radar.

The HF radar LOS analyses conducted (COP, Volume II, Appendix K3; US Wind 2023) show the following:

- For the Assateague Island HF radar, all 125 proposed wind turbines will be within line-of-sight of this radar site at blade-tip heights of 817 and 938 feet (249 and 286 meters) mean sea level (MSL).
- For the Cape Henlopen HF radar, four of the 125 proposed wind turbines will be within line-of-sight of this radar site at blade-tip heights of 817 and 938 feet (249 and 286 meters) MSL.
- For the Cape May Point HF radar, 111 of the 125 proposed wind turbines will be within line-of-sight of this radar site at a blade-tip height of 817 feet (249 meters) MSL. At a blade-tip height of 938 feet (286 meters) MSL, all 125 proposed wind turbines will be within line-of-sight of this radar site.

- For the North Wildwood HF radar, 69 of the 125 proposed wind turbines will be within line-of-sight of this radar site at a blade-tip height of 817 feet (249 meters) MSL. At a blade-tip height of 938 feet (286 meters) MSL, 100 of the 125 proposed wind turbines will be within line-of-sight of this radar site.
- For the Wildwood HF radar, 105 of the 125 proposed wind turbines will be within line-of-sight of this radar site at a blade-tip height of 817 feet (249 meters) MSL. At a blade-tip height of 938 feet (286 meters) MSL, 124 of the 125 proposed wind turbines will be within line-of-sight of this radar site.
- For the Brigantine Long Range HF radar, Cedar Island HF radar, and the Loveladies HF radar, the 125 proposed wind turbines will not be within line-of-sight of these radar sites at blade-tip heights of 817 or 938 feet (249 or 286 meters) MSL. Although the proposed wind turbines will not be within line-of-sight of these radar sites, radar effects are still possible beyond line-of-sight due to the propagation of HF electromagnetic waves over the ocean surface.
- For the Strathmere HF Radar, the 125 proposed wind turbines will not be within line-of-sight of this radar site at blade-tip heights of 817 or 938 feet (249 or 286 meters) MSL. Note that 99 of the 125 proposed wind turbines are beyond the instrumented range of this radar site. Although the proposed wind turbines will not be within line-of-sight of this radar site, radar effects are still possible beyond line—of-sight for the 26 proposed wind turbines within instrumented range of this radar site due to the propagation of HF electromagnetic waves over the ocean surface.

Existing radar systems will continue to provide weather, navigational, and national security support to the region. The number of radars and their coverage area are anticipated to remain at current levels for the foreseeable future.

Scientific Research and Surveys

Various federal, state, and educational organizations regularly conduct scientific research, including aerial-and ship-based scientific surveys, within the geographic analysis area. This includes long-term and seasonal scientific surveys conducted by NOAA for several regional programs. Some survey programs of note included the following as overseen by NOAA's NEFSC: (1) Atlantic Bottom Trawl Survey (NOAA 2019); (2) Marine Recreational Information Program (NOAA 2020a); and (3) Fisheries Large Pelagics Survey (NOAA 2020b).

Current fisheries management and ecosystem monitoring surveys conducted by or in coordination with NMFS NEFSC would overlap with offshore wind lease areas in the Mid-Atlantic region. Surveys include (1) the NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock assessment tool using a bottom trawl; (2) the NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock assessment and habitat characterization tool, using a bottom dredge and camera tow; (3) the NEFSC Surfclam/Ocean Quahog Survey, a stock assessment tool for both species using a bottom dredge; (4) the NEFSC Ecosystem Monitoring Program, a more than 40-year shelf ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units; and (5) AMAPPS shipboard and aerial surveys.

Fisheries-independent data are collected during these surveys to inform stock assessments, set harvest quotas, and support other fisheries management goals. Very few geophysical and geotechnical activities for oil and gas exploration in the mid-Atlantic have been conducted due to a moratorium on Atlantic oil and gas leasing activities during most of the past 30 years. Previous surveys from the 1970s employed older technologies that are considered to be less precise than those used today. No other ongoing long-term surveys were identified within the Offshore Project area. In addition, there is no overlap between the Offshore Project area and oil and gas/geological and geophysical testing area. As offshore wind development continues, alternative platforms, sampling designs, and sampling methodologies could be needed to maintain surveys conducted in or near the Project.

3.6.7.2 Impact Level Definitions for Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

Definitions of impact levels for other uses are provided in Table 3.6.7-1. Table F-17 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on other uses (marine minerals, military use, aviation, scientific research, and surveys).

Table 3.6.7-1. Impact level definitions for other uses (marine minerals, military use, aviation, scientific research, and surveys)

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Impacts on the affected activity would be avoided, and impacts would not disrupt the normal or routine functions of the affected activity. Once the Project is decommissioned, the affected activity would return to a condition with no measurable effects.
Moderate	Adverse	Impacts on the affected activity would be unavoidable. The affected activity would have to adjust to account for disruptions due to impacts of the Project, or, once the Project is decommissioned, the affected activity could return to a condition with no measurable effects if proper remedial action is taken.
Major	Adverse	The affected activity would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the Project is decommissioned, the affected activity could retain measurable effects indefinitely, even if remedial action is taken.

3.6.7.3 Impacts of Alternative A – No Action on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

When analyzing the impacts of the No Action Alternative on other uses, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.6.7.3.1 Future Offshore Wind Activities (without Proposed Action)

Under the No Action Alternative, marine minerals, military and national security uses, aviation and air traffic, offshore cables and pipelines, radar systems, and scientific research and surveys would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities within the geographic analysis area that would contribute to impacts on other uses would generally be associated with offshore developments and climate change. Impacts on the marine environment associated with climate change, commercial fishing, and ongoing offshore wind activity could affect ongoing research and surveys within the geographic analysis area.

No planned activities related to other uses in the offshore environment, such as the installation of new structures on the OCS outside of planned offshore wind projects, were identified. BOEM expects other offshore wind development to primarily affect other uses through the following IPFs.

Marine Mineral Extraction

Presence of structures: The demand for sand and gravel resources is expected to grow with increasing trends in coastal erosion, storm events, and sea level rise. Within the geographic analysis area, there are no mineral leases or ocean disposal sites. There are several USACE borrow areas and BOEM potential sand resources in the geographic analysis area (Unnamed Area, Area B, Area C, Central Region Shoal, and Fenwick Shoal, USACE Proposed Sand Resource Areas P, N, and M). Offshore wind project infrastructure, including WTGs and transmission cables, could prevent future marine mineral extraction activities where the project footprint overlaps with the extraction area. Marine mineral extraction typically occurs within 8 miles (12.9 kilometers) of the shoreline, limiting adverse impacts on the offshore export cables. Additionally, other offshore wind projects may be able to avoid existing and proposed borrow areas through consultation with the BOEM Marine Minerals Program, USACE, and relevant state agencies before an offshore wind cable route is approved, though avoidance may not be possible in some scenarios. The adverse impacts on sand and marine mineral extraction of offshore wind activities within this geographic analysis area are anticipated to be minor.

National Security and Military Uses

The offshore wind lease area geographic boundaries were developed through coordination with stakeholders to address concerns surrounding overlapping military and security uses. BOEM continues to coordinate with stakeholders to minimize these concerns, as needed.

Presence of structures: Existing stationary facilities within the geographic analysis area are limited to meteorological buoys operated for offshore wind farm site assessment. Dock facilities and other structures are concentrated along the coastline. Offshore wind development within the geographic analysis area is expected to result in 113 foundations (110 WTGs and 3 OSSs) by 2030 (Appendix D, *Planned Activities Scenario*, Table D2-1) which would affect military and national security, including USCG SAR operations, primarily through increased risk of allision with foundations and other stationary structures. Generally, deep-draft military vessels are not anticipated to transit outside of navigation channels unless necessary for SAR operations or other non-typical activities. Smaller-draft vessels moving within or near the wind installation have a higher risk of allision with offshore wind structures. Wind energy facility structures would be equipped with lighting according to USCG and BOEM requirements at sea level to decrease allision risk. Allision risk would be further mitigated through coordination with stakeholders on WTG layouts to allow for safe navigation through the offshore wind lease areas in the analysis area.

The construction of offshore wind projects in the geographic analysis area would incrementally change navigational patterns and would increase navigational complexity for vessels and military aircraft operating in the region around the wind energy projects. The structures associated with offshore wind energy may necessitate route changes to navigate around the offshore wind lease areas and vessels associated with the construction of a project. Military and national security aircraft would be affected by the presence of tall equipment necessary for offshore wind facility construction, such as stationary lift vessels and cranes, which would increase navigational complexity in the area. It is assumed, however, that all offshore wind energy projects would coordinate with relevant agencies during the COP development process to identify and minimize conflicts with military and national security operations.

Once the WTGs are operational, the artificial reef effect created by the offshore structures could attract commercial and recreational fishing vessels farther offshore than currently, possibly leading to use conflicts. An increase in commercial and recreational vessels in and around offshore wind projects could increase the risk of vessel collisions with military and national security vessels and may lead to an increased demand for USCG SAR operations.

Potential measures mitigating risks that offshore wind projects could implement include operational protocols to stop WTG rotation during SAR aircraft operations and implementation of FAA- and BOEM-recommended navigational lighting and marking to reduce the risk of aircraft collisions. Wind energy structures would be visible on military and national security vessel and aircraft radar. Even if these mitigation measures were implemented, the presence and layout of large numbers of WTGs could make it more difficult for SAR aircraft to perform operations, leading to less effective search patterns or earlier abandonment of searches. This could result in otherwise avoidable loss of life due to maritime incidents.

Navigational hazards would be eliminated as structures are removed during decommissioning. Due to anticipated coordination with agencies and the mitigation measures described previously, the overall impacts on military and national security uses from offshore wind energy activities are anticipated to be minor, except for USCG SAR operations, which would have moderate adverse impacts.

Traffic: Impacts on military operations from vessel traffic related to the construction and operation of offshore wind activities on the OCS are expected to be short term, localized, and minor. Vessel traffic is expected to increase during construction. Military and national security vessels may experience congestion and delays in ports due to the increase in offshore wind facility vessels.

Aviation and Air Traffic

Presence of structures: Other offshore wind development could add up to 113 foundations (WTG, OSS, and Met Tower) over the next 7 years (Appendix D, *Planned Activities Scenario*) to the offshore environment within the geographic analysis area. WTGs could have a maximum blade tip height of 1,050 feet (320 meters) AMSL. As these structures are built, aircraft navigational patterns and complexity would incrementally increase in the region around the offshore wind lease areas, along transit routes between ports and construction sites, and locally around ports. These changes could compress lower-altitude aviation activity into more limited airspace in these areas, leading to airspace conflicts or congestion and increasing collision risks for low-flying aircraft. After all foreseeable offshore wind energy projects are built, there would still be open airspace available over the open ocean. Navigational hazards and collision risks in transit routes would be reduced as construction is completed and would be gradually eliminated during decommissioning as offshore WTGs are removed.

All stationary structures would have aviation and navigational marking and lighting in accordance with FAA, USCG, and BOEM requirements and guidelines to minimize and mitigate impacts on air traffic. BOEM assumes offshore wind projects would coordinate with aviation interests through the planning, construction, operations, and conceptual decommissioning processes to avoid or minimize impacts on aviation activities and air traffic. For this reason, the adverse impacts on aviation and airports are anticipated to be minor.

Cables and Pipelines

Presence of structures: There are no known or documented submerged cables, pipelines, or military seafloor assets in the vicinity of the Project area. However, the total area of direct seafloor disturbance related to new cable emplacement and maintenance for future offshore wind activities is estimated at up to 2,256 acres (913 hectares), though not all disturbances would be simultaneous. The installation of WTGs and OSSs could preclude future submarine cable placement within the foundation footprint, which would cause future cables to route around these areas. However, the presence of existing submarine cables would not prohibit the placement of additional cables and pipelines. Following standard industry procedures, cables and pipelines can be crossed without adverse impact. Impacts on submarine cables would be eliminated during decommissioning of offshore wind farms when foundations are removed and if the export and inter-array cables associated with those projects are removed. Because there are no known or documented submerged cables, pipelines or military seafloor assets in the vicinity of the Project area, no impacts are anticipated.

Radar Systems

Presence of structures: WTGs that are near to or in the direct line of sight of land-based radar systems can interfere with the radar signal, causing shadows or clutter in the received signal. Construction of other wind energy projects would approximately 110 WTGs with a maximum blade tip height of up to 1,050 feet (320 meters) AMSL in the geographic analysis area. The presence of these wind energy structures could lead to localized, long-term, moderate impacts on land-based radar systems. Development of offshore wind projects could incrementally decrease the effectiveness of individual land-based radar systems if the field of WTGs expands within the land-based radar system’s coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded radar coverage that could affect multiple land-based radars. Most offshore wind structures would be sited at such a distance from existing and proposed land-based radar systems to minimize interference to most radar systems, but some impacts are anticipated.

For land-based radar structures with a co-located secondary surveillance radar (including the Dover AFB DASR and McGuire AFB DASR), the secondary surveillance radar is the main source of aircraft identification and positional data for air traffic control. A Department of Homeland Security-funded study found that secondary radar tracks were rarely affected by wind turbines (JASON 2008). Additional flight trials by the Department of Energy, Department of Homeland Security, DOD, and FAA found that while primary surveillance radars were affected by wind turbines, beacon transponder-based secondary surveillance radars were not affected (Sandia National Laboratories, MIT Lincoln Laboratory 2014).

BOEM assumes project proponents would conduct an independent radar analysis and coordinate with FAA to identify potential impacts and any mitigation measures specific to aeronautical, military, and weather radar systems. BOEM would continue to coordinate with the Military Aviation and Installation Assurance Siting Clearinghouse to review each proposed offshore wind project on a project-by-project basis and would attempt to resolve project concerns identified through such consultation related to military and national security radar systems with COP approval conditions. Refer to Section 3.6.6, *Navigation and Vessel Traffic*, for discussion of impacts on marine vessel radar.

Scientific Research and Surveys

Presence of structures: Construction of other wind energy projects in the geographic analysis area would add approximately 113 structures (110 WTGs), associated cable systems, and associated vessel activity that would present additional navigational obstructions for sea- and air-based scientific studies. Collectively, these developments would prevent NOAA from continuing scientific research surveys or protected species surveys under current vessel capacities, would affect monitoring protocols in the geographic analysis area, could conflict with state and nearshore surveys, and may reduce opportunities for other NOAA scientific research studies in the area. This EIS incorporates by reference the detailed summary of and potential impacts on NOAA's scientific research provided in the Vineyard Wind 1 Final EIS in Section 3.12.2.5, Scientific Research and Surveys (BOEM 2021). In summary, offshore wind facilities actuate impacts on scientific surveys and advice by preclusion of NOAA survey vessels and aircraft from sampling in survey strata and impacts on the random-stratified statistical design that is the basis for assessments, advice, and analyses. NOAA has determined that survey activities within offshore wind facilities are outside of safety and operational limits. Survey vessels would be required to navigate around offshore wind projects to access survey locations, leading to a decrease in survey precision and operational efficiency. The height of turbines would affect aerial survey design and protocols, requiring flight altitudes and transects to change. Scientific survey and protected species survey operations would therefore be reduced or eliminated as offshore wind facilities are constructed. If stock or population changes, biomass estimates, or other environmental parameters differ within the offshore wind lease areas but cannot be observed as part of surveys, resulting survey indices could be biased and unsuitable for monitoring stock status. Offshore wind facilities will disrupt survey sampling statistical designs, such as random stratified sampling. Impacts on the statistical design of region-wide surveys violate the assumptions of probabilistic sampling methods. Development of new survey technologies, changes in survey methodologies, and required calibrations could help to mitigate losses in accuracy and precision of current practices caused by the impacts of wind development on survey strata.

Other offshore wind projects could also require implementation of mitigation and monitoring measures identified in records of decision. Identification and analysis of specific measures are speculative at this time, although they would likely be consistent with the joint NMFS/BOEM Final Survey Mitigation

Strategy for the Northeast U.S. Region (Hare et. al. 2022). Any such measures could further affect NOAA's ongoing scientific research surveys or protected-species surveys because of increased vessel activity or in-water structures from these other projects. BOEM is committed to working with NOAA toward a long-term regional solution to account for changes in survey methodologies as a result of offshore wind farms.

Overall, reasonably foreseeable offshore wind energy projects in the area would have major effects on NOAA's scientific research and protected-species surveys, potentially leading to impacts on fishery participants and communities; as well as potential major impacts on monitoring and assessment activities associated with recovery and conservation programs for protected species.

3.6.7.3.2 Conclusions

BOEM expects ongoing activities and planned non-offshore wind activities including offshore wind activities to have continuing impacts on military and national security uses, aviation and air traffic, radar systems, and scientific research and surveys primarily through presence of structures that introduce navigational complexities and vessel traffic.

Ongoing activities in the geographic analysis area would likely result in **negligible** impacts on marine and national security uses, aviation and air traffic, and radar systems. Currently, offshore structures in the geographic analysis area are limited to meteorological buoys associated with planned offshore wind activities. Military and national security use, aviation and air traffic, vessel traffic, commercial fishing, and scientific research and surveys are expected to continue in the geographic analysis area. Ongoing activities would likely result in **minor** impacts on marine mineral extraction and **moderate** impacts on scientific research and surveys due to the impacts from ongoing offshore wind activity, climate change, and fishing on the marine environment.

Planned non-offshore wind activities would also contribute to impacts on other uses. Planned activities expected to occur in the geographic analysis area other than offshore wind include increasing vessel traffic; continued residential, commercial, and industrial development onshore and along the shoreline; and continued development of FAA-regulated structures including cell towers and onshore wind turbines.

BOEM anticipates any issues with aviation routes or radar systems would be resolved through coordination with DOD or FAA, as well as through implementation of aviation and navigational marking and lighting of structures according to FAA, USCG, and BOEM requirements and guidelines. There are no planned offshore activities anticipated to affect marine mineral extraction or cable and pipeline infrastructure. Therefore, BOEM anticipates the impacts of planned activities other than offshore wind would be **negligible** for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and radar systems. Impacts of planned activities other than offshore wind are anticipated to be **minor** for scientific research and surveys due to the lack of proposed development in the offshore area. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in **negligible** impacts on marine minerals, military and national security uses, aviation and air traffic, cables and pipelines, and radar systems, and **moderate** for scientific research and surveys, primarily due to ongoing effects from offshore wind activity, climate change, and fishing.

BOEM anticipates offshore wind activities in the geographic analysis area would result in **negligible** to **minor** impacts for marine mineral extraction, aviation and air traffic, and cables and pipelines; **moderate** for radar systems due to WTG interference; **minor** for military and national security uses except for USCG SAR operations, which would have **moderate** adverse impacts; and **major** for scientific research and surveys. The presence of stationary structures associated with offshore wind energy projects could prevent or impede continued NOAA scientific research surveys using current vessel capacities and monitoring protocols or reduce opportunities for other NOAA scientific research studies in the area. Coordinators of large-vessel survey operations or operations deploying mobile survey gear have determined that activities within offshore wind facilities would not be within current safety and operational limits. In addition, changes in required flight altitudes due to the proposed WTG height would affect aerial survey design and protocols.

Under the No Action Alternative, existing environmental trends and activities would continue, and other uses would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **negligible** impacts for marine mineral extraction, marine and national security uses, aviation and air traffic, cables and pipelines, and radar systems; and **moderate** impacts on scientific research and surveys. BOEM anticipates the No Action Alternative combined with all planned activities (including other offshore wind activities) in the geographic analysis area would result in **negligible** impacts for aviation and air traffic and cables and pipelines; **minor** impacts for marine mineral extraction; **moderate** impacts for radar systems due to WTG interference; **minor** impacts for military and national security uses except for USCG SAR operations, which would have **moderate** impacts; and **major** impacts for scientific research and surveys.

3.6.7.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on other uses:

- The number, size, location, and spacing of WTGs;
- Timing of offshore construction and installation activities; and
- Location and route of offshore export cables

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

- WTG size and location: larger turbines closer to shore could increase impacts on land-based radar systems, movements of civilian and military aircraft, and military vessels.
- WTG spacing: Removal of groups of WTGs, creating spacing of greater than 1 nautical mile (1.9 kilometer), could allow for scientific research and surveys in those areas, decreasing the impact.
- Timing of construction: Construction could affect submarine or surface military vessel activity during typical operations and training exercises.

- Offshore cable route options: The route chosen (including variants within the general route) could conflict with marine mineral extraction or cables and pipelines.

US Wind has committed to the mitigation measures outlined in Appendix G, Table G-1 to reduce impacts on other marine uses to the extent practicable.

3.6.7.5 Impacts of Alternative B – Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

3.6.7.5.1 Construction and Installation

3.6.7.5.1.1 Onshore Activities and Facilities

Marine minerals, national security and military use, aviation and air traffic, cables and pipelines, radar, and scientific research and surveys are not anticipated to be impacted by onshore construction and installation activities associated with the Proposed Action.

3.6.7.5.1.2 Offshore and Inshore Activities and Facilities

Marine Minerals

Traffic: The construction and maintenance of offshore export cables and corresponding increased construction and maintenance vessel traffic may impact vessel traffic associated with sand borrow and dredge disposal activity through temporary restrictions to the sand borrow areas in the geographic analysis area, though it is not anticipated that construction will interfere with marine minerals operations. Active mineral resources are not present in the Lease Area, and construction barges will be part of routine traffic passing by the borrow areas offshore Ocean City. At present, no sand borrow areas have been identified in the vicinity of the Lease Area (BOEM 2012). Sand borrow areas within the vicinity of the lease may be identified during the timeline for this project for coastal renourishment efforts. The Offshore Export Cable Routes cross sand resource areas in addition to a portion of two sand borrow areas (Borrow Areas C and G) (COP, Volume II, Figure 17-10; US Wind 2023). In the event that dredging of any offshore sand resource is necessary, US Wind would work with the appropriate federal and state agencies to safeguard the export cable assets.

US Wind would also monitor and control Project vessel movements to minimize impacts on dredging and dredge spoil dumping activities. In the context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to vessel traffic impacts on marine mineral extraction from ongoing and planned activities would be long-term, localized, and negligible.

National Security and Military Use

Traffic: Increased vessel traffic in the Wind Farm Area, Offshore Export Cable Route, and cable landfall location during construction, operations, and decommissioning could result in an increased risk of vessel collisions with military and national security vessels, cause military and national security vessels to change routes, and result in congestion and delays in ports. Impacts would be greatest during construction when vessel traffic is highest and would be reduced during operations. US Wind would schedule and track Project-related vessels to best manage congestion and traffic flow in coordination with the USCG, DoD, and other national security stakeholders. Where practical, Project vessels would utilize transit lanes, fairways, and predetermined passage plans consistent with existing waterway uses and would send and receive AIS signals for awareness and collision avoidance. The USCG would publish LNTMs and broadcast LNTMs to inform mariners and aviators of Project activities in the area. Additionally, US Wind would publish an operations plan on the Project website to inform mariners and other interested parties on what work is being done in the Offshore Project area.

In context of reasonably foreseeable environmental trends, combined impacts, most likely to occur during construction and decommissioning time frames, associated with the Proposed Action and planned activities would be localized, temporary, and minor.

The Obstruction Evaluation and Airspace Analysis (COP, Volume II, Appendix K4; US Wind 2023) includes an assessment of impacts on Military Training Routes and Military Operations Areas.

