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ABSTRACT

This Final 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 two wind energy facilities (Project 1 and Project 2). Collectively these projects are referred to as the Atlantic Shores Offshore Wind South Project (Atlantic Shores South), as proposed by Atlantic Shores Offshore Wind, LLC (Atlantic Shores) in its Construction and Operations Plan (COP). The proposed Atlantic Shores South Project (consisting of Project 1 and Project 2) described in the COP and this Final EIS would be approximately 1,510 megawatts (MW) for Project 1; the number of MW is yet to be determined for Project 2. Atlantic Shores has a goal for Project 2 of 1,327 MW, which would align with the interconnection service agreements and interconnection construction service agreements Atlantic Shores intends to execute for both projects with the regional transmission organization, PJM. The Atlantic Shores South Project is proposed to be located 8.7 miles (14 kilometers) from the New Jersey shoreline at its closest point within the area covered by Renewable Energy Lease Number OCS-A 0499 (Lease Area). The Project is designed to meet the demand for renewable energy in New Jersey.

This Final 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 Final 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).

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Abbreviations and Acronyms

Acronym	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
µPa	micropascal
µg/L	microgram per liter
AAQS	ambient air quality standard
ACE	Atlantic City Electric
ACHP	Advisory Council on Historic Preservation
ADLS	Aircraft Detection Lighting System
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AMAPPS	Atlantic Marine Assessment Program for Protected Species
AMM	avoidance, minimization, and mitigation
AMP	alternative monitoring plan
AMSL	above mean sea level
AOCs	Areas of Concern
APE	area of potential effects
AQRV	air quality related values
ARSR	Air Route Surveillance Radar
ASLF	ancient submerged landform feature
ASR	Airport Surveillance Radar
Atlantic Shores	Atlantic Shores Offshore Wind, LLC
Atlantic Shores South	Atlantic Shores Offshore Wind South Project
BA	Biological Assessment
BGEPA	Bald and Golden Eagle Protection Act
BIA	Biologically Important Areas
BIWF	Block Island Wind Farm
BLM	Bureau of Land Management
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BPU	New Jersey Board of Public Utilities
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CBRA	Cable Burial Risk Assessment
CDC	Center for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CHRVEA	Cumulative Historic Resources Visual Effects Assessment
CLOs	Community Liaison Officers
CMECS	Coastal and Marine Ecological Classification Standard
CO	carbon monoxide

Acronym	Definition
CO_2	carbon dioxide
CO_2e	CO_2 equivalent
COARE	Coupled Ocean-Atmosphere Response Experiment
COBRA	CO-Benefits Risk Assessment
COP	Construction and Operations Plan
CTV	crew transfer vessel
CVOW	Coastal Virginia Offshore Wind Project
CVOW-C	Coastal Virginia Offshore Wind Commercial Project
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DA	Department of the Army
DAS	distributed acoustic sensing
DAT	deposition analysis threshold
dB	decibels
dBA	A-weighted decibel
dBBC	double Big Bubble Curtains
dbh	diameter at breast height
DC	direct current
DH	Dredge Hole
DHAI	disproportionately high and adverse impact
DHS	Department of Homeland Security
DIN	dissolved inorganic nitrogen
DIP	dissolved inorganic phosphorus
DO	dissolved oxygen
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DP	Dynamic Positioning
DPS	distinct population segment
DMA	Dynamic Management Areas
DTS	distributed temperature system
EA	Environmental Assessment
EC	earth curvature
ECC	Export Cable Corridor
EEM	estuarine emergent
EFH	essential fish habitat
EIS	Environmental Impact Statement
EMF	electromagnetic field
EO	Executive Order
EPM	environmental protection measure
ERP	Emergency Response Plan
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDR	Facility Design Report
FERC	Federal Energy Regulatory Commission
FIR	Fabrication and Installation Report