Aviation and Air Traffic

Presence of structures: The Proposed Action would install up to 121 WTGs (PDE) with maximum blade tip heights of 938 feet (286 meters) AMSL in the Wind Farm Area. Based on an Obstruction Evaluation Analysis and an Air Traffic Flow Analysis conducted by Capitol Airspace Group (COP, Volume II, Appendices K4 and K6; US Wind 2023), there are no anticipated adverse impacts on published instrument departure or approach procedures or 14 CFR 77.19 imaginary surfaces. The height of the WTGs should not require an increase to the minimum enroute altitudes in the area; however, the height of 104 WTGs would exceed the obstacle clearance surface and require an increase to the Potomac (PCT) TRACON Sector NHK-F Minimum Vectoring Altitude (MVA) or create an isolation area with a higher segment altitude. Historical air traffic data indicate the required changes to Potomac (PCT) TRACON Sector NHK-F should not affect a significant volume of radar vectoring operations. As a result, it is possible that PCT TRACON would be willing to increase the affected MVAs to accommodate wind development up to 938 feet (286 meters) tall (COP, Volume II, Appendix K6; US Wind 2023). This mitigation option is subject to FAA approval.

US Wind will continue to consult with the DoD Clearinghouse for an informal review of onshore and Offshore Project components. Coordination with the FAA and Virginia Department of Aviation will be performed to ensure that, once onshore engineering details are more complete, each proposed onshore structure will be entered into the FAA’s Obstruction Evaluation Notice Criteria Tool for analysis.

In the context of reasonably foreseeable environmental trends and planned activities, the Proposed Action and other offshore wind projects would contribute to impacts on aviation and air traffic. BOEM assumes offshore wind project operators would coordinate with aviation interests throughout the planning, construction, operations, and conceptual decommissioning processes to avoid or minimize impacts on aviation activities and air traffic. Navigational hazards and space use conflicts would exist during construction, operations, and maintenance, and would be gradually eliminated during decommissioning as offshore WTGs are removed. Adverse impacts on air traffic are anticipated to be negligible if mitigation measures are approved by the FAA and implemented.

Cables and Pipelines

It is not anticipated that construction will interfere with offshore utilities. No submerged cables or pipelines have been identified in the Project area. The proposed Offshore Export Cable Route and vessel routes avoid crossing any neighboring wind energy lease areas. US Wind is willing to coordinate with appropriate parties about future submarine cable crossings as needed.

Presence of structures: The presence of future offshore wind energy structures could preclude future submarine cable placement within any given development footprint, requiring future cables to route around these areas. However, the placement and presence of the offshore export cables for the Proposed Action would not prohibit the placement of additional cables and pipelines because these could be crossed following standard industry protection techniques. Impacts on submarine cables and pipelines would be eliminated during decommissioning of the Project as the export and inter-array cables are removed. Project structures, including WTGs and OSSs, and the stationary lift vessels used during Project construction and installation, may pose allision risks and navigational hazards to vessels conducting maintenance activities on existing submarine telecommunication cables. FAA, USCG, and BOEM navigational hazard marking as well as the relative infrequency of maintenance activities would minimize the risk of allision under the Proposed Action. The risk of vessel collision between cable maintenance vessels and vessels associated with the Project would be limited to the construction and installation phase and during planned maintenance activities in the operational phase.

In the context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to the impacts on cables and pipelines from ongoing and planned activities could result in some localized and long-term impacts. However, these impacts would be negligible because they can be avoided by standard protection techniques.

Radar Systems

Presence of structures: There are several land-based radar systems in the general vicinity of Project, including DoD, FAA, and NOAA land-based radar sites, as well as HF Coastal Radar sites. US Wind is continuing to engage and coordinate with applicable military contacts to assess and address potential impacts as needed.

Equipment (cranes and barges) used during construction of Offshore Project components would not exceed the height of the WTGs. US Wind would be in direct communication with relevant agencies and personnel to alert the appropriate parties to planned construction movements and actions. All WTG Components and construction equipment would be properly lighted and marked in accordance with FAA’s Advisory Circular 70/7460-1M within FAA jurisdiction and beyond, or other methods as deemed required during consultation and as applicable. Cranes would also be used during construction of the onshore substation and for loading/unloading materials in ports. If the introduction of new cranes is required, an FAA Notice Criteria check (14 CFR 77.9) and additional airspace and aviation radar system assessment would be performed to determine whether there are potential airspace impacts and FAA filing is required during the storage or transit of Project materials and Offshore Project components.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute to the impacts on radar systems from ongoing and planned activities, primarily due to the presence of

WTGs within the line of sight causing interference with land-based radar systems. Development of offshore wind projects could incrementally decrease the effectiveness of individual land-based radar systems if the field of WTGs expands within the land-based radar system's coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded land-based radar coverage that could affect multiple radars. Impacts are anticipated to be minor.

Scientific Research and Surveys

Presence of structures: Scientific research and surveys, particularly for NOAA surveys supporting commercial fisheries and protected-species research programs, could be affected during the construction and operations of the Proposed Action; however, research activities may continue within the Project area, as permissible by survey operators. The Proposed Action would affect survey operations by excluding certain portions of the Lease Area occupied by Project components from sampling. Additionally, NOAA's Office of Marine and Aviation Operations has determined that the NOAA Ship Fleet will not conduct survey operations in wind facilities with 1 nautical mile (1.9 kilometer) or less separation between turbine foundations. The Proposed Action WTGs would have a spacing of 0.75 by 0.93 nautical mile (1.4 by 1.7 kilometer) between WTGs, which would mean survey operations in the Wind Farm Area would likely be curtailed.

This Draft EIS incorporates by reference the detailed analysis of potential impacts on scientific research and surveys provided in the Vineyard Wind Final EIS (BOEM 2021). The analysis in the Vineyard Wind Final EIS is summarized under the discussion of the No Action Alternative in Section 3.17.1.3, *Future Offshore Wind Activities (without Proposed Action)*.

The Proposed Action would install up to 121 WTGs (PDE) with a maximum blade tip of 938 feet (286 meters) AMSL. Aerial survey track lines for cetacean and sea turtle abundance surveys could not continue at the current altitude (600 feet [182.9 meters] AMSL) within the Project area because the planned maximum-case scenario for WTG blade tip height would exceed the survey altitude. The increased altitude necessary for safe survey operations could result in lower chances of detecting marine mammals and sea turtles, especially smaller species. Agencies would need to expend resources to update scientific survey methodologies due to construction and operation of the Proposed Action, as well as to evaluate these changes on stock assessments and fisheries management. To this end, NMFS published a survey mitigation strategy for the Northeast region that details mitigation measures for federal surveys (Hare et al. 2022).

In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to the impacts on scientific research and surveys from ongoing and planned activities would be long term and major, particularly for NOAA surveys that support commercial fisheries and protected-species research programs. The entities conducting scientific research and surveys would have to make significant investments to change methodologies to account for areas occupied by offshore energy components, such as WTGs and cable routes, that are no longer able to be sampled.

3.6.7.5.2 Operations and Maintenance

3.6.7.5.2.1 Onshore Activities and Facilities

Marine minerals, national security and military use, aviation and air traffic, cables and pipelines, radar, and scientific research and surveys are not anticipated to be impacted by onshore O&M activities associated with the Proposed Action.

3.6.7.5.2.2 Offshore and Inshore Activities and Facilities

Marine Minerals

Space use conflicts: None of the sand resource areas identified in Section 3.6.7.1 are in the Lease Area; however, the proposed Offshore Export Cable Route would cross five BOEM sand resource areas and two USACE sand borrow areas. The presence of a cable or cables through these areas would restrict the use of a portion of the sand for future renourishment projects until decommissioning.[22] A BOEM Marine Minerals Program analysis estimated that approximately 35,147,300 cubic yards of OCS sand would become inaccessible within the Offshore Export Cable Route (assuming a 5-feet [1.5-m] thickness volume). This includes the exclusion of 12 percent of Fenwick Shoal and a smaller percentage of the Central Region Shoal. OCS sand resources are valued at approximately $13.60 per cubic yard based on an analysis of four prior OCS projects. Using this analysis, the value of the sand resource excluded from use (until decommissioning) due to the cable route is $478,003,280 (Crist 2021). The need for federal sand resources (including resources in state waters) is expected to increase over time due to increased storm activity, coastal erosion, and sea level rise. These offshore sand resources are used to protect coastal infrastructure and economic viability of the localities in need. US Wind has determined that avoidance of all areas identified as having potential sand resources along the submarine export cable route is not possible.

During O&M, users would be restricted from dredging in sand resource areas within 1,640.4 feet (500 meters) of the offshore export cables to avoid uncovering the buried cable or due to the presence of remedial surface cable protection. If existing sand resource areas are considered for designation as sand borrow areas, US Wind would work with the appropriate federal and state agencies to safeguard the export cable assets under the Proposed Action.

In the context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to space use impacts on marine mineral extraction from ongoing and planned activities would be long-term, localized, and moderate.

National Security and Military Use

Presence of structures: The addition of up to 121 WTGs (PDE) and up to 4 OSSs would increase the risk of allisions for military vessels during Project operations, particularly in bad weather or low visibility. The presence of structures could also change navigational patterns and add to the navigational complexity for military vessels and aircraft operating in the Project area during construction and operation of the

[22] Presently, the USACE restricts the use of an offshore sand resource to 5 percent of that resource to preserve the morphology and habitat. While sand resources offshore Maryland and Delaware are not limited, this 5 percent threshold does limit the amount of available sand resources for future beach renourishment projects.

Proposed Action. Project structures would be marked as a navigational hazard per FAA, BOEM, and USCG guidelines, and WTGs would be visible on military and national security vessel and aircraft radar, minimizing the potential for allision and increased navigational complexity. US Wind would work with the DoD and USCG to facilitate training exercises within the Lease Area. Additional navigational complexity would increase the risk of collision and allisions for military and national security vessels or aircraft within the Project area.

Overall, presence of stationary structures from the Proposed Action in the Wind Farm Area would cause localized, long-term, minor impacts from increased space use conflicts.

Radar

Presence of structures: Air traffic control and national defense land-based radar within the line of sight of the offshore infrastructure associated with the Proposed Action may be affected by the O&M phase of the Project. US Wind conducted an analysis of the impact on radar systems from the Proposed Action and found that either portions or the entire Project area are within the line of sight of and would affect the Dover AFB DASR and Wallops Island ASR-8 radar systems (COP, Volume II, Appendix K3; US Wind 2023). Impacts on the Gibbsboro ARSR-4, Oceana ARSR-4, Atlantic City ASR-9, and the NAS Patuxent River ASR-11 are not expected, as the WTGs in the Project area would not be within the line of sight.

Potential impacts for radar operations in the immediate vicinity of the Project area include unwanted radar returns (clutter), resulting in a partial loss of primary target detection and numerous false primary targets, and partial loss of weather detection, including false weather indications (COP, Volume II, Appendix K3; US Wind 2023).

Mitigations for land-based radar include:

Operational mitigations identified for impacts on ARSR-4 and for ASR-8/9:

- Passive aircraft tracking using ADS-B or signal/transponder
- Increasing aircraft altitude near radar
- Sensitivity time control (range-dependent attenuation)
- Range azimuth gating (ability to isolate/ignore signals from specific range-angle gates)
- Track initiation inhibit, velocity editing, plot amplitude thresholding (limiting the amplitude of certain signals)

Modification mitigations for ARSR-4 and for ASR-8/9 systems:

- Utilizing the dual beams of the radar simultaneously
- In-fill radars

To mitigate operational impacts on oceanographic HF radars, the following options have been identified:

- Data sharing from turbine operators to include the following:
    - Before rotor blades are installed within the Project, and continuing throughout the life of the Project until the point of decommissioning where all rotor blades are removed, US Wind making publicly available via the NOAA U.S. Integrated Ocean Observing System (IOOS) Office near real-time accurate numerical telemetry of surface current velocity, wave height, wave period,

wave direction, and other oceanographic data measured at Project locations selected by US Wind in coordination with the NOAA IOOS Office.
    - If requested by the NOAA IOOS Office, US Wind sharing with IOOS accurate numerical time-series data of blade rotation rates, nacelle bearing angles, and other information about the operational state of each turbine in the Project to aid interference mitigation.
- Wind farm curtailment/curtailment agreement

Additional modifications identified for oceanographic HF radar systems to mitigate impacts:

- Signal processing enhancements
- Antenna modifications

Operational mitigations to NEXRAD weather radar systems include:

- Wind farm curtailment/curtailment agreement

Research shows that impacts on weather radar can be mitigated by employing adaptive clutter filters, changing the radar scan strategy to pass over areas with wind turbines, using phased array radars to achieve a null in the antenna radiation pattern in the direction of the wind turbine, or curtailment (De la Vega et al. 2013).

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the impacts on radar systems from ongoing and planned activities including offshore wind, primarily due to the presence of WTGs within the line of sight causing interference with radar systems. Development of offshore wind projects could incrementally decrease the effectiveness of individual radar systems if the field of WTGs expands within the radar system's coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded radar coverage that could affect multiple radars. Therefore, impacts would be moderate.

Scientific Research and Surveys

Impacts on scientific research and surveys due to the presence of structures during proposed Project construction and operations are discussed in Section 3.6.7.5.1.2.

3.6.7.5.3 Conceptual Decommissioning

3.6.7.5.3.1 Onshore Activities and Facilities

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the inter-array and export cable systems. Decommissioning impacts are expected to be similar to construction impacts. It is not anticipated that decommissioning will impact marine minerals, national security and military use, aviation and air traffic, cables and pipelines, radar, and scientific research and surveys.

3.6.7.5.3.2 Offshore Activities and Facilities

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the inter-array and export cable systems. Decommissioning impacts are expected to be similar to construction impacts.

3.6.7.5.4 Conclusions

Under the Proposed Action, up to 121 WTGs (PDE), with a maximum blade tip of 938 feet (286 meters) AMSL would be installed, operate, and eventually be decommissioned within the Project area. The presence of these structures would introduce navigational complexity and increased vessel traffic in the area that would continue to have temporary to long-term impacts that range from **negligible** to **major** on marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar systems, and scientific research and surveys.

- Marine mineral extraction: The Offshore Export Cable Route would intersect sand borrow areas and sand resource areas that could be targeted for future beach renourishment efforts, resulting in potential long term, **moderate** impacts.
- Military and national security uses: The installation of WTGs in the Project area would result in increased navigational complexity, allision risk, and vessel traffic, creating potential long term, **moderate** adverse impacts on USCG SAR operations and military and national security uses.
- Aviation and air traffic: Potential impacts on aviation and air traffic would be **negligible** with the implementation of mitigation measures, if approved by the FAA.
- Cables and pipelines: Potential impacts on cables and pipelines would be **negligible** due to the use of standard protection techniques to avoid impacts.
- Radar: Potential **minor** adverse impacts on radar systems would primarily be caused by the presence of WTGs within the line of sight causing interference with radar systems. Options are available to minimize or mitigate impacts and US Wind would continue to coordinate with the FAA, DoD, and NOAA on impacts.
- Scientific research and surveys: Potential impacts on scientific research and surveys would generally be **major**, particularly for NOAA surveys supporting commercial fisheries and protected-species research programs. The presence of structures would exclude certain areas within the Project area occupied by Project components (e.g., WTG foundations, cable routes) from potential vessel and aerial sampling.

In context of reasonably foreseeable environmental trends in the area, the contribution of the Proposed Action to the impacts of individual IPFs resulting from ongoing and planned activities would range from **negligible** to **major**. Considering all IPFs collectively, BOEM anticipates the overall impacts associated with the Proposed Action when combined with ongoing and planned activities would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; **moderate** for most military and national security uses and marine mineral extraction; and **major** for scientific research and surveys. The presence of structures associated with the Proposed Action is the primary driver for impacts on other marine uses. Impacts on NOAA scientific research and surveys would qualify as **major** because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected-species research as a whole as well as on the commercial fisheries community.

3.6.7.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

In an attempt to minimize impacts on Indian River Bay, Alternative C was created. This alternative would include an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route). There are two sub-alternatives, each with different Onshore Export Cable Routes that vary based on the proposed landfall location and potential Onshore Export Cable Route.

Alternative C-1 assumes the northern Offshore Export Cable Route would be selected with the landfall at Towers Beach and could have one Onshore Export Cable Route (route) before reaching the POI. The potential route avoids crossing through most of Indian River Bay. The route would use Delaware DOT ROWs to run the cabling underground, to the extent feasible. Route 2 does cross a small Indian River Bay tributary (Indian River) just east of Millsboro, Delaware, and would require HDD to reach the US Wind substation.

Alternative C-2 assumes the southern Offshore Export Cable Route is selected with the landfall would be at 3R's Beach, similar to the Proposed Action; however, only terrestrial-based Onshore Export Cable Routes will be considered in the three optional routes (1a, 1b, and 1c), which all run south of Indian River Bay to their POI. These routes are generally 16 or 17 miles (25.7 or 27.4 kilometers) long. As none of these southern proposed onshore routes traverse Indian River Bay, there would be no difference in the impacts from Alternative C-2 compared to the Proposed Action.

Offshore Project components within the Lease Area (WTGs, OSSs, inter-array cables, and Met Tower) for Alternatives C-1 and C-2 would be the same as the Proposed Action (Alternative B) and are discussed in Section 3.6.7.5.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C to the combined impacts from ongoing and planned activities including offshore wind would be similar to those of the Proposed Action.

3.6.7.6.1 Conclusions

The anticipated **negligible** to **major** impacts associated with Alternative C would not be substantially different than those of the Proposed Action. While this action alternative could slightly change the impacts on other marine uses, ultimately the same or highly similar construction, operation, and decommissioning impacts would still occur. When considering all the IPFs, the impact on other marine uses would still be **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction, most military and national security uses; and **major** for scientific research and surveys.

In context of reasonably foreseeable environmental trends in the area, the contribution of Alternative C to the impacts of individual IPFs resulting from ongoing and planned activities would range from **negligible** to **major**. Considering all IPFs collectively, BOEM anticipates the overall impacts associated with Alternative C when combined with ongoing and planned activities would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction and most military and national security uses. Similar to the Proposed Action, the presence of structures associated with Alternative C is the primary driver for impacts on other marine uses. Impacts on NOAA scientific research and surveys would qualify as **major** because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected-species research as a whole, as well as on the commercial fisheries community.

3.6.7.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

Alternative D was developed to address public comments concerning the visual impacts of the Proposed Action. Alternative D would exclude 32 WTGs and 1 OSS associated with the future development phase. The public requested a 15-miles (24.1-kilometer) exclusion zone from the shore (in the northeast portion of the Lease Area); however, these structures are within 14 miles (22.5 kilometers) from the Maryland coastline, though the 1-mile (1.6-kilometer) difference is not likely to result in a significant difference. This exclusion would not impact the full development of MarWin and Momentum (phases 1 and 2, respectively).

Even with removal of the WTGs, OSSs, and repositioning of the Offshore Export Cable Route, implementation of this action alternative would result in most of the same types of impacts from all the IPFs on other marine uses from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, with some impacts being minimally decreased.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative D to the combined impacts from ongoing and planned activities, including offshore wind, would be similar to those of the Proposed Action.

3.6.7.7.1 Conclusions

The anticipated **negligible** to **major** impacts associated with Alternative D would not be substantially different than those of the Proposed Action. While this action alternative could slightly change the impacts on other marine uses, ultimately the same or highly similar construction, operation, and decommissioning impacts would still occur. When considering all the IPFs, the impact on other marine uses would still be **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction, most military and national security uses and scientific research and surveys.

In context of reasonably foreseeable environmental trends in the area, the contribution of Alternative D to the impacts of individual IPFs resulting from ongoing and planned activities would range from **negligible** to **major**. Considering all IPFs collectively, BOEM anticipates the overall impacts associated with Alternative D when combined with ongoing and planned activities would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction and most military and national security uses. Similar to the Proposed Action, the presence of structures associated with Alternative D is the primary driver for impacts on other marine uses. Impacts on NOAA scientific research and surveys would qualify as **major** because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected-species research as a whole, as well as on the commercial fisheries community.

3.6.7.8 Impacts of Alternative E – Habitat Impact Minimization on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

Alternative E would avoid impacts on AOCs which includes sensitive benthic habitats (Figure 2-9). There are up to five areas which may be excluded along the perimeter of the Lease Area.

Alternative E, the Habitat Impact Minimization Alternative was developed through the scoping process in response to comments about minimizing impacts on offshore benthic habitats. Alternative E would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and/or repositioning the Export Cable Route location. Micrositing of WTGs and cables may be necessary to avoid AOCs (i.e., sensitive benthic habitats). BOEM expects the impacts resulting from Alternative E would be similar to the Proposed Action to a lesser degree due to the removal of WTGs.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the combined impacts from ongoing and planned activities including offshore wind would be similar to those of the Proposed Action.

3.6.7.8.1 Conclusions

The anticipated **negligible** to **major** impacts associated with Alternative E would not be substantially different than those of the Proposed Action. While this action alternative could slightly change the impacts on other uses, ultimately the same or highly similar construction, operation, and decommissioning impacts would still occur. When considering all the IPFs, the impact on other marine uses would still be **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction, most military and national security uses and scientific research and surveys.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on other uses would range from undetectable to noticeable. BOEM anticipates the overall impacts from Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, and most military and national security uses; **moderate** for marine mineral extraction, radar systems and USCG SAR operations; and **major** scientific research and surveys. These impact ratings are primarily driven by the presence of offshore structures such as WTGs in the offshore wind lease areas.

3.6.7.9 Comparison of Alternatives

As described earlier, BOEM expects the impacts of the Proposed Action in combination with ongoing and planned activities to be **negligible** to **minor** for aviation and air traffic, cables and pipelines, and land-based radar systems; and **moderate** for marine mineral extraction, most military and national security uses and **major** for scientific research and surveys when compared to impacts expected under the No Action Alternative. The Proposed Action would impact other marine uses through presence of structures, traffic, and space use conflicts. Under the No Action Alternative, these impacts would not occur.

As discussed in Section 3.6.7.5, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although alternatives may include an Onshore Export Cable Route and alter the number of WTGs and OSSs, the impacts of alternatives on other marine uses would likely be **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction and military and national security uses and **major** for scientific research and surveys.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur under the same scenario (Appendix D). Therefore, impacts would only vary if the alternative's incremental contributions differ. BOEM expects individual impacts ranging from **negligible** to **minor** for aviation and air traffic, cables and pipelines, and radar systems; and **moderate** for marine mineral extraction, most military and national security uses, and **major** for scientific research and surveys, because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected-species research as a whole, as well as on the commercial fisheries community. The overall impact of any action alternative on other marine uses when combined with past, present, and reasonably foreseeable activities would be **moderate**.

If BOEM requires increased spacing between the WTGs, then Proposed Action impacts on surveys and scientific research could be further reduced and impacts would be **minor**.

3.6.8 Recreation and Tourism

This section discusses potential impacts on recreation and tourism resources and activities from the Proposed Action, action alternatives, and ongoing and planned activities in the geographic analysis area. The recreation and tourism geographic analysis area (Figure 3.6.8-1) includes the following:

- The primary geographic analysis area is an offshore and coastal area that consists of a 40-mile (64.4-kilometer) area measured from the borders of the Lease Area, encompassing portions of the New Jersey, Delaware, Maryland, and Virginia coastlines from approximately Cape May, New Jersey, to Chincoteague, Virginia, selected to coincide with the geographic analysis area for visual resources (Section 3.6.9, *Visual Resources*). This encompasses areas where the Proposed Action's visual impacts could also affect recreation and tourism.

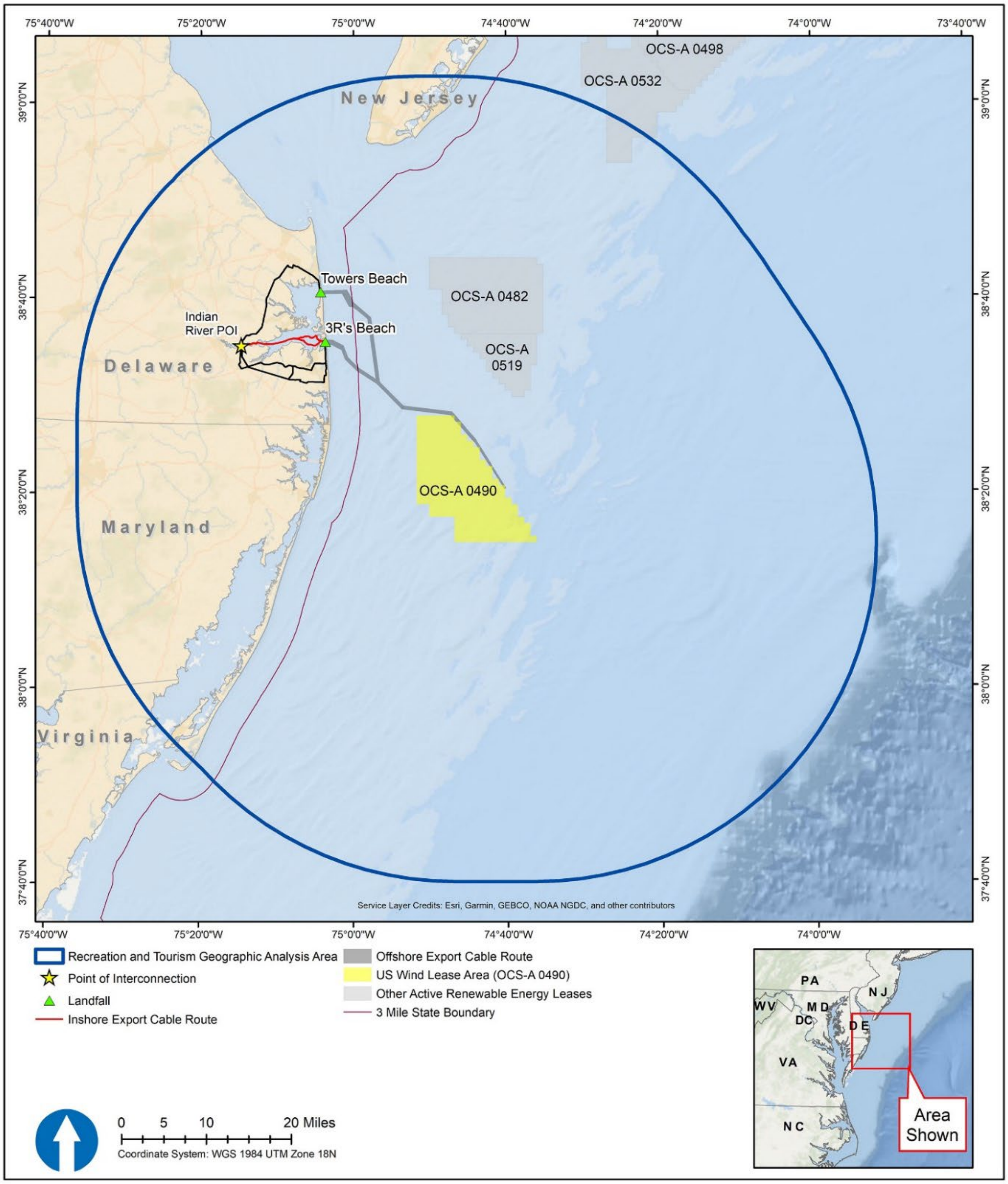

Figure 3.6.8-1. Recreation and tourism geographic analysis area

- This geographic analysis area also includes the portions of Worcester County, Maryland, and Sussex County, Delaware that would host the O&M facility, primary support shorebase, landfall sites, onshore substations, and cable routes.
- Although not included in Figure 3.6.8-1, the discussion of recreation and tourism also addresses the areas affected by Proposed Action-related marine activity, including areas near Sparrows Point, Maryland and open-water areas of Chesapeake Bay and Delaware Bay.

Section 3.6.3, *Demographics, Employment, and Economics*, discusses the economic aspects of recreation and tourism in the Project area.

3.6.8.1 Description of the Affected Environment and Future Baseline Conditions

3.6.8.1.1 Regional Setting

The geographic analysis area includes coastal Delaware and Maryland, as well as Cape May on the southern New Jersey Coast and northern Chincoteague Island, Virginia. The area also includes Chesapeake and Delaware Bay waterways that would be used for marine transportation. The coastal areas and Bays support recreation and tourist activities that include beach visitation, fishing, shellfishing, boating, swimming, surfing, scuba diving, and bird and wildlife viewing. The waters of the Bays are regionally important for recreational boating and sailing, fishing, shellfishing, and bird watching recreational activities.

Coastal Delaware and Maryland, as well as nearby areas of Virginia and New Jersey coasts, have a wide range of visual characteristics, with communities and landscapes ranging from large cities to small towns, suburbs, rural areas, and wildlife preserves. As a result of the proximity of the Atlantic Ocean, as well as the views associated with the shoreline, the coastal areas of these four states have been extensively developed for water-based recreation and tourism. The scenic quality of the coastal environment is important to the identity, attraction, and economic health of many of the coastal communities. Additionally, the visual qualities of coastal cities, towns, and parks, which incorporate marine activities, beaches, ocean and bay views, and the ability to view birds and marine life, are important community characteristics.

3.6.8.1.2 Project Area

Recreational and tourist-oriented activities are located throughout the coastal communities of Worcester and Sussex Counties. Coastal communities provide hospitality, entertainment, and recreation for millions of visitors each year; for example, the Ocean City Department of Tourism estimates that Ocean City receives more than 8 million visitors annually (Ocean City Tourism Department 2022). Although many of the coastal and ocean amenities, such as beaches, that attract visitors to these regions are accessible to the public for free and thus do not directly generate employment, these nonmarket features function as key drivers for recreation and tourism businesses.

Water-oriented recreational activities in the Project area occur within ocean, bay, and inland waters. Beach activities are focused along the sandy ocean beaches while boating, hiking, fishing, shellfishing, and bird and wildlife viewing are widespread throughout onshore and offshore environments. Boating covers a wide range of activities, from ocean-going vessels to small boats used by residents and tourists in sheltered waters, and includes sailing, sailboat races, fishing, shellfishing, kayaking, canoeing, and paddleboarding.

Commercial businesses offer hotels, house rentals, campgrounds, restaurants, and entertainment. Additionally, commercial businesses offer services directly related to coastal recreation such as marinas, boat rentals, private charter boats for fishing and scenic cruising, and canoe or kayak tours. As discussed in Section 3.6.3, *Demographics, Employment, and Economics*, tourism and hospitality are major sectors of the economy for the coastal communities of Sussex and Worcester counties, supported by ocean-based recreation uses.

3.6.8.1.3 Onshore, Inshore, and Offshore Recreation

Beach visitation, swimming, recreational boating, fishing, and shellfishing are popular, especially during summer months, along the Maryland and Delaware coastlines. Charter boats offer scenic boat tours as well as fishing expeditions. Whale and dolphin-watching areas within the geographic analysis area occur east and south of the mouth of Delaware Bay, including areas within the Lease Area and to its north and east (NROC 2022). No significant locations for scuba diving or snorkeling are identified within the geographic analysis area (NROC 2022).

Recreational boating varies seasonally, with peak boating season occurring between May and September. Boating excursions commonly include expenditures at other recreation and tourism related businesses, including marinas, restaurants, lodging, and entertainment (UCI 2016). Most recreational boating in the geographic analysis area occurs on inshore waters or closer to shore than the Lease Area. From 2018 through 2021, more than 82 percent of recreational fishing catches in Delaware (including for-hire recreational fishing, as well as individual recreational fishing) occurred in inshore waters such as Indian River Bay and other coastal bays, along with inland lakes, ponds, and rivers (COP Volume II, Table 17-24; US Wind 2023), while more than 97 percent of Maryland recreational fishing catches occurred in inshore and inland waters (COP Volume II, Table 17-25; US Wind 2023).

A boater survey for mid-Atlantic states showed a high density of recreational boating within the bays and waterways west of the barrier islands, headlands, and non-island bay barriers that form the Maryland, Delaware, and Virginia coasts, moderate to high density in the ocean waters within 1 to 3 miles (1.6 to 4.8 kilometers) of the Worcester County and Sussex County coastline, and low densities farther offshore and within the Lease Area (COP, Volume II, Appendix K1, Figure 2-42; US Wind 2023). A USCG survey found that approximately 44,000 recreational boats registered or stored in Delaware and 183,000 recreational boats registered or stored in Maryland were used on inland or marine waters at least once in 2018 (RTI International 2020). Approximately 9.4 percent of the Delaware-based boats and 5.5 percent of the Maryland-based boats—including 19 and 11 percent, respectively, of motorized boats—traveled at least 3 nautical miles (5.6 kilometers) from the coastline at least once (RTI International 2020). Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing* provides additional information on the for-hire recreational fishing industry.

Vessel data are available for vessels that carry AIS devices (Section 3.6.6, *Navigation and Vessel Traffic*). In 2019, approximately 21 percent of vessel tracks passing within 4.3 nautical miles (8 kilometers) of the

Lease Area were “pleasure craft” or recreational vessels and 2 percent were passenger vessels, a category likely to include tour vessels (COP, Volume II, Appendix K1, Figure 2-6; US Wind 2023). Vessel tracks within 4.3 nautical miles (8 kilometers) of the Lease Area in 2019 included 172 passenger vessel tracks representing 27 unique vessels (each passing through the area multiple times during the year), as well as 1,718 pleasure vessel tracks representing 762 unique vessels (COP, Volume II, Appendix K1, Figure 2-5; US Wind 2023). Pleasure vessel trips to waters near and within the offshore wind area are most likely to come from the Ocean City Inlet, Cape May, the Indian River Inlet, or Lewes (COP, Volume II, Appendix K1, Figure A-6; US Wind 2023).

One long distance sailing race has historically transited near the Lease Area: the Annapolis to Newport Race, a 475-mile (764-kilometer) biennial race, transits close to the southeastern portion of the Lease Area (NROC 2022). Other races that begin within Chesapeake Bay traverse ocean waters to the south of the mouth of the bay, avoiding waters near the Lease Area (Annapolis Bermuda Ocean Race 2022). Many sailing races occur within the confines of Chesapeake Bay and its tributary rivers (MSA 2022).

Mid-Atlantic states accounted for 22.9 percent of the national total of marine recreational fishing trips in 2019 (NOAA 2022). Collectively, there were almost 43 million marine recreational angler trips within mid-Atlantic states in 2019, including 2.1 million trips in Delaware, 6.8 million trips in Maryland, 13.4 million trips in New Jersey and 7.2 million trips in Virginia. These trips include fishing from shore as well as charter boats and private boats (owned or rented). Marine recreational fishing expenditures resulted in an estimated $106.8 million in sales in Delaware and $286.2 million in sales in Maryland in 2019 (NOAA 2022).

Fishing for Atlantic HMS, defined as federally regulated sharks, blue and white marlin, sailfish, roundscale spearfish, swordfish, and federally regulated tunas, occurs farther offshore than most other recreational fishing and is therefore more likely to overlap offshore wind lease areas. Federal Atlantic HMS angling permits are issued to a vessel and authorize anyone traveling in that vessel to fish for, retain, or possess federally regulated HMS. In 2016, there were 20,020 permit holders. Approximately 2.3 percent of all U.S. HMS angling trips began in Delaware and 4.5 percent began in Maryland (Hutt and Silva 2019). Ocean City, Maryland, hosts several well-known annual tournaments for billfishes and tunas (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*).

Section 3.6.4, *Environmental Justice*, discusses NOAA’s social indicator mapping, which identifies the importance or level of dependence of recreational fishing to coastal communities. Several communities in the geographic analysis area have a medium recreational fishing reliance, which measures the presence of recreational fishing in relation to the population size of a community, and high recreational fishing engagement, which measures the presence of recreational fishing through fishing activity estimates. The communities with the highest reliance on recreational fishing, as shown in Figure 3.6.4-10, are Ocean City, Maryland; Lewes, Delaware; Rehoboth Beach-Dewey Beach-Indian River, Delaware; and Cape May, New Jersey. These communities have high recreational fishing engagement and medium recreational fishing reliance.

In a survey of recreational boaters in northeastern Atlantic states, most boaters (58 percent) indicated that they could continue to enjoy recreational boating near offshore WTGs, and 53 percent had the same response for recreational boating near ship/tanker/ferry traffic (Starbuck and Lipsky 2013). In other words, boaters indicated more comfort operating near offshore WTGs—a new type of structure for U.S. vessel operators—than near large vessels that have been present in Atlantic waterways for decades. Boaters ranked port operations and industrial waterfront as the least compatible with recreational boating, with only 44 percent indicating that they could enjoy recreational boating near these uses (Starbuck and Lipsky 2013).

3.6.8.1.3.1 Worcester County, Maryland

The Atlantic coastline of Worcester County consists entirely of barrier islands; thus, the tourist and recreational activities of coastal communities include both the ocean beaches and the calmer beaches and waters of the coastal bays that form the western border of the barrier islands, including Assawoman Bay, Isle of Wight Bay, Sinepuxent Bay, and Chincoteague Bay.

Inland areas of Worcester County are also popular for natural resource recreational activities, including boating, camping, bird watching and hiking. Resources include the Pocomoke River State Park, Pocomoke State Forest, Chesapeake Forests State Park, and several state wildlife management areas. The County operates neighborhood parks, four regional parks, and four nature parks (Worcester County Recreation and Parks 2022). County parks include public boat launches on inland waterways. The County is particularly popular with birdwatchers because many migratory species pass through Worcester County (COP, Volume II, Section 17.3.1; US Wind 2023).

The coastal area of Worcester County, Maryland, includes the municipality of Ocean City as well as Assateague Island State Park and Assateague National Seashore. Ocean City is well known for its boardwalk, beaches, and commercial tourist attractions. As discussed in Section 3.6.3, *Demographics, Employment, and Economics*, tourism and recreation accounted for nearly all the County's overall Ocean Economy GDP. The total Ocean Economy GDP for Worcester County accounts for 22.1 percent of the statewide Ocean Economy GDP. Assateague State Park and Assateague National Seashore provide camping, swimming beaches, hiking, horseback riding, bicycle trails, fishing, shellfishing, hunting, canoeing and kayaking, and ranger-guided programs (NPS 2022; MDNR 2022).

3.6.8.1.3.2 Sussex County, Delaware

Delaware's Sussex County has 26 miles (41.8 kilometers) of Atlantic Ocean coastline. Because much of the County's coastline consists of barrier islands, recreational opportunities are also available along the west coast of the barrier islands, which have shorelines along Little Assawoman Bay, Indian River Bay, and Rehoboth Bay. Sussex County contains the oceanfront towns and cities of Lewes, Rehoboth Beach, Dewey Beach, Bethany Beach, South Bethany, and Fenwick. The coastal municipalities provide recreational amenities and activities such as beaches, boardwalks and piers, lodging, restaurants, and other tourist facilities. Nearly all the Ocean Economy GDP and employment in Sussex County is from tourism and recreation (Section 3.6.3, *Demographics, Employment, and Economics*).

Delaware Seashore State Park follows the Atlantic coast for about 5 mi (8.0 kilometer) north of the Indian River Inlet and more than 1 mile (1.6 kilometers) south of the inlet. The park has campgrounds on either side of the inlet, two ocean swimming beaches and a surfing area (DNREC 2014). Clamming and crabbing are only permitted in limited areas of the park, but fishermen pursuing finfish frequent the ocean beaches and banks of the inlet. The Indian River Marina, located on the north side of the inlet, is open year-round and offers a boat ramp, dock space, and charter fishing trips. Canoes, kayaks, and sailboats use non-motorized boat launches north of the inlet on Rehoboth Bay. The Burton Island Nature Preserve on the bay side of Delaware Seashore State Park features a walking path through coastal salt marsh and is popular for birding and guided walks (DNREC 2022).

Inland state parks within Sussex County include Holts Landing, on the south side of Indian River Bay, and Trap Pond State Park (DNREC n.d.). The Assawoman Wildlife Area is a preserved area of more than 3,000 acres (1,214 hectares) on the western side of the barrier island, north of the Indian River. Other recreation areas include private golf courses, preserved areas, and the Delaware Botanic Gardens. As stated in Section 3.6.8.1.3, inshore waters such as Indian River Bay are frequently used for recreational fishing. Other coastal state parks in Sussex County include Cape Henlopen State Park near Lewes and Fenwick Island State Park along the coast north of the town of Fenwick Island (DNREC n.d.).

3.6.8.1.3.3 Baltimore County, Maryland

Water-based recreational opportunities, supported by marinas and waterfront parks, are locally important to the communities near Chesapeake Bay within Baltimore County, Maryland. Baltimore County has seven state parks that feature boat launches with public access to Chesapeake Bay. The Baltimore County shoreline of Chesapeake Bay also includes smaller county parks, community beaches, and marinas (COP, Volume II, Section 17.3.1; US Wind 2023).

Baltimore County operates recreation facilities within the Sparrows Point and neighboring Edgemere residential communities that include small sites, a senior center, and Fort Howard Park, a 93-acre (37.6 hectare) waterfront park and historic site that has piers, shoreline access, playgrounds, picnicking, and trails (Baltimore County 2022a). A new, 21-acre (8.5 hectare) waterfront park is planned as part of the Sparrows Point industrial area redevelopment; this Sparrows Point Park will include a community center and gym, synthetic turf field, playground, fishing pier and boat ramp (Baltimore County 2022b).

3.6.8.2 Impact Level Definitions for Recreation and Tourism

Definitions of impact levels for recreation and tourism are provided in Table 3.6.8-1. Table F-18 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on recreation and tourism.

Table 3.6.8-1. Impact level definitions for recreation and tourism

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on the recreation setting, recreation opportunities, or recreation experiences would be so small as to be unmeasurable.
Negligible	Beneficial	No effect or measurable impact.
Minor	Adverse	Impacts would not disrupt the normal functions of the affected activities and communities.
Minor	Beneficial	A small and measurable improvement to infrastructure/facilities and community services or benefit for tourism.
Moderate	Adverse	The affected activity or community would have to adjust somewhat to account for disruptions due to the Proposed Action.
Moderate	Beneficial	A notable and measurable improvement to infrastructure/facilities and community services or benefit for tourism.
Major	Adverse	The affected activity or community would have to adjust to significant disruptions due to large local or notable regional adverse impacts of the Proposed Action.
Major	Beneficial	A large local, or notable regional, improvement to infrastructure/facilities and community services or benefit for tourism.

3.6.8.3 Impacts of Alternative A – No Action on Recreation and Tourism

When analyzing the impacts of the No Action Alternative on recreation and tourism, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, recreation and tourism in the geographic analysis area would continue to be affected by ongoing and planned activities, especially onshore and coastal regional trends and land development. Visitors would continue to pursue activities that rely on the area's coastal and ocean environment, scenic qualities, natural resources, and establishments that provide services for recreation and tourism. While the geographic analysis area has a strong tourism industry and abundant coastal and offshore recreational facilities, many of which are associated with scenic views, local jurisdictions face challenges maintaining recreational resources due to budget limitations, increasing demand, and aging public infrastructure at recreational sites. Ongoing beach replenishment programs are important to maintain beaches and protect waterfront facilities such as boardwalks, tourism-related businesses, and park facilities (Town of Ocean City 2023).

Planned activities for coastal and marine activity, other than offshore wind, include development of diversified, small-scale, onshore renewable energy sources; ongoing onshore development at or near current rates; continued increases in the size of commercial vessels; potential port expansion and channel-deepening activities; and efforts to protect against potential increased storm damage and sea level rise (Appendix D, *Planned Activities Scenario*). Other planned non-offshore wind activities may result in adverse impacts on recreational resources by limiting land or coastal areas available for recreational facilities, increasing offshore traffic, and affecting water quality.

3.6.8.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind activities to affect recreation and tourism through the following primary IPFs.

Anchoring: This IPF could affect recreational boating through the presence of an increased number of anchored vessels within the geographic analysis area during construction. Offshore wind development in the geographic analysis area is anticipated to result in increased survey activity and overlapping construction periods between 2023 and 2030. Increased vessel anchoring is anticipated during this offshore wind development period. The greatest volume of anchored vessels would occur in offshore work areas during construction. The USCG may establish temporary safety zones around anchored construction vessels within 12 miles (19.3 kilometers) of the coastline. Since the WTGs included in reasonably foreseeable offshore development are 13 to 26 miles (20.9 to 41.8 kilometers) from the shoreline, the safety zones potentially apply only to cable emplacement. Other vessels not involved in construction would be required to avoid these safety zones (COP, Volume II, Appendix K1, Section 5.1; US Wind 2023).

Anchored construction or survey vessels (with accompanying USCG-designated safety zones) would have localized, temporary impacts on recreational boating. Recreational vessels could navigate around anchored vessels with only brief inconvenience. The temporary turbidity from anchoring would briefly alter the behavior of species important to recreational fishing (Section 3.5.5) and reduce dolphin and whale sightings (Section 3.5.6).

Vessel anchoring would occur as part of maintenance and monitoring activities during O&M. Following construction of other offshore projects, the presence of operating offshore wind projects in the geographic analysis area would result in a long-term, infrequent increase in the number of vessels anchored during periodic O&M.

Inconvenience and navigational complexity for recreational vessels would be localized, variable, and short term due to the increased frequency of anchored vessels during surveying and construction. Overall, vessel anchoring for the No Action Alternative would have moderate impacts on recreation and tourism.

Cable emplacement and maintenance: Under the No Action Alternative, other offshore wind export cables in the recreation and tourism geographic analysis area could total 40 mi (64 kilometer), while inter-array cables could total 302 mi (486.0 kilometer) (excluding the Proposed Action). Cables for other offshore wind projects would likely be emplaced within the geographic analysis area between 2023 and 2030. Offshore cable emplacement for offshore wind development projects would have temporary, localized, adverse impacts on recreational boating while cables are being installed, because vessels would need to navigate around work areas and recreational boaters would likely prefer to avoid the noise and disruption caused by installation. Cable installation could also have temporary impacts on fish and invertebrates of interest for recreational fishing, due to the required dredging, turbulence, and disturbance; however, species would recover upon completion (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). The degree of temporal and geographic overlap of each cable is unknown, although cables for some projects could be installed simultaneously. Active work and restricted areas would only occur over the cable segment being emplaced at a given time.

Once installed, cables would affect recreational boating when Project-related vessels perform O&M activities along the cable routes. Additionally, recreational vessels may experience limitations or difficulty in anchoring, and gear entanglement or loss could occur, due to the creation of offshore areas with hard cable protection or scour protection, although accurate mapping of these protection areas could make operators aware of these hazards. Buried offshore cables would not pose a risk for most recreational vessels, as anchors from smaller vessels would not penetrate to the target burial depth for the cables. Impacts of cable emplacement and maintenance on recreational boating and tourism would be continuous, adverse, and localized.

Impacts of cable emplacement on recreational boating and tourism would be short term, adverse, and localized. Disruptions from cable emplacement are anticipated to have a minor impact on recreation and tourism.