Acronym	Definition
FLO	Fisheries Liaison Officer
FLM	Federal Land Managers
FMP	Fisheries Management Plan
FOV	field of view
FTE	full-time equivalent
FWRAM	Full Waveform Range-dependent Acoustic Model
G&G	geophysical and geotechnical
GBS	gravity-based structure
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information system
GRLWEAP	GRL Wave Equation Analysis Program
GSOE	Garden State Offshore Energy
GW	gigawatt
GWP	global warming potential
HAP	hazardous air pollutant
HAPCs	Habitat Areas of Particular Concern
HAT	highest astronomical tide
HDD	horizontal directional drilling
HF	high frequency
HMS	Highly Migratory Species
HPTP	historic property treatment plan
HREA	Historic Resource Effects Assessment
HRG	high-resolution geophysical
HRVEA	Historic Resources Visual Effects Assessment
HUC	hydrologic unit code
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
Hz	hertz
IPF	impact-producing factor
IOOS	Integrated Ocean Observing System
ITA	Incidental Take Authorization
IWG	Interagency Working Group
IWQAR	Integrated Water Quality Assessment Report
JCP&L	Jersey Central Power & Light
KE	kinetic energy
kg/ha/yr	kilograms per hectare per year
kHz	kilohertz
kj	kilojoules
KOP	key observation point
Lease Area	Lease Area OCS-A 0499
LCA	landscape character area
LME	Large Marine Ecosystem
LOA	Letter of Authorization
Lpk	maximum broadband peak sound pressure
LNM	Local Notice to Mariners

Acronym	Definition
LRR	Long Range Radar
m	meter
MAFMC	Mid-Atlantic Fishery Management Council
MAOD	Mid-Atlantic Offshore Development
MARA	Marine Archaeological Resources Assessment
MARIPARS	Massachusetts and Rhode Island Port Access Route Study
MARPOL VI	International Convention for the Prevention of Pollution from Ships, Annex VI protocol
MBES	multibeam echosounders
MBTA	Migratory Bird Treaty Act of 1918
MDAT	Marine-life Data and Analysis Team
MEC	munitions and explosives of concern
met	meteorological
metocean	meteorological and oceanographic
MFC	mid-frequency cetacean
mG	milligauss
mg/L	milligrams per liter
MLW	Mean Low Water
MLLW	Mean Lower Low Water
MMP	Marine Minerals Program
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPRSA	Marine Protection, Research, and Sanctuaries Act
MRA	Marine Resource Administration
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MT	metric ton
MW	megawatt
MWh	MW-hour
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standard
NARW	North Atlantic right whale
NAS	Noise Abatement Systems
National OCS Program	North Atlantic Planning Area of the OCS Oil and Gas Leasing Program
NCCA	National Coastal Condition Assessment
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NEXRAD	Next Generation Weather Radar
NGTC	National Guard Training Center
NHLs	National Historic Landmarks
NHPA	National Historic Preservation Act
NJDEP	New Jersey Department of Environmental Protection
NJDOT-OMR	New Jersey Department of Transportation, Office of Maritime Resources
NJGWS	New Jersey Geological and Water Survey

Acronym	Definition
NJHPO	New Jersey Historic Preservation Office
NJPARS	New Jersey Port Access Route Study
NJPDES	New Jersey Pollutant Discharge Elimination System
NJSA	New Jersey Statutes Annotated
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NO_X	nitrogen oxide
NOI	Notice of Intent
NORAD	North American Aerospace Defense Commend
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NSRA	Navigation Safety Risk Assessment
NSSP	National Shellfish Sanitation Program
NWI	National Wetlands Inventory
NWS	National Weather Service
NYSDOS	New York State Department of State
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
O_3	ozone
OBC	overburdened community
OCA	ocean character area
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OE/AA	Obstruction Evaluation/Airspace Analysis
OLPD	online partial discharge
OPAREA	Operating Area
OREC	Offshore Wind Renewable Energy Certificate
OSRP	Oil Spill Response Plan
OSS	offshore substation
PAM	Passive Acoustic Monitoring
PATON	Private Aid to Navigation
PCB	polychlorinated biphenyls
PCN	Pre-Construction Notification
PDE	Project Design Envelope
PE	potential energy
PEM	palustrine emergent
PFO	palustrine forested
PIP	Phased Identification Plan
PM_{10}	particulate matter smaller than 10 microns in diameter
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
POI	Point of Interconnection
PPA	purchase power agreement
ppm	parts per million