EMFs and cable heat: Installation of other offshore wind export cables in the recreation and tourism geographic analysis area would generate EMF during operation of the wind farms. Where installation occurs near beaches, fishing sites, and other areas of recreational activity, visitors may be exposed to EMF. Common household items including television sets, hair dryers, and electric drills can emit magnetic fields similar to or higher in intensity than those emitted by undersea power cables (CSA Ocean Sciences Inc. and Exponent 2019). Based on typical EMF values from submarine power cables buried at a depth of 3 feet (1 meter), maximum emissions directly above the onshore export cable would not exceed 165 milligauss (mG). From 10 to 25 feet (3 to 7.5 meters) away from the onshore export cable, emissions values drop to less than 0.1 to 12 mG. These values are below the reported human health reference levels of 2,000 and 9,040 mG for the general population (IEEE 2006; ICNIRP 2010). Even if other offshore wind export cables were of higher voltage or buried closer to the surface, EMF levels are still anticipated to be well below the human health reference levels and, therefore, EMF impacts on recreation and tourism would be long term but negligible.

Land disturbance: Other offshore wind development would require installation of onshore export cables and onshore substation infrastructure, which would cause temporary traffic delays and could temporarily affect access to adjacent properties, resulting in localized, temporary disturbances of recreational activity or tourism-based businesses near cable routes and construction sites for substations and other electrical infrastructure. These impacts would only last through construction and occasionally during maintenance events. The exact extent of impacts would depend on the locations of landfall and onshore transmission cable routes for offshore wind energy projects; however, the No Action Alternative would generally have localized, short-term minor impacts during construction or maintenance and no long-term impacts on recreation and tourism use.

Lighting: Construction-related nighttime vessel lighting would be used if offshore wind development projects include nighttime, dusk, or early morning construction or material transport. In a maximum-case scenario, lights could be active throughout nighttime hours for up to two other offshore wind projects within the geographic analysis area simultaneously under active construction. Vessel lighting would enable recreational boaters to safely avoid nighttime construction areas. The impact on recreational boaters would be localized, sporadic, short term, and minimized by the limited offshore recreational activities that occur at night. Offshore construction lighting is anticipated to have a negligible impact on recreation and tourism.

Permanent aviation warning lighting required on the WTGs would be visible from beaches and coastlines within the geographic analysis area and could have impacts on recreation and tourism in certain locations if the lighting influences visitor decisions in selecting coastal locations to visit. FAA hazard lighting systems would be in use for the duration of O&M for up to 485 WTGs and 19 OSSs potentially visible from within the geographic analysis area, with the largest number visible from the portions of the geographic analysis area in New Jersey and fewer structures visible in Delaware, Maryland, and Virginia. Section 3.6.9, *Visual Resources*, describes the FAA hazard lighting in detail. The presence of WTGs and associated synchronized flashing strobe lights within the offshore wind lease areas would have long-term impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use, including nighttime conditions, found that WTGs visible more than 15 mi (24.1 kilometer) from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The study participants viewed visual simulations of WTGs in clear, hazy, and nighttime conditions without ADLS. A 2017 visual preference study conducted by North Carolina State University evaluated the impact of offshore wind facilities on vacation rental prices. The study found that nighttime views of aviation hazard lighting (without ADLS) for WTGs located 5 to 12 miles (8 to 19.3 kilometers) from shore would adversely affect the rental price of properties with ocean views, with decreasing adverse effect as distance from shore increased (Lutzeyer et al. 2017). At 18 miles from shore, little to no impact on rental price was found. WTGs in the No Action Alternative would be 13 to 26 miles (20.9 to 41.8 kilometers) from the shoreline.

Nearly all the Delaware and Maryland coastlines are within the viewshed of WTGs constructed in the No Action Alternative, and portions of these coastlines have been extensively developed for recreation and tourism (particularly near beach resorts such as Ocean City, Maryland, and Fenwick Island, Bethany Beach, Rehoboth Beach, and Lewes, Delaware). Nighttime lighting is prevalent in these developed areas. Elevated boardwalks, jetties, and seawalls afford greater visibility of offshore elements for viewers in tidal beach areas. Nighttime views toward the ocean from the beach and adjacent inland areas are diminished by ambient light levels and glare of shorefront developments. Visible aviation warning lighting would add additional developed/industrial visual element to seaward views. WTG and OSS lighting would be more noticeable in views that were previously characterized by dark, open ocean, broken only by transient lighted vessels and aircraft passing through the view.

In addition to recreational fishing, some recreational activity in the region involves wildlife-viewing activity. A 2013 BOEM study of the impacts of WTG lighting on birds, bats, marine mammals, sea turtles, and fish found that existing guidelines “appear to provide for the marking and lighting of [WTGs] that will pose minimal if any impacts on birds, bats, marine mammals, sea turtles or fish” (Orr et al. 2013). By extension, aviation safety lighting following existing lighting guidelines would impose a minimal impact on recreational fishing or wildlife viewing.

As a result, although lighting on WTGs would have a continuous, long-term, adverse impact on recreation and tourism, the impact in the geographic analysis area is likely to be limited to individual decisions by visitors with less impact on the recreation and tourism industry as a whole. Lighting impacts on recreation and tourism are therefore anticipated to be negligible.

For the Proposed Action, use of ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS (Capitol Airspace Group 2023). BOEM assumes that implementation of ADLS for other projects in the geographic analysis area would result in similar reductions in nighttime visual impacts of those projects.

Noise: Onshore construction noise from cable installation at landfall sites, and inland where cable routes are near parkland, recreation areas, or other areas of public interest, would temporarily disturb the quiet enjoyment of the site (in locations where such quiet is an expected or typical condition), with short term, minor impacts on recreation and tourism.

Offshore noise from HRG survey activities, pile-driving, trenching, and construction-related vessels would intrude on the natural sounds of the marine environment. This noise could cause some boaters to avoid areas of noise-generating activity. Safety zones could be established by the USCG within 12 nautical miles (22.2 kilometers) of the coast for areas of active construction. These safety zones would apply only to cable emplacement, as the WTGs would be off-limits to recreational boaters.

BOEM conducted a qualitative analysis of impacts on recreational fisheries for the construction phases of offshore wind development in the Atlantic OCS region. Results showed the construction phase is expected to have a slightly negative to neutral impact on recreational fishing due to both direct exclusion of fishing activities and displacement of mobile target species by the construction noise (Kirkpatrick et al. 2017). The impact of noise on recreation and tourism during construction would be adverse (i.e., intense and disruptive), but short term and localized.

Adverse impacts of noise on recreation and tourism would also result from the impacts on species important to recreational fishing and sightseeing within the recreation and tourism geographic analysis area and along cable routes, as discussed in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, and Section 3.5.6, *Marine Mammals*. HRG survey noise and pile-driving would cause the most impactful noises. Because most recreational fishing takes place closer to shore, only a small proportion of recreational fishing would be affected by construction noise of WTGs, which would be more than 13 mi (20.9 kilometer) offshore. Recreational HMS fishing is more likely to be affected because these species are usually found farther offshore than most recreational fisheries and are therefore more likely to experience temporary impacts resulting from offshore wind construction noise. Construction noise could contribute to temporary impacts on marine mammals, with resulting impacts on marine sightseeing that benefits from the presence of dolphins or whales. However, as noted in Section 3.5.6, *Marine Mammals*, other projects are expected to comply with mitigation measures (e.g., exclusion zones, protected species observers) that would avoid and minimize underwater noise impacts on marine mammals.

Offshore wind surveying and construction would occur within the geographic analysis area between 2023 and 2030. Multiple construction projects would increase the spatial and temporal extent of temporary disturbance to marine species within the geographic analysis area. BOEM's assumed construction schedule for offshore wind projects in Appendix D, *Planned Activities Scenario*, Table D2-1 indicates the possibility of up to two offshore wind projects (comprising up to 110 WTGs) under development (not including the Proposed Action) between 2024 and 2030 in the geographic analysis area. These temporary noise impacts are not anticipated to cause any population-level harm to fish and marine mammal populations (Sections 3.5.5 and 3.5.6).

During O&M, the continuous noise generated by WTG operation would occur at least 13 mi (20.9 kilometer) offshore. WTG noise is not expected to produce sound in excess of background levels at any onshore locations. Noise from operational WTGs would be expected to have little effect on finfish, invertebrates, and marine mammals and, therefore, little effect on recreational fishing or sightseeing (COP, Volume II, Sections 8.2.2 and 9.2.2; US Wind 2023).

Based on the discussion above, noise from offshore wind construction, O&M, and decommissioning would result in localized, short- to long-term adverse, and minor impacts on recreational fishing and marine sightseeing.

Port utilization: Ports within the geographic analysis area for recreation and tourism that could be used for construction of offshore wind projects include Sparrows Point (Port of Baltimore), Ocean City Harbor, and Lewes, Delaware. The Port of Baltimore is industrial in character and can support the large, deep-draft vessels needed for installation and feeder vessels. It is not used by recreational vessels, although vessels approaching and leaving the Port of Baltimore share the waters of Chesapeake and Delaware Bays with recreational vessels. The Ocean City and Lewes harbors are used primarily by recreational boaters and commercial fishing or for-hire boating businesses. These harbors would be suitable for offshore wind support service and crew transfer vessels.

Port improvements could result in short-term delays and crowding during construction but could provide long-term benefits to recreational boating if the improvements result in increased berths and amenities for recreational vessels or improved navigational channels. The impact of port utilization on recreation and tourism is anticipated to be negligible.

The same ports within the geographic analysis area for recreation and tourism could be used for O&M of offshore wind development: the Port of Baltimore, Ocean City Harbor, and Lewes. Port improvements related to O&M could result in short-term delays but could provide long-term benefits to recreational boating if the improvements result in increased berths and amenities for recreational vessels. The impact of port utilization on recreation and tourism is anticipated to be negligible.

Presence of structures: The placement of 113 foundations (110 WTGs and 3 OSSs) (excluding the Proposed Action) within the geographic analysis area would contribute to impacts on recreational fishing and boating. The offshore structures would have long-term, adverse impacts on recreational boating and fishing due to increased risk of allision; risk of gear entanglement, damage, or loss;

navigational hazards; space use conflicts; presence of cable infrastructure; and visual impacts. Offshore wind structures could also have beneficial impacts on recreation through fish aggregation and reef effects (Sections 3.5.5 and 3.5.6).

The presence of offshore wind structures would increase the risk of allision or collision with other vessels and the complexity of navigation within the recreation and tourism geographic analysis area. Generally, the vessels more likely to allide with WTGs or OSSs would be smaller vessels moving within and near wind installations, such as recreational vessels. The USCG would need to adjust its SAR planning and search patterns to allow SAR aircraft to fly within offshore wind lease areas, leading to a less -optimized search pattern and a lower probability of success (Sections 3.6.6 and 3.6.7). Offshore wind development would require adjustment of routes for recreational boaters, anglers, sailboat races, and sightseeing boats. The adverse impacts of offshore wind structures on recreational boating would be limited because fewer recreational vessels operate as far offshore as the offshore wind lease areas.

The 113 foundations in the Skipjack and GSOE projects, which are closest to the Project, would have scour protection totaling 143 acres (57.9 hectares). Offshore export and inter-array cables would have 9.8 acres (4 hectares) of hard cover protection. These protected areas would increase the risk of fishing gear entanglement. The cable protection would also present a hazard for anchoring, as anchors could have difficulty holding or become snagged and lost. Accurate marine charts could make recreational vessel operators aware of the locations of the cable protection and scour protection. If the hazards are not noted on charts, operators may lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored. Buried offshore cables would not pose a risk for most recreational vessels, as smaller-vessel anchors would not penetrate to the target burial depth for the cables. Because anchoring is uncommon in water depths where the No Action Alternative WTGs would be installed, anchoring risk is more likely to be an impact over export cables in shallower water closer to coastlines. The risk to recreational boating would be long term, localized, and continuous.

Offshore WTGs could provide new opportunities for offshore tourism by attracting recreational fishing and sightseeing, a phenomenon known as the “reef effect.” The reef effect refers to the introduction of a new hard-bottom habitat that has been shown to attract numerous species of algae, shellfish, finfish, and sea turtles to new benthic habitat (COP, Volume II, Section 8.2.2; US Wind 2023). The reef effect could attract species of interest for recreational fishing and result in an increase in recreational boaters traveling farther from shore to fish within the recreation and tourism geographic analysis area. Although the likelihood of recreational vessels visiting the offshore WTGs would diminish with distance from shore, increasing numbers of offshore structures may encourage a greater volume of recreational vessels to travel to the offshore wind lease areas.

Additional fishing and tourism activity generated by the reef effect could also increase the likelihood of allisions and collisions involving recreational fishing or sightseeing vessels, as well as commercial fishing vessels (Section 3.6.6, *Navigation and Vessel Traffic*).

Up to 485 WTGs and 19 OSSs from projects other than the Proposed Action would potentially be visible from within the geographic analysis area (depending on vegetation, topography, weather, atmospheric conditions, and the viewers’ visual acuity). The largest number of WTGs would be visible from the portions of the geographic analysis area in New Jersey; fewer structures would be visible in Delaware, Maryland, and Virginia. The visual impacts of WTGs on the offshore horizon may affect recreational experience and tourism in the geographic analysis area. If the purpose of the viewer's sightseeing excursion is to observe the mass and scale of the WTGs' offshore presence, then the increasing visual dominance would benefit the recreation/tourism experience as the viewer navigates toward the WTGs. However, if experiencing a vast pristine ocean condition is important to the viewer, then the increasing visual dominance may detract from the viewer's recreation/tourism experience.

Studies and surveys evaluating the impacts of offshore wind facilities on tourism have found that established offshore wind facilities in Europe did not result in decreased tourist numbers, tourist experience, or tourist revenue, and that Block Island Wind Farm's WTGs provide excellent sites for fishing and shellfishing (Smythe et al. 2018). A survey-based study found that, for prospective offshore wind facilities (based on visual simulations), proximity of WTGs to shore is correlated to the share of respondents who would expect a worsened experience visiting the coast (Parsons and Firestone 2018). Specific findings of the Parsons and Firestone (2018) study include:

- At 15 miles (24.1 kilometers), the percentage of respondents who reported that their beach experience would be worsened by the visibility of WTGs was about the same as the percentage of those who reported that their experience would be improved (e.g., by knowledge of the benefits of offshore wind).
- About 68 percent of respondents indicated that the visibility of WTGs would neither improve nor worsen their experience.
- Reported trip loss (respondents who stated that they would visit a different beach without offshore wind development) averaged 17 percent when wind projects were 7.5 miles (12.1 kilometers) offshore, 14 percent when wind projects were 10 miles (16 kilometers) offshore, 8 percent when wind projects were 12.5 miles (20.1 kilometers) offshore, 6 percent when 15 miles (24.1 kilometers) offshore, and 5 percent when 20 miles (32.2 kilometers) offshore.
- About 2.6 percent of respondents were more likely to visit a beach with visible offshore wind facilities at any distance.

A 2019 survey of 553 coastal recreation users in New Hampshire included participants in water-based recreation activities such as fishing from shore and boats, motorized and non-motorized boating, beach activities, and surfing at the New Hampshire seacoast. Most (77 percent) supported offshore wind development along the New Hampshire coast, while 12 percent opposed it, and 11 percent were neutral. Regarding the impact on their outdoor recreation experience, 43 percent anticipated that offshore wind development would have a beneficial impact, 31 percent anticipated a neutral impact, and 26 percent anticipated an adverse impact (Ferguson et al. 2020).

As described under the IPF for lighting, portions of the Maryland and Delaware shore within the viewshed of the WTGs are highly developed, while other portions (e.g., within Delaware Seashore State Park, Assateague State Park, and Assateague Island National Seashore) are largely undeveloped. Public beaches and tourism attractions in this area are highly valued for scenic, historic, and recreational qualities and draw large numbers of daytime visitors during the summertime tourism seasons. When visible (i.e., on clear days, in locations with unobstructed ocean views), WTGs would add a developed/industrial visual element to ocean views. These structures would be most noticeable and would be most likely to impact recreational decisions in areas that were previously characterized by open ocean, broken only by transient vessels and aircraft passing through the view.

WTGs visible from some shoreline locations in the geographic analysis area would have adverse impacts on visual resources when discernable due to the introduction of industrial elements in previously undeveloped views (Section 3.6.9, *Visual Resources*). Based on the relationship between visual impacts and impacts on recreational experience, the impact of visible WTGs on recreation and tourism would be long term, continuous, and adverse. Seaside locations could experience some reduced recreational and tourism activity, but the visible presence of WTGs would be unlikely to affect the overall level of shore-based or marine recreation and tourism in the geographic analysis area.

Considering all the factors previously described, the presence of structures from the No Action Alternative would have moderate adverse impacts and minor beneficial impacts on recreation and tourism in the geographic analysis area.

Traffic: Other offshore wind project construction would generate increased vessel traffic that could inconvenience recreational vessel traffic within the geographic analysis area. The impacts would occur primarily along routes between ports and the offshore wind construction areas.

Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action, which is projected to result in as many as 39 vessels operating in the Lease Area or over the Offshore Export Cable Route at any given time during construction (COP, Volume II, Appendix C1, Table 3; US Wind 2023). Based on the simultaneous construction of two offshore wind projects in the geographic analysis area (Appendix D, *Planned Activities Scenario*, Table D2-1) between 2023 and 2030, offshore wind project construction could thus result in as many as 65 vessels present simultaneously in the geographic analysis area.

Increased vessel traffic would require increased alertness on the part of recreational or tourist-related vessels and would result in minor delays or route adjustments. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. The possibility of delays and risk of collisions would increase if more than one offshore wind facility is under construction at the same time. Higher volumes during construction would result in greater inconvenience, disruption of the natural marine environment, and risk of collision.

BOEM estimates that O&M activities for other offshore wind projects would result in vessel traffic similar to the Proposed Action, with an estimated 4 vessels per day per project traveling to the offshore wind area (Section 3.6.6, *Navigation and Vessel Traffic*). In the geographic analysis area, the No Action Alternative would generate an average of 8 vessel trips per day within the geographic analysis area. Vessel traffic associated with No Action Alternative offshore wind would have short-term, variable, minor adverse impacts on vessel traffic related to recreation and tourism.

3.6.8.3.2 Conclusions

Under the No Action Alternative, baseline conditions for recreation and tourism would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities.

Recreation and tourism in the geographic analysis area would continue to be affected by ongoing activities, especially ongoing vessel traffic; noise and trenching from periodic maintenance or installation of piers, pilings, seawalls, and offshore cables; occasional beach replenishment; and onshore development activities. These activities would contribute to periodic disruptions to recreation and tourism activities but are typical of the Maryland and Delaware coastline and would not substantially affect recreational enjoyment in the geographic analysis area. Planned non-offshore wind activities that may affect recreation and tourism include emplacement of submarine cables and pipelines, dredging and port improvements, marine mineral use, and military use.

Like ongoing activities, other planned non-offshore wind activities may result in periodic disruptions to recreation and tourism activities along the coast through the primary IPFs of vessel traffic, noise, and cable emplacement. Planned activities other than offshore wind would have localized, temporary impacts on recreational boating and would not affect the area's scenic quality.

Other offshore wind activities are expected to contribute considerably to several IPFs, the most prominent being noise and vessel traffic during construction and decommissioning and the presence of offshore structures during O&M. Noise and vessel traffic would have impacts on visitors, who may avoid onshore and offshore noise sources and vessels, and on recreational fishing and sightseeing as a result of the impacts on fish, invertebrates, and marine mammals. The long-term presence of offshore wind structures would result in increased navigational constraints and risks, potential entanglement and loss, and visual impacts from offshore structures. Offshore wind activities in the geographic analysis area would result in beneficial impacts due to the presence of offshore structures and cable and foundation hard protection, which could provide opportunities for fishing and sightseeing.

Under the No Action Alternative, current environmental trends and activities would continue, and recreation and tourism would continue to be affected by natural and human caused IPFs. The No Action Alternative would result in **negligible** impacts on recreation and tourism from ongoing activities. The No Action Alternative combined with all planned activities in the geographic analysis area (including other offshore wind activities) would result in **moderate** adverse and **minor beneficial** impacts on recreation and tourism.

3.6.8.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) would influence the magnitude of the impacts on recreation and tourism:

- The Project layout including the number, type, height, and placement of the WTGs and OSSs, and the design and visibility of lighting on the structures;
- Arrangement of WTGs and accessibility of the Lease Area to recreational boaters; and

- The time of year during which onshore and nearshore construction occurs.

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

- WTG number, size, location, and lighting: More WTGs and larger turbine sizes closer to shore could increase visual impacts that affect onshore recreation and tourism as well as recreational boaters. Arrangement and type of lighting systems would affect nighttime visibility of WTGs onshore.
- WTG arrangement and orientation: Different arrangements of WTG arrays may affect navigational patterns and safety of recreational boaters.
- Time of construction: Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). Impacts on recreation and tourism would be greater if Project construction were to occur during this season.

US Wind has committed to measures to minimize impacts on recreation and tourism, which include developing a construction schedule to minimize activities at the landfall during the peak summer recreation and tourism season (COP, Volume II, Section 17.3.2.1; US Wind 2023).

3.6.8.5 Impacts of Alternative B – Proposed Action on Recreation and Tourism

The reasonably foreseeable environmental trends and impacts of the Proposed Action on recreation and tourism, in addition to ongoing non-offshore wind activities, planned non-offshore wind activities, and offshore wind activities are described by IPF below.

3.6.8.5.1 Construction and Installation

3.6.8.5.1.1 Onshore Activities and Facilities

Land disturbance: Onshore construction and installation of the export cables would affect recreation and tourism where construction activity interferes with access to recreation sites or increases traffic, noise, or temporary emissions that degrade the recreational experience. The landfall site would use the parking area for 3R's Beach within Delaware Seashore State Park. US Wind would use HDD to install cables between the Atlantic and landfall location at 3R's Beach; from 3R's Beach into Indian River Bay; and from the Indian River to the onshore substation near the Indian River Power Plant. As a result, land disturbance from onshore activities would be limited to the 3R's Beach parking lot and the onshore substation site.

US Wind has committed to a construction schedule to minimize activities at the landfall during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction (COP, Volume II, Section 17.3.2.1; US Wind 2023). Off-season beachgoers who wish to use the 3R's Beach parking lot during cable installation would have to find alternate parking, use alternate transportation, or, most likely, use an alternate beach (COP, Volume II, Section 17.3.2.1; US Wind 2023). As a result, the impacts of land disturbance on recreation and tourism would be localized, short term, and minor.

The exact extent of land disturbance associated with other projects would depend on the locations of landfall, onshore transmission cable routes, and onshore substations for other offshore wind energy projects. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined land disturbance impacts on recreation and tourism from ongoing and planned activities including offshore wind, which would be localized, short term, and minor.

Port utilization: Section 3.6.8.3.1 describes the ports used for proposed Project construction—including Sparrows Point (Port of Baltimore), Ocean City Harbor, and Lewes—as well as the types of impacts that could occur at those ports. The impact of port utilization on recreation and tourism during proposed Project construction is anticipated to be negligible.