Acronym	Definition
ppt	parts per thousand
PRDP	post-review discovery plan
Project	Atlantic Shores Offshore Wind South Project
Project 1 and Project 2	two electrically distinct wind energy facilities
PSD	Prevention of Significant Deterioration
PSO	protected species observer
PSS	palustrine scrub-shrub
PST	Preliminary Screening Tool
PTS	permanent threshold shift
QMA	Qualified Marine Archaeologist
RHA	Rivers and Harbors Act
rms	root-mean-square
ROD	Record of Decision
RODA	Responsible Offshore Development Alliance
RODEO	Realtime Opportunity for Development of Environmental Observations
ROSA	Responsible Offshore Science Alliance
ROW	right-of-way
RTO	regional transmission organization
SAA	State Agreement Approach
SAP	site assessment plan
SAR	Search and Rescue
SAROPS	Search and Rescue Optimal Planning System
SAV	submerged aquatic vegetation
SBP	sub-bottom profiler
SCA	seascape character area
SC-GHG	social cost of greenhouse gases
SCADA	supervisory control and data acquisition
SEL	sound exposure level
SF_6	sulfur hexafluoride
SFV	sound field verification
SFWF	South Fork Wind Farm
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLIA	seascape and landscape impact assessment
SMA	Seasonal Management Area
SO_2	sulfur dioxide
SOV	service operations vessel
SPCC	Spill Prevention, Control, and Countermeasure
SPL	sound pressure level
SSP	Sound speed profile
SPL_{RMS}	root-mean-square sound pressure level
SSS	side-scan sonars
SUA	special use airspace
SWPPP	stormwater pollution prevention plan
SZ	shutdown zone
TARA	Terrestrial Archaeological Resources Assessment

Acronym	Definition
TCP	traditional cultural property
TDWR	Terminal Doppler Weather Radar
TMP	Traffic Management Plan
TN	True North
TSS	total suspended solid
TTS	temporary threshold shift
UDP	Unanticipated Discovery Plan
ULSD	ultra-low sulfur diesel
UME	unusual mortality event
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded ordnances
VGP	Vessel General Permit
VHF	very high frequency
VIA	Visual Impact Assessment
VMS	Vessel Monitoring System
VOC	volatile organic compound
VTR	vessel trip report
WEA	Wind Energy Area
WNS	white-nose syndrome
WTA	Wind Turbine Area
WTG	wind turbine generator

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Executive Summary

Executive Summary

ES.1 Introduction

This Final Environmental Impact Statement (EIS) assesses the potential impacts on physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance (O&M), and conceptual decommissioning of two wind energy facilities (Project 1 and Project 2). Collectively these projects are referred to as the Atlantic Shores Offshore Wind South Project (Atlantic Shores South) as proposed by Atlantic Shores Offshore Wind Project 1, LLC (Atlantic Shores Project 1 Company) and Atlantic Shores Offshore Wind Project 2, LLC (Atlantic Shores Project 2 Company) in its Construction and Operations Plan (COP) (Atlantic Shores 2024). As Atlantic Shores (Atlantic Shores Offshore Wind, LLC) is the owner and an affiliate of both the Atlantic Shores Project 1 Company and the Atlantic Shores Project 2 Company, for ease of reference, the term "Atlantic Shores" is used throughout the Final EIS to refer interchangeably to the Project Companies.[1] The COP and its appendices are incorporated in this Final EIS by reference and available on BOEM's website: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-south. The Bureau of Ocean Energy Management (BOEM) has prepared the Final EIS under the National Environmental Policy Act (NEPA) (42 U.S. Code [USC] 4321–4370f). This Final EIS will inform BOEM's decision on whether to approve, approve with modifications, or disapprove the Project's COP.

Cooperating agencies may rely on this Final EIS to support their decision-making. In conjunction with submitting its COP, Atlantic Shores (the Applicant) applied to the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) for an incidental take authorization under the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 USC 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 Sections 10 and 14 of the Rivers and Harbors Act of 1899 (RHA), Section 404 of the Clean Water Act (CWA), and Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA).

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 Biden stated that it is the policy of the United States "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;

[1] Atlantic Shores Offshore Wind, LLC is a joint venture between EDF-RE Offshore Development, LLC (a wholly owned subsidiary of EDF Renewables, Inc.) and Shell New Energies US LLC, each having 50 percent ownership.