3.6.8.5.1.2 Offshore and Inshore Activities and Facilities

Anchoring: Anchoring by Proposed Action construction vessels would disturb benthic habitats (Section 3.5.2, *Benthic Resources*) and marine species (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*; Section 3.5.6, *Marine Mammals*; Section 3.5.7, *Sea Turtles*) and would inconvenience recreational vessels that must navigate around the anchored vessels. Construction of the Proposed Action would generate up to 39 vessels operating in the Lease Area or over the Offshore Export Cable Route at any given time during construction (COP, Volume II, Appendix C1, Table 3; US Wind 2023). US Wind has committed to establishing safety zones around active construction areas and marking areas with highly visible marking and lighting (Appendix G, Table G-1). As is the case for the No Action Alternative, the USCG may establish temporary safety zones around anchored vessels involved in Offshore Project construction within 12 nautical miles (22.2 kilometers) of the coast. Non-Project vessels would be required to avoid any such safety zones, reducing the potential for recreational boater interaction with anchored construction vessels in these areas (Section 3.6.6, *Navigation and Vessel Traffic*). Vessel anchoring for construction of the Proposed Action would have localized, short-term, minor impacts on recreation and tourism due to the need to navigate around vessels and work areas and the disturbance of species important to recreational fishing.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the anchoring impacts on recreational boating from ongoing and planned activities including offshore wind, which would likely be localized, short term, and minor to moderate during the period in which offshore wind projects are being constructed in the geographic analysis area. A greater number of vessels would be anchored when multiple offshore wind projects are under construction at one time within the recreation and tourism geographic analysis area, potentially resulting in moderate impacts.

Cable emplacement and maintenance: The Proposed Action's cable emplacement would generate vessel anchoring and dredging at worksites, requiring recreational vessels to avoid and navigate around the worksites and resulting in short-term disturbance to species important to recreation and tourism. The Proposed Action would require up to 125.6 miles (204.2 kilometers) of inter-array cables, 142.5 miles (229.3 kilometers) of offshore export cables and 42.3 miles (68.1 kilometers) of inshore export cable (Appendix C, *Project Design Envelope and Maximum Case Scenarios*). Installation of each cable would require up to seven active construction vessels at one time (COP, Volume I, Section 3.6.1

and Volume II, Appendix C1, Table 3; US Wind 2023). US Wind has not stated the number of cable-laying vessel groups operating simultaneously or the length of time that cable installation vessels would occupy any given location. Recreational vessels traveling near the Offshore Export Cable Route would need to navigate around cable-laying vessels (including any USCG-established safety zones). Installation of the Inshore Export Cable Route within Indian River Bay and the Indian River would disrupt boating and fishing within the waterway for the duration of the installation process. US Wind has committed to coordinate with appropriate regulatory agencies and other stakeholders during construction to communicate planned vessel movements and construction activities (Appendix G, Table G-1).

Cable installation could also affect fish and marine mammals of interest for recreational fishing and sightseeing through dredging and turbulence, although species would recover upon completion (Sections 3.5.5 and 3.5.6), resulting in localized, short-term impacts on recreation and tourism. Cable emplacement that occurs near beaches, fishing sites, or nearshore recreational sites could affect recreation through temporary water quality impacts. As discussed in Section 3.4.2, impacts on water quality from cable installation and maintenance would be short term and minor and are therefore not anticipated to result in substantive impacts on recreation and tourism.

Overall, offshore and inshore cable installation for the Proposed Action would require adjustments by participants in water-based recreational activities, and thus would have short term, localized, moderate impacts on recreation and tourism.

Specific cable locations associated with other offshore wind projects have not been identified within the geographic analysis area. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the impacts of cable emplacement and maintenance on recreational marine activities from ongoing and planned activities including offshore wind. The combined impacts would likely be short term and moderate.

Lighting: Although most offshore and coastal construction is expected to occur during daylight hours, construction vessels would use work lights to improve visibility during night or poor visibility, in accordance with USCG requirements. When nighttime or low-light construction occurs, the vessel lighting for vessels traveling to and working at the Proposed Action's offshore and coastal construction areas may be visible from onshore locations. Depending on the distance from shore, vessel height, and atmospheric conditions, visibility of this lighting would be sporadic and variable but would be unlikely to meaningfully change recreation and tourist activities. Therefore, lighting from offshore Proposed Action construction would have short term, localized, minor impacts on recreation and tourism.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined lighting impacts from ongoing and planned activities including offshore wind, which would be minor.

Noise: Noise from O&M, pile-driving and trenching, and vessels could result in impacts on recreation and tourism. Temporary impacts on recreation and tourism would result from impacts within the Lease Area and along the Offshore and Inshore Export Cable Routes on species important to recreational fishing and marine sightseeing (Sections 3.5.5 and 3.5.6).

In addition to the temporary disruption to fish and shellfish, noise generated by offshore construction and inshore export cable installation would have impacts on the recreational enjoyment of the marine and coastal environments. Offshore construction noise would include pile-driving, vessel engines, and trenching along the Offshore Export Cable Route and within the Lease Area. Areas within or near the Offshore Export Cable Route and Lease Area (except for restricted areas around construction vessels) would remain available for recreational boating during construction. Increased noise from construction would temporarily inconvenience recreational boaters in these areas and would likely lead to avoidance of portions of the Lease Area and cable routes under construction. Overall, noise during Proposed Action construction would have a short-term, localized, moderate impact on recreation and tourism.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined noise impacts from ongoing and planned activities including offshore wind, which would be moderate.

Presence of structures: Construction and installation of offshore structures (WTGs and OSSs), expected to begin in 2024 and be completed in 2027, would affect recreational boaters. The risk of allision with anchored vessels would increase incrementally during construction, as more anchored vessels would be within the recreation and tourism geographic analysis area. The Proposed Action's offshore construction would also affect recreation and tourism through visual impacts. During construction, viewers on the Delaware and Maryland coast would see the upper portions of tall equipment such as mobile cranes. These cranes would move from position to position as construction progresses. While these cranes would not be long-term fixtures in any single location, they would be visible for the duration of Proposed Action construction. The visibility of cranes and other tall equipment during construction would be unlikely to alter onshore recreation and tourist activity; however, the presence of cranes and other equipment in the Lease Area could have similar impacts as anchoring and cable installation, likely leading to avoidance of active construction areas by some recreational vessels, As a result, the presence of structures during Proposed Action offshore construction would have short term, localized, moderate impacts on recreation and tourism.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts from the presence of structures from ongoing and planned activities including offshore wind, which would be moderate.

Traffic: The Proposed Action would contribute to increased vessel traffic and associated vessel collision risk during Project construction, as well as along routes between ports and the offshore construction areas. Vessel routes from the construction staging facility at Sparrows Point would travel to the Atlantic Ocean and the Offshore Project area either by traveling north in Chesapeake Bay to the Chesapeake and Delaware Canal and south through Delaware Bay, or south through Chesapeake Bay and up the Atlantic coast. Both bays are extensively travelled by recreational, cargo, fishing, and other types of vessels. Recreational vessels in these areas would be able to continue operating with minimal changes to existing activities. Vessel Traffic from Proposed Action construction would therefore have minor impacts on recreation and tourism.

Overlapping construction schedules of offshore wind projects in the geographic analysis area would increase traffic between ports and work areas, requiring increased alertness on the part of recreational or tourist-related vessels, and possibly resulting in a greater number of minor delays or route adjustments. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. These effects notwithstanding, recreational vessel activity would likely be able to continue with minimal change during construction of the Proposed Action and other offshore wind projects. In the context of reasonably foreseeable environmental trends, operation of the Proposed Action would contribute a noticeable increment to the combined vessel traffic impacts on recreation and tourism from ongoing and planned activities including offshore wind, which would be short term, variable, and minor during construction.

3.6.8.5.2 Operations and Maintenance

3.6.8.5.2.1 Onshore Activities and Facilities

Port utilization: Within the geographic analysis area, O&M of the Proposed Action would use existing or new structures within the Ocean City Harbor facility. Worcester County's planning policies call for retaining marine commercial activities in Ocean City Harbor (Worcester County 2006). O&M requiring deep-draft or jack-up vessels may use terminals at Sparrows Point (Port of Baltimore), Maryland, or Portsmouth (Hampton Roads area), Virginia. Project O&M is projected to require an average of 4 vessel round trips daily during summer months and 1 to 2 vessel round trips daily during non-summer months, primarily from the main shore base at Ocean City, Maryland (US Wind 2023 Vessel summary RFI). This O&M activity would be detectable compared to existing activity, but would have long term, negligible impacts on recreation and tourism.

In the context of reasonably foreseeable environmental trends, the Proposed Action would incrementally contribute to the combined port utilization impacts on recreation and tourism from ongoing and planned activities including offshore wind, although those combined cumulative impacts would be negligible.

3.6.8.5.2.2 Offshore and Inshore Activities and Facilities

EMFs and cable heat: Once installed, inshore export cables would generate EMF during O&M of the Project. The cables, which would be buried at a target depth of 3.3 to 9.8 feet (1 to 3 meters), would be in and near areas of recreation and tourism use, including 3R's Beach within Delaware Seashore State Park, where visitors may be exposed to EMF generated by the cables. As discussed in Section 3.6.8.3, buried power cables at these depths would produce weak field strengths well below the recommended threshold values for human exposure. Accordingly, EMF from offshore cable routes would have long term, negligible impacts on recreation and tourism.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the EMF impact on recreation and tourism from ongoing and planned activities including offshore wind, which would be long term and negligible.

Lighting: During O&M, the Proposed Action's WTGs, OSSs, and Met Tower would all have FAA-required aviation hazard lighting that could be visible from onshore viewing locations, depending on vegetation, topography, weather, atmospheric conditions, and the viewers' visual acuity. US Wind has committed to voluntarily implement ADLS for all FAA aviation hazard lighting, which would reduce the frequency and duration of the potential impacts of nighttime aviation lighting by over 99 percent compared to lights that are illuminated continuously at night (Capitol Airspace Group 2023), equivalent to approximately 0.1 percent of all annual nighttime hours. During times when the Proposed Action's aviation warning lighting is visible, Proposed Action offshore lighting would add a developed/industrial visual element to views that were previously characterized by dark, open ocean. These impacts would be stronger in onshore locations with limited existing artificial lighting and would be less detectable (if at all) in coastal cities and towns developed specifically to attract tourism. Although some visitors to undeveloped portions of the geographic analysis area with views of the ocean may choose to visit other beaches without offshore lighting, the Proposed Action's FAA aviation hazard lighting is unlikely to meaningfully change recreation and tourism patterns in the geographic analysis area. Due to the limited duration and frequency of such events and the distance of the Proposed Action's WTGs from shore, visible aviation hazard lighting for the Proposed Action would result in a long-term, intermittent, negligible impact on recreation and tourism.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined lighting impacts on recreation and tourism from ongoing and planned activities including offshore wind, which would be minor.

Noise: Offshore operational noise from the WTGs would be similar to the noise described for other projects under the No Action Alternative, and would therefore have continuous, long-term, negligible impacts. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the noise impacts on marine recreation activities from ongoing and planned activities including offshore wind, which would likely be localized, short term, and negligible.

Presence of structures: The Proposed Action's up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower would affect recreation and tourism through increased navigational complexity; risk of allision or collision; attraction of recreational vessels to offshore wind structures for fishing and sightseeing; the adjustment of vessel routes used for sightseeing and recreational fishing; the risk of fishing gear loss or damage by entanglement due to scour or cable protection; and potential difficulties in anchoring over scour or cable protection. These structures would also affect recreation and tourism through impacts on visual and scenic resources, as summarized in Section 3.6.9, *Visual Resources*.

As noted in Section 3.6.8.1, most recreational boating occurs within 3 miles (4.8 kilometers) of the coastline and within the geographic analysis area is concentrated in the inland and nearshore waters of Assawoman Bay and Isle of Wight Bay. Recreational boating activity within the Lease Area, approximately 10 miles (16.1 kilometers) offshore from Ocean City, is much less frequent than in areas closer to the coast. US Wind would take measures to familiarize recreational boaters with the information needed for safe transit through the Lease Area (COP, Volume II, Appendix K1, Table 17-1; US Wind 2023).

During O&M of the Proposed Action, the permanent presence of WTGs would create obstacles for recreational vessels. Vessels that exceed a height of 70 feet (21.6 meters) would be at risk of alliding with WTG blades at mean high water (COP, Volume II, Appendix K1, Section 3.2; US Wind 2023). Larger vessels, especially sailboats under sail, would likely navigate around the Lease Area, while smaller vessels could navigate unobstructed (except for the WTG monopiles).

As described in Section 3.6.8.3, the reef effect from the Proposed Action's foundations could provide new opportunities for offshore tourism by attracting recreational fishing and sightseeing but could also increase the risk of allisions and collisions involving recreational fishing or sightseeing vessels, as well as commercial fishing vessels (Section 3.6.6, *Navigation and Vessel Traffic*). Recreational anglers may choose to avoid fishing in the Lease Area due to concerns about the ability to safely fish within or navigate through the area.

BOEM does not anticipate the establishment of enforceable restrictions on vessels operating within the Lease Area. As with the No Action Alternative, the USCG would need to adjust its SAR planning and search patterns to allow aircraft to fly within the Lease Area, leading to a less-optimized search pattern and a lower probability of success (Sections 3.6.6 and 3.6.7). US Wind's Navigational Safety Risk Assessment (NSRA) modeling (COP, Volume II, Appendix K1, Section 11.2.2; US Wind 2023) finds a projected increase in accident frequency within the Lease Area of 0.29 marine accidents annually, or 2.9 accidents every 10 years. For recreational vessels (the "pleasure vessel category"), the increase is 0.22 accidents annually, or 2.2 every 10 years.

The Proposed Action's WTGs would be in open ocean approximately 10 miles (16.1 kilometers) east of Ocean City. As described in Appendix C, *Project Design Envelope and Maximum-Case Scenario*, the WTGs would have blade tips that reach up to 938 feet (286 meters) above the ocean surface, with towers that reach up to 531 feet (162 meters) above the ocean surface. Observers on Atlantic beaches, the first row of buildings or houses, and inland portions of Assateague Island and the inland shores west of Assateague Island would have views of Proposed Action WTGs, OSSs, and the Met Tower. For developed areas, the first row of buildings tends to block views from locations farther inland. As discussed in Section 3.6.9, *Visual Resources*, the Proposed Action would have major impacts on visual resources.

These impacts could have beneficial or adverse impacts on recreation and tourism depending on a viewer's orientation, activity, purpose for visiting the area, and attitude toward offshore wind energy. Section 3.6.8.3 summarizes the limited available research on the link between visual impacts of future offshore wind and resultant impacts on recreation and tourism. While most visitors would be unaffected (or even attracted) by views of offshore WTGs, some may choose to visit other beaches without visible WTGs (although few such beaches would exist between Ocean City and central New Jersey by 2030, when numerous offshore wind projects along those coasts are likely to be complete).

As a conservative measure, assuming that the change in tourism behavior due to visible WTGs is noticeable, and in consideration of potential increases in navigational complexity and navigational safety concerns within the Lease Area, Proposed Action O&M would have a long term, continuous, and moderate impact, as well as minor beneficial impacts on recreation and tourism.

In the context of reasonably foreseeable environmental trends, structures from other planned offshore wind development would generate comparable types of impacts on recreation and tourism as the Proposed Action alone. The geographic extent of impacts would increase as additional offshore wind projects are constructed. The Proposed Action would contribute a noticeable increment to the impacts of offshore structures on recreational activities from ongoing and planned activities including offshore wind, which would be moderate and minor beneficial.

Traffic: As stated for the Port Utilization IPF, the Proposed Action O&M would primarily use Ocean City Harbor and the Ocean City Inlet for O&M vessel trips, generating a maximum of seven vessels during the summer months for typical O&M (COP, Volume II, Appendix C1, Table 3; US Wind 2023) and one or two trips per week during other seasons (US Wind 2023 Vessel summary RFI 2023-02-05). These vessel volumes would be nearly indistinguishable from existing vessel activity levels; therefore, traffic from Proposed Action O&M would have localized, long-term, intermittent, negligible impacts on recreational vessel traffic near ports and in open waters.

Section 2.3 describes the non-routine activities associated with the Proposed Action. Activities requiring repair of WTGs, equipment or cables, or spills from maintenance or repair vessels, which could affect water quality, would generally require intense, temporary activity to address emergency conditions or respond to an oil spill. Non-routine activities could temporarily prevent or deter recreation or tourist activities near the site of a given non-routine event. With implementation of the navigation-related mitigation measures listed in Appendix G, the impacts of non-routine activities on recreation and tourism would be minor.

Even if other offshore wind projects also use Ocean City Harbor as an O&M base, multiple operating offshore wind projects in the geographic analysis area would result in small increases in vessel traffic between ports and offshore wind areas, insufficient to result in delays for other vessels. In the context of reasonably foreseeable environmental trends, operation of the Proposed Action would contribute a substantial increment to the combined vessel traffic impacts on recreation and tourism from ongoing and planned activities including offshore wind, which would be long term, intermittent, localized, and negligible.

3.6.8.5.3 Conceptual Decommissioning

The impacts of Onshore and Offshore Project decommissioning would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Decommissioning would require offshore traffic and equipment usage for removal of offshore structures. Impacts from cable removal could be negligible to minor if some offshore or inshore export cables are retired in place rather than removed. Overall, decommissioning is anticipated to have negligible to moderate impacts on recreation and tourism.

In the context of reasonably foreseeable environmental trends, decommissioning of the Proposed Action would contribute a substantial increment to the combined decommissioning impacts on recreation and tourism from ongoing and planned activities including offshore wind, which would be long term, intermittent, localized, and negligible to moderate.

3.6.8.5.4 Conclusions

Overall, BOEM anticipates Proposed Action's impacts on recreation and tourism would be **negligible** to **moderate** adverse with **minor beneficial** impacts. Impacts from the Proposed Action would result from short-term impacts during construction: noise, anchored vessels, and hindrances to navigation from the installation of the export cable and WTGs; and the long-term presence of cable and foundation hard protection and structures in the Lease Area during O&M, with resulting impacts on recreational vessel navigation and visual quality. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures.

In the context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on recreation and tourism would range from undetectable (i.e., for vessel traffic) to substantial (i.e., for visual impacts from the presence of structures). BOEM anticipates the overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** adverse with **minor beneficial** impacts. The main drivers for this impact rating are the visual impacts associated with the presence of structures and lighting; impacts on fishing and other recreational activity from noise, vessel traffic, and cable emplacement during construction; and beneficial impacts on fishing from the reef effect.

3.6.8.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Recreation and Tourism

Alternatives C-1 and C-2 would alter the routes of onshore and offshore export cables and could thus affect the exact length of cable installed and area of ocean floor and land disturbed. The Onshore Export Cable Routes for Alternatives C-1 and C-2 would follow road and utility ROWs. The routes would not cross recreational lands, but may cause temporary noise, dust and emissions near recreation sites along the routes. Alternatives C-1 and C-2 could result in short-term disruption of traffic along roads such as SR 1 and SR 404, which are heavily used by local and tourist traffic, especially (but not exclusively) during the summer tourist season. Disruption of traffic along these public roads during Onshore Export Cable Route installation would have an impact on tourist-related travel, whereas Alternative B would disrupt recreational boating within the Indian River Bay and Indian River during cable installation. Although the type and location of impact is different, the impacts of Alternative B and C cable installation on recreation and tourism are both short-term and localized.

3.6.8.6.1 Conclusions

While Alternatives C-1 and C-2 would have marginally different impacts, they would have the same overall impact magnitudes as Alternative B. As a result, the impacts of Alternatives C-1 and C-2 would likely remain the same as Alternative B: **negligible** to **moderate** and **minor beneficial**. In the context of reasonably foreseeable environmental trends and planned actions, Alternatives C-1 and C-2 would occur under the same scenario (Appendix D) as Alternative B. The overall impact of Alternatives C-1 and C-2 on recreation and tourism when combined with past, present, and reasonably foreseeable activities would therefore be **moderate** adverse and **minor beneficial**.

3.6.8.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative on Recreation and Tourism

Alternative D would exclude all WTGs and OSSs within 14 mi (22.5 kilometer) of the shoreline, resulting in the exclusion of 32 WTGs and 1 OSS. The exclusion of 32 WTGs could reduce the potential impact on visitor experience and visitor-oriented businesses attributable to the views of WTGs during O&M. Nearly all Proposed Action WTGs would be beyond 15 miles (24.1 kilometers) from shoreline; as described in Section 3.6.8.3, 15 miles (24.1 kilometers) is the point at which impacts on businesses dependent on recreation and tourism activity were found to be negligible due to views of WTGs (Parsons and Firestone 2018). However, the visual assessment indicates that Alternative D would have seascape/landscape and visual impacts similar to Alternative B (Section 3.6.9).

Alternative D would also incrementally reduce impacts on recreational boating resulting from marine traffic, noise, seafloor disturbance, scour and cable hard protection, and navigational complexity during construction, O&M, and decommissioning because there would be fewer offshore structures and they would be further from the coast. However, for the recreational boaters that do enter the area occupied by WTGs during O&M, Alternative D would have similar risks (compared to Alternative B) of vessel allisions and collisions within the Lease Area, would still reduce the effectiveness of USCG SAR activities in the Lease Area.

3.6.8.7.1 Conclusions

Based on the discussions above, while some individual components of impact would be reduced under Alternative D, the overall level of impacts of Alternative D would be similar to Alternative B: **negligible** to **moderate** and **minor beneficial**. In the context of reasonably foreseeable environmental trends and planned actions, Alternative D would occur under the same scenario as Alternative B (Appendix D). The overall impact of Alternative D on recreation and tourism when combined with past, present, and reasonably foreseeable activities would therefore be **moderate** adverse and **minor beneficial**.

3.6.8.8 Impacts of Alternative E – Habitat Impact Minimization Alternative on Recreation and Tourism

Alternative E would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), and realignment of the offshore export cables. The WTG positions removed for Alternative E would not meaningfully alter the views of WTGs within the Lease Area or the navigational complexity for recreational vessels. Accordingly, these changes would not change the impact levels for Alternative B related to IPFs for the presence of offshore structures.

3.6.8.8.1 Conclusions

The impacts of Alternative E would likely remain the same as Alternative B: **negligible** to **moderate** and **minor beneficial**. In the context of reasonably foreseeable environmental trends and planned actions, Alternative E would occur under the same scenario as Alternative B (Appendix D). The overall impact of Alternative E on recreation and tourism when combined with past, present, and reasonably foreseeable activities would therefore be **moderate** adverse and **minor beneficial**.

3.6.8.9 Comparison of Alternatives

As described in Section 3.6.8.5, the Proposed Action in combination with ongoing and planned activities would have similar impacts on recreation and tourism as the No Action Alternative: **moderate** adverse as well as **minor beneficial**. The Proposed Action would impact recreation and tourism primarily through construction vessel anchoring, noise, and hindrances to navigation from the installation of the export cable and WTGs, as well as the long-term presence of cable and foundation hard protection and structures in the Lease Area during O&M, with resulting impacts on recreational vessel navigation and visual quality. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures. Under the No Action Alternative, these impacts would not occur.

Alternatives C-1 and C-2 would have different landfall locations and Onshore Export Cable Routes, while Alternatives D and E would have a reduced number of WTGs and OSSs. These differences notwithstanding, the impact magnitudes for the action alternatives would be similar to those for Alternative B: **moderate** and **minor beneficial**. In the context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternatives on recreation and tourism when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **moderate** and **minor beneficial**.

If BOEM requires the mitigation measures beyond the design features described in Section 3.6.8.4, particularly the implementation of ADLS for other offshore wind projects, then adverse Proposed Action impacts on recreation and tourism could be further reduced and beneficial impacts could be increased; however, overall impact magnitudes would remain the same as described in this section.