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 Code of Federal Regulations (CFR) 585.211, Atlantic Shores was awarded commercial Renewable Energy Lease OCS-A 0499 covering an area offshore New Jersey (Lease Area). Under the terms of the lease, Atlantic Shores has the exclusive right to submit a COP for activities within the Lease Area. Atlantic Shores has submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of two offshore wind energy facilities in the Lease Area in accordance with BOEM's COP regulations under 30 CFR 585.626-628. The proposed Project (consisting of Project 1 and Project 2) would generate approximately 1,510 megawatts (MW) for Project 1 and an output that is yet to be determined for Project 2. Atlantic Shores has a goal of 1,327 MW for Project 2, which would align with the interconnection service agreements and interconnection construction service agreements Atlantic Shores intends to execute for both projects with the regional transmission organization (RTO), PJM. (Figure ES-1).

Based on BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA)[2] to authorize renewable energy activities on the Outer Continental Shelf (OCS); EO 14008; the shared goals of the federal agencies to deploy 30 gigawatts (GW) of offshore wind energy capacity in the United States by 2030, while protecting biodiversity and promoting ocean co-use;[3] and in consideration of the goals of the Applicant, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Atlantic Shores' COP. BOEM will make this determination after weighing the factors in Subsection 8(p)(4) of the 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 in accordance with the applicable regulations in 30 CFR Part 585, which require BOEM to make a decision on the lessee's plans to construct and operate two commercial-scale offshore wind energy facilities within the Lease Area (the Proposed Action) (30 CFR 585.628).

[2] 43 USC 1331 et seq.

[3] Fact Sheet: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs | Interior, Energy, Commerce, and Transportation Departments Announce New Leasing, Funding, and Development Goals to Accelerate and Deploy Offshore Wind Energy and Jobs | The White House.
Available: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

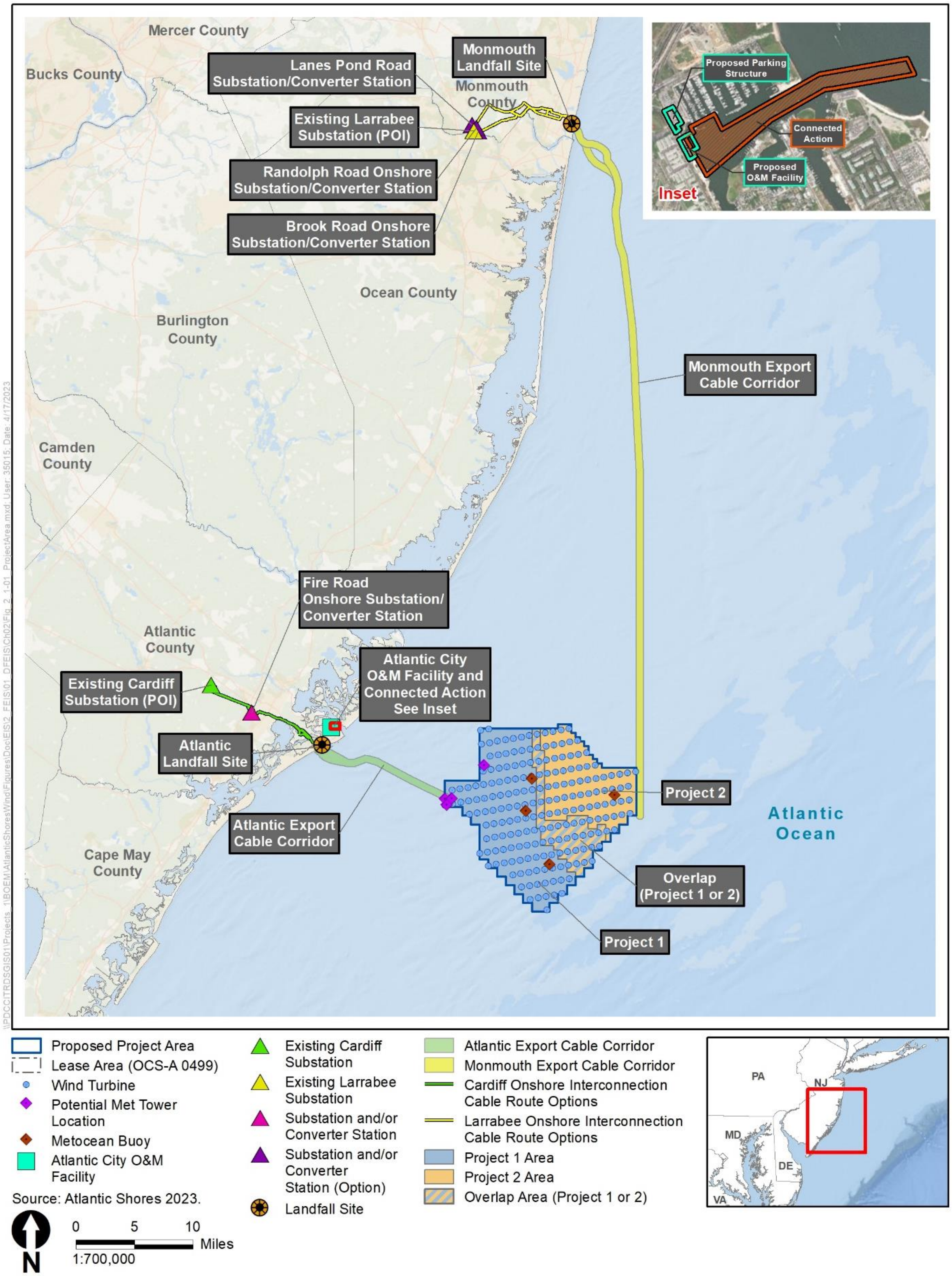

Figure ES-1. Atlantic Shores South Project

In addition, NMFS received a request for authorization to take marine mammals incidental to activities related to the Atlantic Shores South Project, which NMFS may authorize under the MMPA. NMFS' issuance of an MMPA incidental take authorization is a major federal action and, in relation to BOEM's action, is considered a connected action (40 CFR 1501.9(e)(1)). The purpose of the NMFS action—which is a direct outcome of Atlantic Shores' request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile driving)—is to evaluate Atlantic Shores' request pursuant to specific requirements of the MMPA and its implementing regulations administered by NMFS, and to decide whether to issue the authorization. NMFS needs to render a decision regarding the request for authorization due to NMFS' responsibilities under the MMPA (16 USC 1371(a)(5)(A and 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 Final EIS to support that decision and to fulfill its NEPA requirements.

The USACE Philadelphia District received requests for authorization of a permit action to be undertaken through authority delegated to the District Engineer by 33 CFR 325.8, pursuant to Section 10 of the RHA (33 USC 403) and Section 404 of the CWA (33 USC 1344). In addition, USACE received a request for "Section 408 permission," which is required pursuant to Section 14 of the RHA (33 USC 408) for any proposed alterations that have the potential to alter, occupy, or use any federally authorized civil works projects. USACE's Regulatory Branch and its Section 408 Program perform distinct but concurrent reviews for the permits and the Section 408 permission, respectively. In addition, if applicable, USACE would issue a permit for the ocean disposal of dredged materials under Section 103 of the MPRSA. USACE considers issuance of permits under these four delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)).

The need for the Project as provided by the Applicant in its COP and reviewed by USACE for NEPA purposes is to provide two commercially viable offshore wind energy projects within Lease Area OCS-A 0499 to meet New Jersey's need for clean energy. The Project's basic purpose, as determined by USACE for Section 404(b)(1) guidelines (40 CFR Part 230) evaluation, is offshore wind energy generation. The overall Project's purpose for Section 404(b)(1) guidelines evaluation, as determined by USACE, is the construction and operation of two commercial-scale offshore wind energy projects, including transmission lines, for renewable energy generation in Lease Area OCS-A 0499 and transmission to the New Jersey energy grids.

The purpose of the USACE Section 408 action, as determined by Engineer Circular 1165-2-220, *Policy and Procedural Guidance for Processing Requests to Alter U.S. Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408,* issued September 10, 2018, is to evaluate the Applicant's request and determine whether the proposed alterations are injurious to the public interest or impair the usefulness of the USACE civil works project. USACE Section 408 permission is needed to ensure that congressionally authorized civil works projects continue to provide their intended benefits to the public.

USACE intends to adopt BOEM's EIS to support its decision on any permits and permissions requested under Sections 10 and 14 of the RHA, Section 404 of the CWA, and Section 103 of the MPRSA. USACE would adopt the EIS under 40 CFR 1506.3 if, after its independent review of the document, it concludes that the EIS satisfies USACE's comments and recommendations. Based on its participation as a cooperating agency and its consideration of the Final EIS, USACE would issue its own Record of Decision (ROD) to formally document its decision on the Proposed Action. The ROD would be a combined decision document for both the USACE Regulatory Branch and the Section 408 Program.