3.6.9 Visual Resources

This section discusses potential impacts on seascape, open ocean, and landscape character and viewers from the Project, action alternatives, and ongoing and planned activities in the visual resources geographic analysis area, as recommended in Sullivan (2021) (*Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Developments on the Outer Continental Shelf of the United States*) and Landscape Institute and Institute of Environmental Management & Assessment (2016) (*Guidelines for Landscape and Visual Impact Assessment*). US Wind's evaluation of the proposed Project's visual impacts did not fully implement BOEM's SLVIA methodology (Sullivan 2021). Specifically, US Wind defined Landscape Similarity Zones (LSZ) based on National Land Cover Database mapping, but did not identify or define seascape, open ocean, or landscape character areas as recommended in Sullivan (2021). As a result, the Draft EIS applies the Seascape/Landscape and Visual Impact Assessment (SLVIA) methodology (Sullivan 2021) to the extent possible, based on information provided in the COP (Volume II, Section 15.0; US Wind 2023 and Appendix II-J1; US Wind 2023).

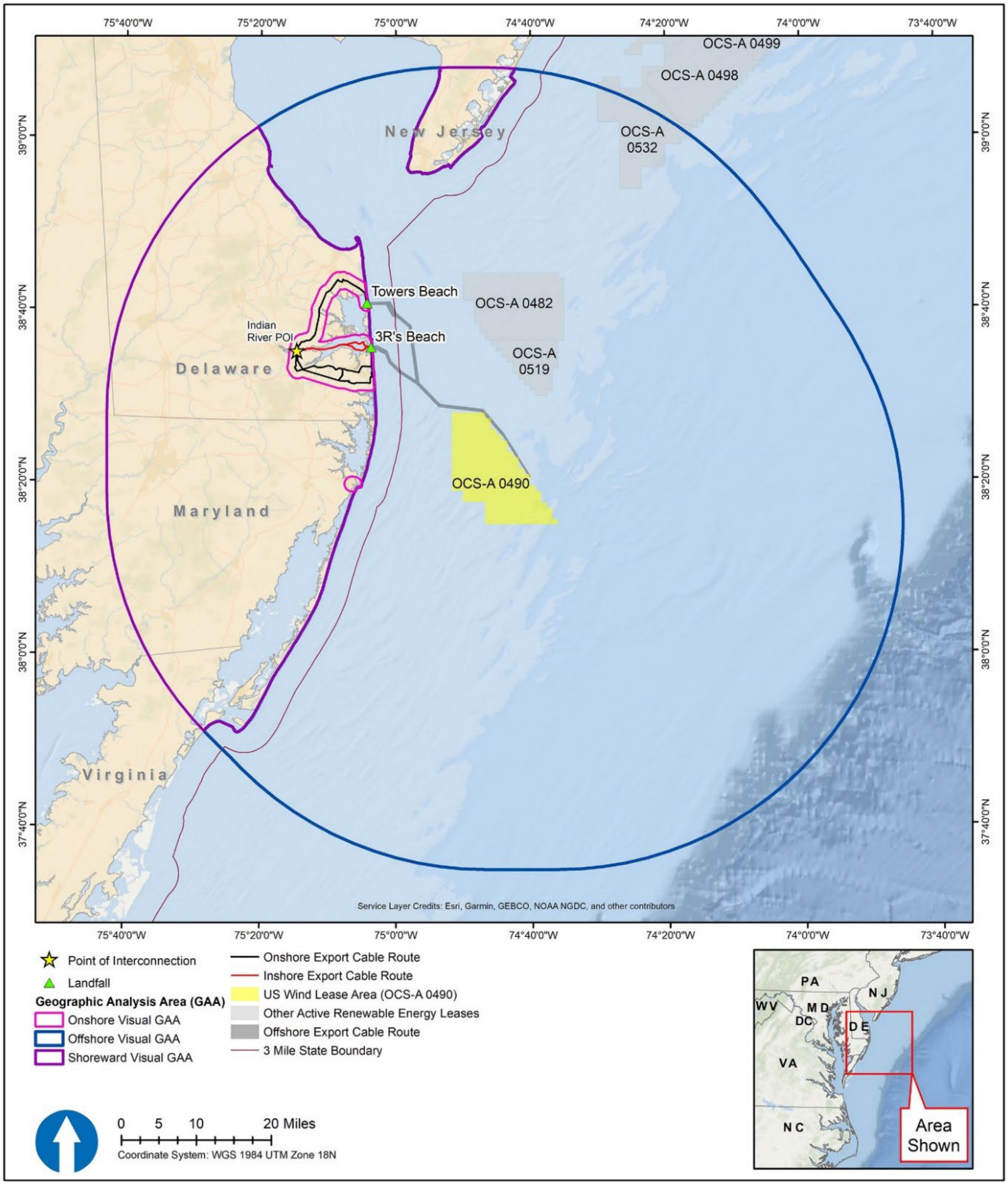

Figure 3.6.9-1. Visual resources geographic analysis area

The 43-mile (69-kilometer) offshore geographic analysis area (Figure 3.6.9-1) includes the New Jersey, Delaware, Maryland, and Virginia coastlines from Cape May, New Jersey, to Chincoteague, Virginia. The overall offshore visual analysis area encompasses 8,043 square miles (20,831 square kilometers) and includes 90 miles (145 kilometers) of oceanfront shoreline in Maryland, Delaware, Virginia, and New Jersey (excluding Delaware Bay). Approximately 1,766 square miles (4,574 square kilometers, 22 percent) of the area is landward of the shoreline (i.e., the shoreward geographic analysis area), of which approximately 14 percent would have views of Project facilities (COP, Volume II, Appendix J1; US Wind 2023); other portions of the shoreward geographic analysis area would not have views due to screening by buildings, topography, and/or vegetation.

The onshore geographic analysis area encompasses the 1-mile (1.6-kilometer) perimeters from the onshore substations, landfall, Inshore Export Cable Route to the onshore substations, the connection from the onshore substation to the existing electrical grid, and O&M facility in Ocean City, Maryland.

This geographic analysis area was selected to coincide with the US Wind's Seascape, Landscape, and Visual Impact Assessment (SLVIA) analysis area (COP, Volume II, Appendix J1; US Wind 2023) to address Project visibility from sensitive resources and encompass all locations where BOEM anticipates impacts associated with Project construction, O&M, and conceptual decommissioning. Appendix H, *Cumulative Seascape, Landscape, and Visual Impact Assessment*, contains additional analysis of the LSZs as well as viewer experiences that would be affected by the Proposed Action and action alternatives, and visual simulations of Alternative A (No Action Alternative), Alternative B (Proposed Action), Alternative D (No Surface Occupancy to Reduce Visual Impacts), and Alternative E (Habitat Impact Minimization Alternative). The other action alternatives (Sections 3.6.9.5 and 3.6.9.8) would not affect the number or location of WTGs, and thus did not require simulations.

The maximum vertical blade tip height of the Project WTGs would be 938 feet (286 meters) and the center hub height would be 528 feet (161 meters). FAA-required aviation hazard lights would be mounted on top of the WTG nacelles, slightly higher than the center hub height. Due to the tall blade height, the WTGs will be visible from farther away than the nacelles. Based on BOEM's SLVIA methodology, this study uses 43 miles (69 kilometers) as the outer limit of visibility for the WTGs (Sullivan 2021). Most of the Project area where the WTGs are visible consists of open ocean and the shoreline. In built-up areas such as Ocean City and Delaware beach towns, the first row of buildings tend to obstruct views from locations farther inland. Areas farther from the shoreline would have limited views due to intervening vegetation and potential smaller structures that were not accounted for in the visual analysis (COP, Volume II, Appendix J1; US Wind 2023).

The onshore facilities will consist of two US Wind substations and an interconnection to the existing Indian River 230 kV substation, which is adjacent to the Indian River Power Plant near Millsboro, Delaware, as well as an O&M facility in Ocean City, Maryland. The substations would sit northwest and southwest of the Indian River substation and connect via a short overhead line. The location of the O&M facility has not been determined. One option would use existing structures near the Ocean City Inner Harbor, which would not affect the visual character of the area. Another option includes development of new facilities on a property less than 0.1 mile (0.2 kilometer) inland of the Ocean City Inner Harbor.

This facility would be adjacent to existing marine commercial uses, and also would not affect the visual character of the area.

3.6.9.1 Description of the Affected Environment and Future Baseline Conditions

This section summarizes the seascape (areas adjacent to and influenced by views of the open ocean), open ocean, landscape, and viewer baseline conditions as described in the COP (Volume II, Appendix J1; US Wind 2023). According to the National Land Cover Database analysis, 81 percent of the geographic analysis area is open water, including ponds, lakes, Delaware Bay, and the Atlantic Ocean. In addition, 13 percent of the shoreward geographic analysis area is inland open water. The remainder of the shoreward geographic analysis area contains forests and forested wetlands, agricultural land; developed open space such as golf courses and recreational fields; wetlands; developed areas of low, medium, and high urban intensity; beaches; and scrub/shrub grassland areas. Urban areas in the shoreward geographic analysis area are clustered around Ocean City, Maryland; Fenwick Island, Bethany Beach, Rehoboth Beach, and Lewes, Delaware; Cape May and Wildwood, New Jersey; and along major road routes such as Route 26 in Bethany Beach and Route 20 in Fenwick Island. Within developed areas views (except for ocean-facing views from the shoreline) are limited to local scenes and have substantial visual clutter and potential visual interest within the zone itself. Expansive ocean views are limited to unobstructed shore-facing developed areas (i.e., beaches and adjacent uses). Publicly accessible beaches run nearly the full length of the shorefront of the geographic analysis area. While beaches account for a small percentage of the landscape area, they have the highest visual exposure to the Project due to the expansive ocean views.

The demarcation line between seascape and open ocean is the most-distant edge of the sea visible from the mean high tide line. The line defining the separation of seascape and landscape is based on the juxtaposition of seacoast and landward landscape elements, including topography, water (bays and estuaries), vegetation, and structures.

The geographic analysis area is classified by broadly defined land and water areas and more specific LSZs. The land and water areas are based on major differences in landscape structure that define the physical character of the geographic analysis area and include open ocean, shoreline, marsh and bay, and inland areas. Each area is subdivided into LSZs, which are areas defined by similar land use patterns, topography, ecological characteristics, and proximity to the ocean. LSZs provide a framework to systematically analyze potential visual effects throughout the geographic analysis area (COP, Volume II, Appendix J1; US Wind 2023). Table 3.6.9-1 summarizes information on the land and water areas and Landscape Similarity Zones used in this analysis.

Existing visual resources in the geographic analysis area including conservation areas, waterfowl hunting areas, historic resources and districts, scenic byways, national wild and scenic rivers, beachfront residences and hotels with unobscured views of the Atlantic Ocean, lighthouses for maritime safety, military coastal defense facilities, and the Ocean City Bridge (COP, Volume II, Appendix J1; US Wind 2023). The landforms, water, vegetation, and built environment structures of the geographic analysis area contain common and distinctive landscape features as outlined in Table 3.6.9-2.

The visual characteristics of the seascape, open ocean, and landscape conditions in the geographic analysis area, including surroundings of the Lease Area, landfall sites, offshore, Inshore and Onshore Export Cable Routes, and onshore substation areas, contain both locally common and regionally distinctive physical features, characters, and experiential views (Table 3.6.9-3).

Table 3.6.9-1. Landscape similarity zones within the shoreward visual study area

Landscape Similarity Zone	NLCD Classification	Total Area in square miles (percent of total)	Area Visually Affected (square miles)	Percent of Landscape Similarity Zone Visually Affected
Open Water (excluding open ocean)	Open Water	205 (13.4)	82	40.3
Forest and Forested Wetlands	Deciduous Forest, Evergreen Forest, Mixed Forest, Woody Wetlands	577 (37.8)	0.4	<0.1
Agriculture	Cultivated Crops, Pasture/Hay	438 (28.7)	1.8	<0.1
Developed, Open Space	Developed, Open Space	86 (5.6)	1.2	1.4
Wetlands	Emergent Herbaceous Wetlands	73 (4.8)	9.4	12.9
Low Intensity Development (Residential)	Developed, Low Intensity	64 (4.2)	2.1	3.3
Medium Intensity Development (Urban Fringe)	Developed, Medium Intensity	42 (2.8)	2.6	6.3
High Intensity Development	Developed, High Intensity	17 (1.1)	0.8	4.6
Beach	Barren Land (Rock/Sand/Clay)	13 (0.9)	5.5	41.9
Shrub/Scrub and Grasslands	Grassland/Herbaceous, Scrub Shrub	11 (0.7)	<0.1	<0.1
	Total	**1,526 (100)**	**106**	**6.9**

NLCD = National Land Cover Database

Table 3.6.9-2. Landform, water, vegetation, and structures

Category	Landscape Features
Landform	Flat shorelines to gently sloping beaches, dunes, islands, and inland topography
Water	Ocean, bay, estuary, tidal river, river, and stream water patterns
Vegetation	Tidal salt marshes and estuarine biomes, beach grass, meadows, and maritime forests
Structures	Buildings, plazas, signage, parking, roads, trails, seawalls, jetties, and infrastructure

Table 3.6.9-3. Seascape, open ocean, and landscape conditions

LSZ Type	Description
Seascape	Inter-visibility by pedestrians and boaters within coastal and adjacent marine areas (3.45 mile [5.6 kilometer]) within the 43-mile (69-kilometer) geographic analysis area.
Seascape Character	Experiential characteristics stem from built and natural landscape forms, lines, colors, and textures to the foreground water's tranquil, mirrored, and flat; active, rolling, and angular; vibrant, churning, and precipitous. Forms range from horizontal planar to vertical structures', landscapes', and water's slopes; lines range from continuous to fragmented and angular; colors of structures, landscape, and the water's foam, and spray reflect the changing colors of the daytime and nighttime, built environment, land cover, sky, clouds, fog, and haze; and textures range from mirrored smooth to disjointed coarse.
Open Ocean	Inter-visibility within the open ocean (beyond the 3.45-mile [5.6-kilometer] seascape area) within the 43-mile (69-kilometer) geographic analysis area from seagoing vessels, including recreational cruising and fishing, commercial cruise ship routes, commercial fishing activities, tankers and cargo vessels; and air traffic over and near the WTG array and cable routes.
Open Ocean Features	Physical features range from flat water to ripples, waves, swells, surf, foam, chop, and whitecaps.
Open Ocean Character	Experiential characteristics range from tranquil, mirrored, and flat; to active, rolling, and angular; to vibrant, churning, and precipitous. Forms range from horizontal planar to vertical slopes; lines range from continuous and horizontal to fragmented and angular; colors of water, foam, and spray reflect the changing colors of sky, clouds, fog, haze, and the daytime and nighttime, built environment and land cover; and textures range from mirrored smooth to disjointed coarse.
Landscape	Inter-visibility within the adjacent inland areas, seascape, and open ocean; nighttime views diminished by ambient light levels of shorefront development; open, modulated, and closed views of water, landscape, and built environment; and pedestrian, bike, and vehicular traffic throughout the region.
Landscape Features	Natural elements: landward areas of barrier islands, bays, marshlands, shorelines, vegetation, tidal rivers, flat topography, and natural areas. Built elements: boardwalks, bridges, buildings, gardens, jetties, landscapes, life-saving stations, umbrellas, lighthouses, parks, piers, roads, seawalls, skylines, trails, single-family residences, commercial corridors, village centers, mid-rise motels, moderate to high-density residences, and high-rise casinos. Designated Public Places: Assateague SP, Assawoman WMA, Bethany Beach Boardwalk, Burton Island Nature Preserve, Cape May National Wildlife Refuge, Cape May SP, Cape Henlopen SP, Delaware Seashore – Fresh Pond, Delaware Seashore SP, Fenwick Island SP, Fort Miles Battery 223, Fort Miles Historic Area, Gordons Pond SP Area, Gordon Pond WMA, Isle of Wight, North Shores Beach, Ocean City Boardwalk, Rehoboth Beach Boardwalk, South Shore Marina, Crook Horn Creek, Edwin B. Forsythe National Wildlife Refuge, Emil Palmer Park, Enos Pond County Park, Forked River State Marina, Forked River Mountain WMA, Garden State Parkway, Gillian's Wonderland Pier, Great Egg Harbor Bay, Island Beach SP, National Natural Landmark Manahawkin Bottomland Hardwood Forest, Ocean City Boardwalk, Ocean City Park, Peck Bay, Sandcastle Park, Southern Pinelands Natural Heritage Trail, Stainton Wildlife Refuge, Stone Harbor Bird Sanctuary, Tuckahoe WMA, Upper Barnegat Bay WMA, Vincent Klune Park, and Wharton State Forest.
Landscape Character	Tranquil and pristine natural, to vibrant and ordered, to chaotic and disordered.

LSZ = landscape similarity zone; SP = State Park; WMA = Wildlife Management Area

The sensitivity of the seascape character within the geographic analysis area is defined by its innate features, elements, and value to residents and visitors. Seascape sensitivity rating criteria are high, medium, or low defined as follows:

- High: Seascape character is distinctive and highly valued by residents and visitors.
- Medium: Seascape character is moderately distinctive and moderately valued by residents and visitors.
- Low: Seascape character is common and unimportant to residents and visitors.
- The sensitivity of the open ocean is defined by the activities of viewers; innate character; and susceptibility to the type of change proposed by the Project.
- High: Open ocean characteristics are pristine, highly distinctive, and highly valued by residents and visitors.
- Medium: Open ocean characteristics are moderately distinctive and moderately valued by residents and visitors.
- Low: Open ocean characteristics are common or with minimal scenic value.

The sensitivity of the landscape character of the geographic analysis area is defined by its innate features, elements, and value to residents and visitors. Landscape sensitivity rating criteria are high, medium, or low defined as follows:

- High: Landscape characteristics are highly distinctive, highly valued by residents and visitors, or within a designated scenic or historic landscape.
- Medium: Landscape characteristics are moderately distinctive and moderately valued by residents and visitors.
- Low: Landscape characteristics are common or within a landscape of minimal scenic value.

3.6.9.2 Impact Level Definitions for Visual Resources

Definitions of impact levels for visual resources are provided in Table 3.6.9-4. Table F-19 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on visual resources.

Table 3.6.9-4. Impact level definitions for visual resources

Impact Level	Definition
Negligible	SLIA: Very little or no effect on LSZ character, features, elements, or key qualities either because the LSZ lacks distinctive character, features, elements, or key qualities; values for these are low; or Project visibility would be minimal. VIA: Very little or no effect on viewers' visual experience because view value is low, viewers are relatively insensitive to view changes, or Project visibility would be minimal.
Minor	SLIA: The Project would introduce features that may have low to medium levels of visual prominence within the geographic area of an LSZ. The Project features may introduce a visual character that is slightly inconsistent with the character of the LSZ, which may have minor to medium negative effects on the unit's features, elements, or key qualities, but the LSZ's features, elements, or key qualities have low susceptibility or value. VIA: The visibility of the Project would introduce a small but noticeable to medium level of change to the view's character; have a low to medium level of visual prominence that attracts but may or may not hold the viewer's attention; and have a small to medium effect on the viewer's experience. The viewer receptor sensitivity/susceptibility/value is low. If the value, susceptibility, and viewer concern for change is medium or high, the nature of the sensitivity is evaluated to determine if elevating the impact to the next level is justified. For instance, a KOP with a low magnitude of change but a high level of viewer concern (combination of susceptibility/value) may justify adjusting to a moderate level of impact.
Moderate	SLIA: The Project would introduce features that would have medium to large levels of visual prominence within the LSZ. The Project would introduce a visual character that is inconsistent with the character of the LSZ, which may have a moderate negative effect on the LSZ's features, elements, or key qualities. In areas affected by large magnitudes of change, the LSZ's features, elements, or key qualities have low susceptibility or value. VIA: The visibility of the Project would introduce a moderate to large level of change to the view's character; may have moderate to large levels of visual prominence that attracts and holds but may or may not dominate the viewer's attention; and has a moderate effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to low. Moderate impacts are typically associated with medium viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has medium levels of change, or low viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has large changes to the character. If the value, susceptibility, and viewer concern for change is high, the nature of the sensitivity is evaluated to determine if elevating the impact to the next level is justified.
Major	SLIA: The Project would introduce features that would have dominant levels of visual prominence within the geographic area of an LSZ. The Project would introduce a visual character that is inconsistent with the character of the LSZ, which may have a major negative effect on the LSZ's features, elements, or key qualities. The concern for change (combination of susceptibility/value) to the LSZ is high. VIA: The visibility of the Project would introduce a major level of character change to the view; attract, hold, and dominate the viewer's attention; and have a moderate to major effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to high. If the magnitude of change to the view's character is medium but the susceptibility or value at the KOP is high, the nature of the sensitivity is evaluated to determine if elevating the impact to major is justified. If the sensitivity (combination of susceptibility/value) at the KOP is low in an area where the magnitude of change is large, the nature of the sensitivity is evaluated to determine if lowering the impact to moderate is justified.

KOP = key observation point; LSZ = landscape similarity zone; SLIA = seascape, open ocean, and landscape impact assessment; VIA = visual impact assessment

3.6.9.3 Impacts of Alternative A – No Action on Visual Resources

When analyzing the impacts of the No Action Alternative on visual resources, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

Under the No Action Alternative, baseline conditions for seascape, open ocean, landscape, and viewers would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities that contribute to impacts on visual resources in the geographic analysis area primarily involve onshore development and construction activities and offshore vessel traffic. These activities could contribute to new structures, traffic congestion, and nighttime light impacts.

Planned non-offshore wind activities within the geographic analysis area that contribute to impacts on seascape, open ocean, landscape, and viewers include activities related to development of undersea transmission lines, gas pipelines, and submarine cables; dredging and port improvements; marine minerals extraction; military use; and marine transportation (Appendix D includes a description of planned activities in the geographic analysis area). Planned activities could affect seascape, open ocean, and landscape character as well as viewer experience through the introduction of structures, light, land disturbance, traffic, air emissions, and accidental releases to the landscape or seascape. Appendix F, Table F-19 provides additional information on potential impacts on visual resources associated with ongoing and planned non-offshore wind activities.

3.6.9.3.1 Future Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind development activities to affect seascape character, open ocean character, landscape character, and viewer experience through the following primary IPFs. The tables in Appendix H, *Cumulative Seascape, Landscape, and Visual Impact Assessment* consider effects on seascape, open ocean, landscape, and viewers of offshore wind development without the Proposed Action and in combination with the Proposed Action.

Accidental releases: Accidental releases during construction, O&M, and decommissioning of offshore wind projects (excluding the Proposed Action) could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewers to experience scenic views along the shore. The potential for accidental releases would be greatest during construction and decommissioning of offshore wind projects and would be lower but continuous during O&M. Accidental releases would cause short-term moderate to major impacts on open water visual resources.

Land disturbance: Other offshore wind development would require installation of onshore export cables, onshore substations, and transmission infrastructure to connect to the electric grid, which would result in localized, temporary visual impacts near construction sites due to land disturbance for vegetation clearing, site grading or trenching, and construction staging. These impacts would last through construction and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M. The exact extent of impacts would depend on the locations of Project infrastructure for offshore wind energy projects; however, the No Action Alternative would generally have localized, short-term minor to moderate impacts on visual resources during construction or O&M due to land disturbance. Impacts would be more widespread and would have higher magnitudes if any onshore export cables are installed aboveground.

Lighting: Construction-related nighttime vessel lighting would be used if offshore wind development projects include nighttime, dusk, or early morning construction or material transport. Lights could be active throughout nighttime hours for two offshore wind projects (Skipjack Wind Phase I and GSOE) within the geographic analysis area (excluding the Proposed Action).

Aircraft and vessel hazard lighting systems would be in use for the entire operations stage of each future offshore wind project, resulting in long-term impacts. The intensity of these impacts would be relatively low, as the lighting would consist of small intermittent flashing lights at a significant distance from the resources. FAA hazard lighting systems would be used for the duration of operations for each planned offshore wind project. This lighting would include synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and two at the top of each WTG nacelle. Field observations of FAA hazard lighting for the Block Island Wind Farm off the coast of Rhode Island were conducted in May 2019 (HDR 2019). These observations, which occurred under clear sky conditions in open water, demonstrated that FAA hazard lighting (mounted at the nacelle top, approximately 328 feet [100 meters] AMSL) was visible up to 26.8 miles (43.1 kilometers) from the viewer (HDR 2019). FAA hazard lighting for Alternative A would be mounted substantially higher (more than 528 feet [161 meters] MLLW) and would thus be visible from greater distances, although the contrast of this light would likely diminish at distances greater than 30 miles (48.3 kilometers) in all but ideal viewing conditions. This lighting would have long-term impacts.

Permanent aviation and vessel warning lighting would be required on all WTGs and ESPs built by future offshore wind projects. Up to 485 WTGs from other offshore wind projects would be within the geographic analysis area and close enough for the nacelle-top aviation warning lights to be visible from the shoreward geographic analysis area. Navigation and aviation lighting would add a permanent developed industrial visual element to views that were previously characterized by dark, open ocean. If implemented on planned offshore wind projects, an aircraft detection lighting system (ADLS) would only activate FAA hazard lighting when aircraft enter a predefined airspace. BOEM assumes if used for other wind energy projects, ADLS would similarly limit the duration of WTG aviation warning lighting use throughout geographic analysis area.

Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

The impact of vessel lighting on visual resources during construction would be localized and short term. Visual impacts of nighttime lighting on vessels would continue at lower magnitudes during O&M of planned offshore wind facilities and the impact on seascape character, open ocean character, nighttime viewer experience, and valued scenery from vessel lighting would be intermittent and long term.

Presence of structures: Other offshore wind development will add structures offshore, including WTGs and OSSs. Under the No Action Alternative, portions of seven offshore wind projects (Skipjack Wind I, GSOE, Skipjack Wind II, Ocean Wind 1, Ocean Wind 2, Atlantic Shores South, and Atlantic Shores North) would be constructed in the geographic analysis area between 2023 and 2030. Up to 485 WTGs and 19 OSS from these projects would be visible from within the geographic analysis area (Appendix D, *Planned Activities Scenario*, Table D2-1) and would contribute to adverse impacts on scenic and visual resources. The largest number of these structures would be visible from the portions of the geographic analysis area in New Jersey and fewer structures visible in Delaware, Maryland, and Virginia. Appendix H, *Cumulative Seascape, Landscape, and Visual Impact Assessment*, provides simulations of offshore wind development without the Proposed Action from 6 key observation points (KOPs) in Virginia, Maryland, Delaware, and New Jersey, as well as one simulation for the onshore substation in Delaware. The presence of structures associated with offshore wind development would affect seascape, open ocean, and landscape character, as well as and viewer experience, with impacts becoming progressively stronger through 2030, when all potentially visible WTGs are in operation (Appendix H).

Traffic: Other offshore wind project construction and decommissioning and, to a lesser extent, O&M would generate increased vessel traffic that could contribute to adverse moderate to major impacts on visual resources within the geographic analysis area. The impacts would occur primarily during construction along water routes between ports and the offshore wind construction areas. Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action, which is projected to generate an average of 130 vessel trips per month in the Lease Area or over the Offshore Export Cable Route at during the construction phase (Section 3.6.6, *Navigation and Vessel Traffic*). As shown in Table 3.6.6-3, between 2023 and 2030, three offshore wind projects (excluding the Proposed Action) could be under construction, including two (Skipjack Wind I and GSOE) under construction simultaneously in 2024. During such periods, assuming similar vessel counts as under the Proposed Action, construction of offshore wind projects would generate an average of 260 vessel trips per month from Atlantic Coast ports to worksites in the geographic analysis area, with as many as 74 vessels present (either underway or at anchor) during times of peak construction.

Onshore and offshore visual impacts would continue from visible vessel activity related to O&M of offshore wind facilities. Based on the estimates for the Proposed Action, O&M of three offshore wind projects under the No Action Alternative would generate an average of 390 vessel trips per month within the geographic analysis area. During O&M of offshore wind projects (excluding the Proposed Action), vessel traffic would result in long-term, intermittent effects on seascape and open ocean character through the addition of new visual elements that are out of character with the underlying seascape, open ocean, or landscape, and would affect viewer experience of valued scenery through the introduction of contrasting elements. Vessel activity would increase again during decommissioning at the end of the assumed 25-year operating period of each project, with impacts similar to those described for construction.

3.6.9.3.2 Conclusions

Under the No Action Alternative, baseline conditions for visual and scenic resources would continue to reflect current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing and planned non-offshore wind activities would have continuing short- and long-term impacts on seascape, open ocean, and landscape character and viewer experience, primarily through the daytime and nighttime presence of structures, lighting, and vessel traffic. The character of the seascape would change in the short term and long term through natural processes and planned activities that would continue to shape onshore features and character. These same processes would also affect viewer experience through the introduction of contrasting features. Ongoing activities in the geographic analysis area that contribute to visual impacts include construction activities and vessel traffic, which lead to increased nighttime lighting, visible congestion, and the introduction of new structures.

Planned activities in the geographic analysis area other than offshore wind include new cable emplacement and maintenance, dredging and port improvements, marine minerals extraction, military use, marine transportation, and onshore development activities. Other offshore wind projects planned within the geographic analysis area would lead to the construction of up to 110 WTGs in areas where no offshore structures currently exist and would change the surrounding marine environment from undeveloped ocean to a wind farm environment. The seascape character and open ocean character would reach the maximum level of change to their features and characters from formerly undeveloped ocean to prominent wind farm character by approximately 2030.

Under the No Action Alternative, current regional trends and activities would continue, and visual resources would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **minor** to **moderate** impacts on visual resources from ongoing activities. The No Action Alternative combined with all other planned activities (including other offshore wind activities) would result in **major** impacts on visual and scenic resources within the geographic analysis area due to addition of new structures, nighttime lighting, onshore construction, and increased vessel traffic.

3.6.9.4 Relevant Design Parameters and Potential Variances in Impacts

This Draft EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) would influence the magnitude of the impacts on visual resources:

- The Project layout, including the number, size, and placement of the WTGs and OSSs, and the design of lighting systems for structures;
- The number and type of vessels involved in construction, O&M, and decommissioning, and time of day that construction, O&M, and decommissioning would occur; and
- Inshore and Onshore Export Cable Route options and the size and location of onshore substations.

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

- WTG number, size, location, and lighting: More WTGs and larger turbine sizes closer to shore would increase visual impacts from onshore KOPs.
- The design and type of WTG lighting would affect nighttime visibility of WTGs from shore. Implementation of ADLS technology would reduce visual impacts.

- Vessel lighting: Nighttime construction, O&M, and decommissioning activities that involve nighttime lighting would increase visibility at night.
- Location and scale of Onshore Project components: Installation of larger-scale Onshore Project components in closer proximity to sensitive receptors would have greater impacts.

US Wind has committed to measures to minimize impacts on visual resources such as addressing key design elements including visual uniformity, minimizing aviation lighting impacts on viewers, painting structures off-white, and planning to bury offshore and onshore export cables to the greatest extent possible (COP, Volume II, Table 1-5; US Wind 2023).

3.6.9.5 Impacts of Alternative B – Proposed Action on Visual Resources

This section addresses the impacts associated with construction, O&M, and decommissioning of the Proposed Action on seascape character, open ocean character, landscape character, and viewer experience in the geographic analysis area. The impact level is judged with reference to the sensitivity of the view receptor and the magnitude of impact, which considers the noticeable features; distance and field of view (FOV); view framing and intervening foregrounds; and the form, line, color, and texture contrasts, scale of change, and prominence in the characteristic seascape, open ocean, and landscape.

The degree of adverse effects is determined by the following criteria:

- The characteristics, contrasts, scale of change, prominence, and spatial interactions of the Proposed Action with the special qualities and extents of the baseline seascape, open ocean, and landscape character;
- Inter-visibility between viewer locations and the features of the Proposed Action; and
- The sensitivities of viewers.

Viewers or visual receptors within the zone of theoretical visibility of the Proposed Action include:

- Residents living in coastal communities or individual residences;
- Tourists visiting, staying in, or traveling through the area;
- Recreational users of the shoreline including those using ocean beaches and tidal areas;
- Recreational users of the open ocean, including those involved in yachting, fishing, boating, and passage on ships;
- Recreational users of onshore areas, including those using landward beaches, golf courses, cycle routes, and footpaths;
- Commuters and through-travelers using transport routes;
- People working in the countryside, commerce areas, or dwellings; and
- People working in the marine environment, such as those on fishing vessels and crews of ships.

US Wind identified 13 KOPs (Figure 3.6.9-2) to be representative of sensitive receptors in shoreline and onshore portions of the geographic analysis area (including one KOP focused on the onshore substation). In addition, BOEM included a theoretical offshore (open ocean) KOP to represent typical views of the Lease Area from boats, cruise ships, and commercial ships. The COP (Volume II, Appendix J1, Appendix A; US Wind 2023) presents visual simulations for the Proposed Action alone from each of the three onshore KOPs considered in this analysis. Tables H-9 and H-10 in Appendix H describe the effects on seascape, open ocean, landscape, and viewers of offshore wind development without the Proposed Action and in combination with the Proposed Action.

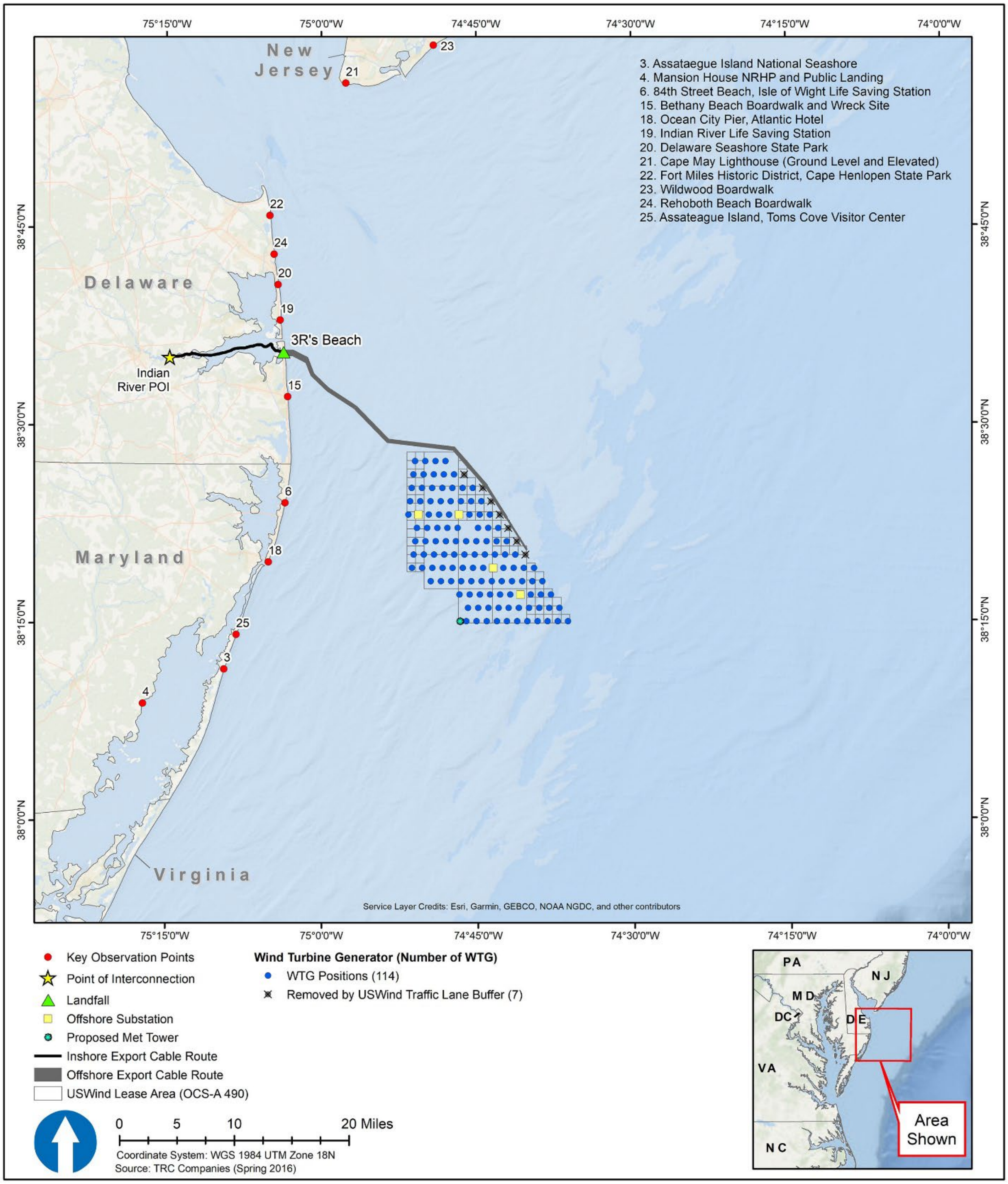

Figure 3.6.9-2. Key observation points

3.6.9.5.1 Construction and Installation

3.6.9.5.1.1 Onshore Activities and Facilities

Land disturbance: The Proposed Action would require installation of onshore substations, and transmission infrastructure to connect to the electrical grid, which would result in localized, temporary visual impacts near construction sites due to land disturbance for vegetation clearing, site grading or trenching, and construction staging. These impacts would last through construction and continue until disturbed areas are restored. The planned O&M facility in the Ocean City Harbor area, would either utilize existing buildings or construct new buildings adjacent to existing marine commercial land uses. Impacts from the Proposed Action related to land disturbance would be minor to moderate.

Construction of onshore components for offshore wind activities could result in construction activities that could impact existing views of visual resources. These impacts would typically consist of short-term disturbance of roads or rights-of-way, as well as construction associated with onshore substations. In the context of reasonably foreseeable trends, the Proposed Action would contribute a minor increment to the combined impacts of land disturbance from ongoing and planned activities including offshore wind, which would be short term, localized, and negligible.

3.6.9.5.1.2 Offshore and Inshore Activities and Facilities

Accidental releases: Accidental releases during construction of the Proposed Action could affect nearby seascape, open ocean, and landscape character, and could also affect the experience of viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewers to experience scenic views along the shore.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an appreciable increment to the combined impacts on visual resources from ongoing and planned activities including offshore wind, which would be moderate to major. The potential for accidental releases would be greatest during construction and decommissioning of offshore wind projects.

Lighting: Nighttime vessel lighting could result from construction of the Proposed Action if the activities are undertaken during nighttime, evening, or early morning hours. Vessel lighting, depending on the quantity, intensity, and location, could be visible from unobstructed sensitive onshore and offshore viewing locations based on viewer distance and atmospheric conditions. The impact of vessel lighting on visual resources during construction would be moderate to major, localized, and short term.

Vessel lights could be active during nighttime hours for up to five offshore wind projects including the Proposed Action. Nighttime vessel lighting for the Proposed Action in combination with other offshore wind development would affect nighttime seascape and open ocean character, as well as the nighttime viewer experience from shore or from vessels. This impact would be localized and short term during construction.

Lighting for offshore wind activities could result in additional negative impacts/changes to existing views of visual resources. In the context of reasonably foreseeable trends, the Proposed Action would contribute a moderate increment to the combined impacts of lighting from ongoing and planned activities including offshore wind, which would be short term, localized, and moderate.

3.6.9.5.2 Operations and Maintenance

3.6.9.5.2.1 Onshore Activities and Facilities

Land disturbance: Intermittent land disturbance may be required to maintain onshore infrastructure of onshore substations, and transmission infrastructure.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined land disturbance impacts on visual resources from ongoing and planned activities including offshore wind, which would be minor to moderate. The exact extent of impacts would depend on the locations of project infrastructure for other offshore wind energy projects.

Presence of structures: The Proposed Action would add up to three onshore substations and interconnection to the Indian River 230 kV substation adjacent to the Indian River Power Plant near Millsboro, Delaware. Considering the location of the sites relative to scenic resources and public viewpoints, context of the sites and surrounding land uses, visual contrast between the substations and the surrounding landscape, and ability to screen the substations from public viewpoints, impacts of the substations on visual resources would be negligible to minor. All landfall export cable infrastructure would be underground and would not contribute to impacts on visual resources.

The presence of onshore components for offshore wind activities could impact existing views of visual resources. In the context of reasonably foreseeable trends, the Proposed Action would contribute a negligible increment to the combined impacts of land disturbance from ongoing and planned activities including offshore wind, which would be limited to the power stations, and negligible.

3.6.9.5.2.2 Offshore and Inshore Activities and Facilities

Accidental releases: Accidental releases during O&M of the Proposed Action could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewers to experience scenic views from along the shore.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an appreciable increment to the combined impacts on visual resources from ongoing and planned activities including offshore wind, which would be moderate to major. The potential for accidental releases would be lower than construction and decommissioning during O&M, but continuous.

Lighting: Nighttime vessel lighting could result from O&M of the Proposed Action if these activities are undertaken during nighttime, evening, or early morning hours.

Vessel lighting, depending on the quantity, intensity, and location, could be visible from unobstructed sensitive onshore and offshore viewing locations based on viewer distance and atmospheric conditions. Visual impacts of nighttime lighting on vessels would be ongoing during O&M but long-term impacts would be less due to the lower number of forecast vessel trips than during construction.

Vessel lights could be active during nighttime hours for up to eight offshore wind projects including the Proposed Action. Nighttime vessel lighting for the Proposed Action in combination with other offshore wind development would affect nighttime seascape and open ocean character, as well as nighttime viewer experience from shore and vessels. This impact would intermittent and long term during O&M.

Permanent aviation warning lighting on Proposed Action WTGs would be visible from beaches and coastlines within the geographic analysis area and would have impacts on visual resources. Field observations associated with visibility of FAA hazard lighting under clear sky conditions indicate that FAA hazard lighting may be visible at a distance of 40 miles (64.4 kilometers) or more from the viewer. Darker-sky conditions may increase this distance due to increased contrast of the light dome (reflections from the ocean) and cloud reflections caused by the hazard lights.

US Wind has committed to installing ADLS on WTGs, which would activate the hazard lighting system in response to detection of nearby aircraft but would leave the FAA warning lights off when no aircraft is nearby. Specifically, in accordance with FAA Advisory Circular 70/7460-1M (FAA 2020), lights controlled by an ADLS must activate and illuminate prior to an aircraft reaching 3 nautical miles (5.6 kilometers) from within 1,000 vertical feet (305 meters) of any WTG. Use of ADLS would reduce the duration of obstruction lighting system activation by more than 99 percent compared to continuously illuminated lights in a system without ADLS. As a result, ADLS for the Proposed Action would be activated for approximately 5 hours, 46 minutes, 22 seconds in a 1-year period (Capitol Airspace Group 2023), which is approximately 0.1 percent of all annual nighttime hours.

Use of ADLS would result in shorter-duration night sky impacts on seascape, open ocean, and landscape character, and nighttime viewers, and would therefore have less nighttime visual impacts than standard continuously operating FAA hazard lighting. ADLS hazard lighting would be in use for the duration of O&M of the Proposed Action and would have intermittent and long-term effects on sensitive onshore and offshore viewing locations based on viewer distance and angle of view, and assuming no obstructions.

The OSS would be lit with two medium intensity red obstruction aviation lights, four low-intensity flashing red obstruction lights in a ring (also controlled by ADLS), and a helicopter hoist light to provide safe working conditions when O&M personnel are present. Lights of the four OSSs, when lit for maintenance, would potentially be visible from beaches and adjoining areas during hours of darkness. The nighttime sky light dome and cloud lighting caused by reflections from the water surface may be seen from distances beyond the 40-mi (64.4-kilometer) geographic analysis area, depending on variable ocean surface and meteorological reflectivity.

FAA hazard lighting systems would be in use for the duration of O&M for up to 601 WTGs and 23 OSS including the Proposed Action and other offshore wind development. These WTGs will have two medium-intensity flashing red lights atop the nacelle, four low-intensity flashing obstruction lights mid-tower, and a helicopter hoist light, within the offshore wind lease areas would have long-term impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

The extent to which other offshore wind projects would implement ADLS is unknown. Impacts from lighting would be reduced if ADLS is implemented across all offshore wind projects in the geographic analysis area and would be more adverse if other projects do not commit to using ADLS. BOEM assumes that implementation of ADLS for other projects in the geographic analysis area would result in similar reductions in nighttime visual impacts of those projects as described above for the Proposed Action. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations. Each offshore wind project would also have at least one OSS that would be lit and marked in accordance with BOEM and USCG lighting standards.

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an appreciable increment to the combined lighting impacts on visual resources from ongoing and planned activities including offshore wind, which would be major. Due to variable distances from visually sensitive viewing locations and potential use of ADLS, other reasonably foreseeable offshore wind projects in combination with the Proposed Action would have minor to major long-term impacts on visually sensitive viewing areas due to lighting. The recreational and commercial fishing, pleasure, and tour boating community would experience major adverse effects in foreground views.

Appendix H, *Cumulative Seascape, Landscape, and Visual Impact Assessment*, in this Draft EIS provides US Wind's simulations of the Proposed Action from 13 KOPs with views of the Proposed Action (including one simulation of the onshore substation) and provides an assessment of the Proposed Action's impacts on seascape, landscape, and open ocean character within the geographic analysis area, as well as impacts on viewer experience.

Lighting for other offshore wind projects could result in additional adverse impacts on existing views of visual resources. In the context of reasonably foreseeable trends, the Proposed Action would contribute a moderate increment to the combined impacts of lighting from ongoing and planned activities including offshore wind, which would be long term, localized, and moderate.

Presence of structures: The Proposed Action would install up to 121 WTGs (PDE) extending up to 938 feet (286 meters) above MSL; 4 OSSs extending up to 144 feet (43 meters) and 128 feet (39 meters) above MSL for the 400 MW and 800 MW substations respectively; and 1 Met Tower 328 feet (100 meters) above MSL within the Lease Area. The WTGs would be painted the FAA-recommended paint color no lighter than Pure White (RAL 9010), and no darker than Light Grey (RAL 7035). Additionally, the lower sections of each WTG would be marked with high-visibility (RAL 1023) yellow paint from the MLLW line to a minimum height of approximately 74.1 feet (22.6 meters) above MLLW. The presence of structures within the geographic analysis area under the Proposed Action would affect seascape, open ocean, and landscape character, as well as viewer experience. The magnitude of WTG and OSS impact is defined by the contrast, scale of the change, prominence, FOV, viewer experience, geographical extent, and duration, correlated against the sensitivity of the receptor, as simulated from onshore KOPs. Appendix H in this Draft EIS provides the US Wind's visual simulations of WTGs, OSSs, and the Met Tower from each of the 12 ocean-facing onshore KOPs considered in this analysis. The Cumulative SLVIA provided in Appendix H, evaluates the daytime and nighttime impacts that the visible Proposed Action structures would have on seascape, landscape, and open ocean character and viewer experience.

The visibility of up to 601 WTGs and 23 OSS, including the Proposed Action, could impact existing views of visual resources. In the context of reasonably foreseeable trends, the Proposed Action would contribute a major increment to the combined impacts of structures from ongoing and planned activities including offshore wind, which would be long term, localized, and major.

Traffic: O&M of the Proposed Action would generate increased vessel traffic that could contribute to adverse impacts on visual resources within the geographic analysis area. O&M activities for the Proposed Action are anticipated to generate an average of four vessels (a maximum of seven vessels) in the Lease Area at any given time (Section 3.6.6, *Navigation and Vessel Traffic*), with other vessels transiting between a port and the Lease Area. Vessel traffic during O&M would result in long-term, intermittent contrasts to open ocean character and in the viewer experience of valued scenery, although the degree of contrast would be small, because vessels associated with the Proposed Action would likely be similar in appearance to vessels already visible from the geographic analysis area. Vessel traffic from O&M would therefore cause minor impacts on seascape and open ocean character and viewer experience.

Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action. Based on the estimated vessel activity for the Proposed Action (Table 3.6.6-3), a total of approximately 2,466 vessel trips per year (approximately 7 per day) could occur for O&M of the three offshore wind projects in the geographic analysis area. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal increment to the combined vessel traffic impacts on visual resources from ongoing and planned activities including offshore wind, which would be minor. Offshore wind activities would increase vessel traffic in the geographic analysis area beyond what the Proposed Action would generate in isolation.

3.6.9.5.3 Conceptual Decommissioning

The impacts of Onshore and Offshore Proposed Action decommissioning on visual resources would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Decommissioning would require similar types of onshore and offshore traffic, vehicles, vessels, and equipment. Decommissioning would therefore have temporary, moderate to major impacts. Decommissioning activity levels could be lower than construction if some inshore export cables are retired in place rather than removed.

Proposed Action decommissioning would contribute a negligible increment to the combined onshore and offshore infrastructure impacts on visual resources from ongoing and planned activities including offshore wind. In the context of reasonably foreseeable environmental trends, impacts of decommissioning of the Proposed Action and other ongoing or planned activities from lighting, the presence of structures, and traffic would be short term, localized, and moderate to major.

3.6.9.5.4 Conclusions

Table 3.6.9-5 summarizes the impacts of the Proposed Action on LSZs. Table 3.6.9-6 summarizes impacts on viewer experience. Higher impact significance stems from unique, extensive, and long-term appearance of strongly contrasting vertical structures in the otherwise horizontal open ocean environment, where structures are an unexpected element and viewer experience includes formerly open views of high-sensitivity seascape, open ocean, and landscape, and from high-sensitivity view receptors. Table 3.6.9-5 consider the totality of the level of impact of the Proposed Action by LSZ.

Table 3.6.9-5. Proposed Action impact on landscape similarity zones

Impact Level	Landscape Similarity Zone
Major	Atlantic Ocean, Developed—High Intensity, Developed—Medium Intensity, Beaches, Low Vegetation
Moderate	None
Minor	Inland Open Water
Negligible	Forest, Agricultural Land, Developed Open Space, Wetlands, Developed—Low Intensity

SLIA = seascape, open ocean, and landscape impact assessment

Table 3.6.9-6. Proposed Action impact on viewer experience

Key Observation Points	Level of Impact
3. Assateague Island National Seashore; Assateague Island, MD	Major
4. Mansion House NRHP and Public Landing; Snow Hill, MD	Moderate
6. 84th Street Beach, Isle of Wight Life Saving Station; Ocean City, MD	Major
15. Bethany Beach Boardwalk and Wreck Site; Bethany Beach, DE	Major
19. Indian River Life Saving Station; Rehoboth Beach, DE	Major
18. Ocean City Pier, Atlantic Hotel; Ocean City, MD	Major
20. Delaware Seashore State Park; Dewey Beach, DE	Major
21. Cape May Lighthouse, Cape May, NJ (Ground level and elevated)	Moderate
22. Fort Miles Historic District, Cape Henlopen State Park; Lewes, DE	Major
23. Wildwood Boardwalk; Wildwood, NJ	Moderate
24. Rehoboth Beach Boardwalk; Rehoboth Beach, DE	Major
25. Assateague Island, Toms Cove Visitor Center; Chincoteague, VA	Major
State Route 24 (Onshore Substation)	Minor
Theoretical Offshore Location	Major

The seascape, open ocean, and landscape character units, and viewer experience would be affected during construction, O&M, and decommissioning by Project features, applicable distances, horizontal and vertical FOV extents, view framing or intervening foregrounds, and form, line, color, and texture contrasts, scale of change, and prominence. These assessments are documented in Appendix H. Project decommissioning effects would be similar to construction effects. Due to distance, extensive FOVs, strong contrasts, large scale of change, and level 6 prominence, and heretofore undeveloped ocean views, the Proposed Action would have **major** impacts on the Atlantic Ocean LSZ and viewer boating and cruise ship experiences. Due to view distances (effects ranges discussion in Appendix H), moderate FOVs, moderate and weak visual contrasts, clear-day conditions, and nighttime ADLS activation, Proposed Action effects on high- and moderate-sensitivity LSZs would be **moderate** to **major**. The daytime presence of offshore WTGs and OSSs, as well as their nighttime lighting, would change perception of ocean scenes from natural and undeveloped to a developed wind energy environment characterized by WTGs and OSSs. In clear weather, the WTGs and OSSs would be an unavoidable presence in views from the coastline, with **moderate** to **major** effects on seascape and landscape character.

Onshore, temporary **moderate** effects would occur during construction and decommissioning of the landfall. Effects during O&M activities would involve temporary vehicular and personnel presence and would be **negligible**. The context of the onshore substation sites surrounding industrial elements, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be insubstantial as viewed from the KOPs. While the visibility of the Project would be moderately prominent from the KOPs, the value of the view is low, having little or no effect on viewers' quality of visual experience. Impacts of the onshore substations on visual resources would be **negligible** to **minor**. Impacts of the Proposed Action on visual resources would range from **minor** to **major**.

In the context of other reasonably foreseeable environmental trends in the area, the incremental impacts contributed by the Proposed Action to the overall impacts on visual resources would be appreciable. BOEM anticipates the overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind development would be **major**. The main drivers for this impact rating are the **major** visual impacts associated with the presence of structures, lighting, and vessel traffic.

3.6.9.6 Impacts of Alternatives C and E on Scenic and Visual Resources

Alternative C-1 would use the Towers Beach landfall instead of the 3R's Beach landfall, and a terrestrial-based Onshore Export Cable Route (route 2) from the Towers Beach landfall to the Indian River substation (Figure 2-6 in Section 2.1.3, *Alternative C – Landfall and Onshore Export Cable Routes Alternative*). Alternative C-2 would use the same 3R's Beach landfall and Indian River substation site as Alternative B but would select from three different terrestrial-based Onshore Export Cable Routes (routes 1a, 1b, or 1c) to reach the substation site (Figure 2-7). Both Alternatives include an Onshore Export Cable Route from the landfall that avoids installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route). All Onshore Export Cable Routes included in Alternatives C-1 and C-2 would be installed underground, and thus would not be visible during operations. The substation sites proposed for Alternative C would be adjacent to existing electrical substations (as is the case for Alternative B). Alternative C would not change the number or location of WTGs or OSSs. Alternative E would result in the exclusion of 11 WTG positions; however, these excluded positions generally would not be distinguishable from onshore viewing locations. These differences would not change the impact ratings compared to Alternative B. As a result, the scenic and visual impacts associated with the Proposed Action (as described in Section 3.6.9.5) would not change substantially under the other action alternatives.

3.6.9.6.1 Conclusions

While Alternatives C and E would have marginally different impacts, they would have the same impact magnitudes as Alternative B. As a result, the impacts of these action alternatives would likely remain the same as Alternative B: **minor** to **major**. In the context of reasonably foreseeable environmental trends and planned actions, Alternatives C and E would occur under the same scenario (Appendix D) as Alternative B. As stated earlier, Alternatives C and E would have the same impact magnitudes as Alternative B. The overall impact of these action alternatives on visual resources when combined with past, present, and reasonably foreseeable activities would therefore be **major**.

3.6.9.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative on Scenic and Visual Resources

Alternative D would exclude all WTGs and OSSs within 14 miles (22.5 kilometers) of the shoreline, resulting in the exclusion of 32 WTG and 1 OSS positions. The exclusion of the 32 WTG structures closest to shore would incrementally reduce nighttime lighting during construction, O&M, and decommissioning. Eliminating the 32 WTG positions closest to shore would marginally reduce seascape/landscape impacts in all LSZs. Within LSZs with direct ocean views (Developed – High Intensity, Developed – Medium Intensity, Beaches, and Low Vegetation) the removal of these positions would perceptibly reduce the scale of the offshore proposed Project facilities. Similarly, the exclusion of WTGs would marginally reduce visual impacts from all KOPs. These marginal changes notwithstanding, Alternative D would not change the impact magnitude components or ratings provided for Alternative B in Section 3.6.9.5.

3.6.9.7.1 Conclusions

The changes previously described notwithstanding, the impacts of Alternative D would likely remain the same as Alternative B: **moderate** to **major**. In the context of reasonably foreseeable environmental trends and planned actions, Alternative D would occur under the same scenario (Appendix D). The overall impact of Alternative D on visual resources when combined with past, present, and reasonably foreseeable activities would therefore be **moderate** to **major**.

3.6.9.8 Comparison of Alternatives

As described in Section 3.6.9.5, the impacts of the Proposed Action on visual resources in combination with ongoing and planned activities would be substantially larger than the No Action Alternative because the Proposed Action would include most of (and all the closest) WTGs and OSSs visible from onshore viewing locations in the geographic analysis area. The Proposed Action would impact visual resources primarily through lighting and the presence of structures (i.e., WTGs, OSSs, and a Met Tower). Under the No Action Alternative, these impacts would not occur.

The action alternatives could reduce or change the extent of impacts on onshore and offshore visual resources, compared to Alternative B. Alternatives C-1 and C-2 could affect onshore resources due to the inclusion of Onshore Export Cable Routes. Alternative D could affect offshore views due to the exclusion of the proposed 32 WTGs and 1 OSS within 14 miles (22.5 kilometers) of the shoreline. Alternative E could have reduced impacts on open ocean and seascape character (compared to Alternative B) due to the removal of 11 WTGs from the Project. These differences notwithstanding, the action alternatives would not result in meaningfully different impacts on visual resources compared to Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **moderate** to **major** with an overall **moderate** impact. In the context of reasonably foreseeable environmental trends and planned actions, the overall impact of the action alternative would also be the same as Alternative B: **moderate** to **major** with an overall **moderate** impact.

Chapter 4

Other Required Impact Analyses

4 Other Required Impact Analyses

4.1 Unavoidable Adverse Impacts of the Proposed Action

CEQ's NEPA-implementing regulations (40 CFR 1502.16(a)(2)) require that an EIS evaluate the potential unavoidable adverse impacts associated with a Proposed Action. Adverse impacts that can be reduced by mitigation measures but not eliminated are considered unavoidable. Table 4.1-1 summarizes unavoidable adverse impacts for each analyzed resource, subject to applicable mitigation and monitoring (refer to Appendix G). However, it does not include potential additional mitigation measures that could avoid or further minimize or mitigate Project impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction phase and would be temporary. Chapter 3 provides additional information on the potential impacts listed below.

Table 4.1-1. Potential unavoidable adverse impacts of the proposed action

Resource Area	Potential Unavoidable Adverse Impacts of the Proposed Action
Air quality	Impacts from emissions from engines associated with vessel traffic, construction activities, and equipment operation.
Water quality	Increase in erosion, turbidity and sediment resuspension, and inadvertent spills during construction and installation, O&M, and conceptual decommissioning.
Bats	Displacement and avoidance behavior due to habitat loss and alteration, equipment noise, and vessel traffic. Individual mortality due to collisions with operating WTGs.
Benthic resources	Habitat quality impacts including reduction in habitat as a result of seafloor surface alterations. Conversion of soft-bottom habitat to new hard-bottom habitat.
Birds	Displacement and avoidance behavior due to habitat loss and alteration, equipment noise, and vessel traffic. Individual mortality due to collisions with operating WTGs.
Coastal habitats and fauna	Habitat alteration and removal of vegetation, including trees. Displacement and avoidance behavior from habitat loss and alteration and from equipment noise. Individual mortality from collisions with vehicles or construction equipment. Short-term habitat alteration.

Resource Area	Potential Unavoidable Adverse Impacts of the Proposed Action
Finfish, invertebrate, and Essential Fish Habitat	Increase in suspended sediments and resulting effects due to seafloor disturbance. Displacement, disturbance, and avoidance behavior due to habitat loss and alteration, equipment noise, vessel traffic, increased turbidity, sediment deposition, and electromagnetic fields. Individual mortality due to construction and installation, O&M, and conceptual decommissioning. Habitat quality impacts, including reduction in certain habitat types as a result of seafloor surface alterations. Conversion of soft-bottom habitat to new hard-bottom habitat.
Marine mammals	Displacement, disturbance, and avoidance behavior due to habitat loss and alteration, equipment noise, vessel traffic, increased turbidity, and sediment deposition during construction and installation and O&M. Short-term loss of acoustic habitat and increased potential for vessel strikes.
Sea turtles	Disturbance, displacement, and avoidance behavior due to habitat loss and alteration, equipment noise, vessel traffic, increased turbidity, sediment deposition, and electromagnetic fields.
Wetlands and other WOTUS	Increase in soil erosion, sedimentation, and discharges and releases from land disturbance during construction and installation, O&M, and conceptual decommissioning.
Commercial fisheries and for-hire recreation fishing	Disruption to access or short-term restriction in port access or harvesting activities due to construction of offshore Project elements. Disruption to harvesting activities during operations of offshore wind facility. Changes in vessel transit and fishing operation patterns. Changes in risk of gear entanglement or target species.
Cultural resources	Impacts to unidentified or undefined submerged marine archaeological resources, terrestrial archaeological resources, and above-ground historic structures from Project construction and installation and O&M. Impacts to above ground historic structures and to the viewshed from Project construction, installation, and O&M.
Demographics, employment, and economics	Any unavoidable disruptions to recreational fishing, commercial fishing, recreation, and tourism would cause commensurate disruptions to the workers and businesses in those industries.
Environmental justice	Changes to air quality, water quality, onshore noise, land use and coastal infrastructure, recreational and subsistence fishing, and commercial and for-hire recreational fishing that are disproportionately borne by minority or low-income populations from Project construction and installation, O&M, and conceptual decommissioning.
Land use and coastal infrastructure	Land use disturbance due to construction as well as effects due to noise, vibration, and travel delays.

Resource Area	Potential Unavoidable Adverse Impacts of the Proposed Action
Navigation and vessel traffic	Changes in vessel transit patterns.
Other marine uses	Changes in access to marine mineral resources, and cable placement. Disruption of scientific surveys, radar systems, military, and aviation traffic.
Recreation and tourism	Disruption of coastal recreation activities during onshore construction, such as beach access. Viewshed effects from the WTGs altering enjoyment of marine and coastal recreation and tourism activities. Disruption to access or short-term restriction of in-water recreational activities from construction of offshore Project elements. Hindrances to some types of recreational fishing from the WTGs during operation.
Visual resources	Change in the quality of scenic and visual resources. Alterations to the open ocean, seascape, and landscape character, and effects on viewer experience from onshore and offshore viewing locations by the wind turbine generators and offshore substations located within the offshore lease area, vessel traffic, onshore landing sites, onshore export cable routes, onshore substation and converter station, and electrical connections with the power grid.

O&M = operations and maintenance; WOTUS = Waters of the United States; WTG = wind turbine generator

4.2 Irreversible and Irretrievable Commitment of Resources

CEQ's NEPA-implementing regulations (40 CFR 1502.16(a)(4)) require that an EIS review the potential impacts on irreversible or irretrievable commitments of resources resulting from implementation of a Proposed Action. CEQ considers a commitment of a resource irreversible when the primary or secondary impacts from its use limit the future options for its use. Irreversible commitments occur when the primary or secondary impacts from the use of a resource either destroy the resource or preclude it from other uses. Irretrievable commitments occur when a resource is consumed to the extent that it cannot recover or be replaced. Table 4.2-1 summarizes irreversible or irretrievable effects for each analyzed resource, subject to applicable mitigation measures. Table 4.2-1 does not include specific additional mitigation measures that could avoid or further minimize or mitigate Project impacts. Chapter 3 provides a detailed discussion of the effects associated with the Project.

Table 4.2-1. Irreversible and irretrievable commitment of resources by resource area for the proposed action

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Air quality	No	No	BOEM expects air emissions to be compliant with permits regulating air quality standards, and emissions would be short- term during construction activities. If the Proposed Action displaces fossil-fuel energy generation, overall improvement of air quality would be expected.
Water quality	No	No	BOEM does not expect activities to cause loss of major impacts on existing inland waterbodies or wetlands. Turbidity and other water quality impacts in the marine and coastal environment would be short-term, with the rare exception of a major spill.
Bats	Yes	No	Irreversible impacts on bats could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bat displacement from foraging habitat.
Benthic resources	No	No	Although local mortality of benthic fauna and habitat alteration could occur, BOEM does not anticipate population -level impacts. The Project could alter habitat during construction and operations but could restore the habitat after conceptual decommissioning.
Birds	Yes	No	Irreversible impacts on birds could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bird displacement from foraging habitat.
Coastal Habitat and Fauna	No	No	Although local mortality could occur, BOEM does not anticipate population-level impacts on other coastal fauna. The Project could alter habitat during construction and operations through limited removal of habitat associated with clearing of the substation area but could restore the habitat after conceptual decommissioning.
Finfish, Invertebrates and Essential Fish Habitat	No	No	Although local mortality of finfish and invertebrates could occur, and habitat alteration and loss of SAV habitat could occur, BOEM does not anticipate population- level impacts on finfish, invertebrates, or EFH. It is expected that the aquatic habitat for finfish and invertebrates would recover following decommissioning activities.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Marine mammals	No	Yes	Irreversible impacts on marine mammals could occur if one or more individuals of an ESA-listed species were injured or killed or if those populations experienced behavioral effects of high severity. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of injury or mortality due to vessel strikes or entanglement with fisheries gear, or due to displacement from the Lease Area. With implementation of mitigation measures, developed in consultation with NMFS (e.g., timing windows, vessel speed restrictions, safety zones), the potential for an ESA-listed species to experience high-severity behavioral effects or be injured or killed would be reduced or eliminated. No irreversible high-severity behavioral effects from Project activities are anticipated; however, due to the uncertainties from lack of information that are outlined in Appendix E, these effects are still possible. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of injury or mortality due to vessel strikes or entanglement with fisheries gear, or due to displacement from the Lease Area.
Sea turtles	No	Yes	The implementation of mitigation measures, developed in consultation with NMFS, would reduce or eliminate the potential for impacts on ESA-listed species. Irreversible impacts on sea turtles could occur if one or more individuals of species listed under the ESA were injured or killed. Irretrievable impacts could occur if individuals or populations grown more slowly as a result of injury or mortality due to vessel strikes or entanglement with fisheries gear caught on the structures, or due to displacement from the Lease Area.
Wetlands and other WOTUS	No	No	BOEM does not expect activities to cause loss of or major impacts on existing wetlands or other WOTUS.
Commercial fisheries and for-hire recreation fishing	No	Yes	Based on the anticipated duration of construction, installation, and O&M, BOEM does not anticipate impacts on commercial fisheries to result in irreversible impacts. The Project could alter habitat during construction or reduce vessel maneuverability during operations. However, the conceptual decommissioning of the Project would reverse those impacts. Irretrievable impacts could occur due to the loss of use of fishing areas at an individual level.
Cultural resources	Yes	Yes	Although unlikely, unanticipated removal or disturbance of previously unidentified cultural resources onshore and offshore could result in irreversible or irretrievable impacts.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Demographics, employment, and economics	No	No	Based on the anticipated duration of construction. Installation, and O&M, BOEM does not anticipate that contractor needs, housing needs, and supply requirements would lead to an irretrievable loss of workers for other projects or increase housing and supply costs.
Environmental justice	No	Yes	Impacts on environmental justice communities could occur due to loss of income or employment for low-income workers in marine industries; this could be reversed by Project decommissioning or by other employment, but income lost during Project operations would be irretrievable.
Land use and coastal infrastructure	Yes	Yes	Land use required for construction and operation activities, such as the land proposed for the interconnection facility, could result in a minor irreversible impact. Construction activities could result in a minor irretrievable impact due to the short-term loss of use of the land for otherwise typical activities. Onshore facilities may or may not be decommissioned.
Navigation and vessel traffic	No	Yes	Based on the anticipated duration of construction, installation, and O&M, BOEM does not anticipate impacts on vessel traffic to result in irreversible impacts. Irretrievable impacts could occur due to changes in transit routes, which could be less efficient during the life of the Project.
Other marine uses	No	Yes	Disruption of offshore scientific research and surveys would occur during proposed Project construction, operations, and decommissioning activities.
Recreation and tourism	No	No	Construction activities near the shore could result in a short-term loss of use of the land for recreation and tourism purposes, but these impacts would not be irreversible or irretrievable.
Visual resources	No	Yes	Changes to the character of scenic and visual resources, and important viewshed would persist for the life of the Project, until conceptual decommissioning is complete. Long-term alterations would occur and affect open ocean, seascape, and landscape character and viewer experience due to construction, O&M, and decommissioning of the wind farm, onshore landing sites, onshore export cable routes, onshore substations, and electrical connections with the power grid.

BOEM = Bureau of Ocean Energy Management; EFH = Essential Fish Habitat; EJ = environmental justice; ESA = Endangered Species Act; O&M = operations and maintenance; SAV = submerged aquatic vegetation; USFWS = United States Fish and Wildlife Service; WOTUS = Waters of the United States; WTG = wind turbine generator

4.3 Relationship Between the Short-term Use of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

CEQ's NEPA implementing regulations (40 CFR 1502.16(a)(3)) require that an EIS address the relationship between short-term use of the environment and the potential impacts of such use on the maintenance and enhancement of long-term productivity. Such impacts could occur as a result of a reduction in the flexibility to pursue other options in the future, or assignment of a specific area (land or marine) or resource to a certain use that would not allow other uses, particularly beneficial uses, to occur at a later date. An important consideration when analyzing such effects is whether the short-term environmental effects of the action would result in detrimental effects to long-term productivity of the affected areas or resources.

As assessed in Chapter 3, BOEM anticipates that most of the potential adverse effects associated with the Proposed Action would occur during construction activities and would be short-term and minor to moderate in severity/intensity. Table 4.1-1 and Table 4.2-1 identify unavoidable, irretrievable, or irreversible impacts that would be associated with the Project. However, BOEM expects most of the marine and onshore environments to return to normal long-term productivity levels after Project conceptual decommissioning. Based on the findings, BOEM anticipates that the Proposed Action would not result in impacts that would significantly narrow the range of future uses of the environment.

Additionally, the Project would provide several long-term benefits:

- Promotion of clean and safe development of domestic energy sources and clean energy job creation;
- Promotion of renewable energy to help ensure geopolitical security; combat climate change; and provide electricity that is affordable, reliable, safe, secure, and clean;
- Delivery of power to the regional electric grid (PJM), to contribute to the state's renewable energy requirements; and
- Increased habitat for certain fish species.

U.S. Department of the Interior (USDOI)

The DOI protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation’s trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

Bureau of Ocean Energy Management (BOEM)

BOEM’s mission is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

BOEM
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