ES.3 Public Involvement

On September 30, 2021, BOEM issued a Notice of Intent (NOI) to prepare an EIS consistent with NEPA regulations (42 USC 4321 et seq.), initiating a 30-day public scoping period from September 30 to November 1, 2021 (86 *Federal Register* 54231). The NOI solicited public input on the significant resources and issues, impact-producing factors, reasonable alternatives, and potential mitigation measures to analyze in the EIS. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the National Historic Preservation Act (54 USC 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), and sought 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 Atlantic Shores South COP. BOEM held three virtual public scoping meetings on October 19, 21, and 25, 2021, to present information on the Project and NEPA process, answer questions from meeting attendees, and solicit public comments. Scoping comments were received through Regulations.gov on docket number BOEM-2021-0057, via email and postal mail to a BOEM representative, and through oral testimony at each of the three public scoping meetings. BOEM received a total of 246 comment submissions from federal, tribal, and state agencies; local governments; non-governmental organizations; and the general public during the scoping period. The topics most referenced in the scoping comments included the NEPA/public involvement process, marine mammals, planned activities scenario/cumulative impacts, commercial fisheries and for-hire recreational fishing, mitigation and monitoring, climate change, employment and job creation, and scenic and visual resources. BOEM considered all scoping comments while preparing this Final EIS.

On May 19, 2023, BOEM issued a Notice of Availability of the Draft EIS, initiating a 45-day public comment period. BOEM held a total of four public meetings. Two in-person meetings were held in Manahawkin, New Jersey, and Atlantic City, New Jersey, on June 21 and June 22, 2023, respectively. Two virtual meetings were held on June 26 and 28, 2023. BOEM received a total of 2,096 comment submissions during the comment period. BOEM assessed and considered all the comments received on the Draft EIS in preparation of the Final EIS. See Appendix A, *Required Environmental Permits and Consultations,* for additional information on public involvement.

ES.4 Alternatives

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. The Final EIS evaluates the No Action Alternative and six action alternatives (three of which have 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 Project.

The alternatives are as follows:

- Alternative A – No Action
- Alternative B – Proposed Action
- Alternative C – Habitat Impact Minimization / Fisheries Habitat Impact Minimization[4]
    - Alternative C1 – Lobster Hole Avoidance
    - Alternative C2 – Sand Ridge Complex Avoidance
    - Alternative C3 – Demarcated Sand Ridge Complex Avoidance
    - Alternative C4 – Micrositing
- Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts[4]
    - Alternative D1 – No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore; Removal of Up to 21 Turbines
    - Alternative D2 – No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore; Removal of Up to 31 Turbines
    - Alternative D3 – No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore; Removal of Up to 6 Turbines
- Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1[4]
- Alternative F – Foundation Structures
    - Alternative F1 – Piled Foundations
    - Alternative F2 – Suction Bucket Foundations
    - Alternative F3 – Gravity-Based Foundations

The Preferred Alternative analyzed in the Final EIS is composed of a combination of Alternative B (Proposed Action), Alternative C4 (Habitat Impact Minimization/Fisheries Habitat Impact Minimization: Micrositing), Alternative D3 (No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore; Removal of Up to 6 Turbines), and Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1), as well as two proposed mitigation

[4] The number of wind turbine generators (WTGs) that could be removed may be reduced if this alternative is selected and combined with another alternative that requires removal of additional WTG positions, and if that combination of alternatives would fail to meet the purpose and need, including any awarded offtake agreement(s).

measures that require WTG removal identified in Appendix G, *Mitigation and Monitoring,* Table G-3 (BOEM-Proposed Mitigation Measure #5 and NOAA/NMFS-Proposed Mitigation Measure #1).

Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Chapter 2, Section 2.2, *Alternatives Considered but Not Analyzed in Detail*.

ES.4.1 Alternative A – No Action

Under the No Action Alternative, BOEM would not approve the COP. The Project's construction and installation, O&M, and eventual 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. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization to the applicant under the MMPA. The current resource conditions, trends, and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all direct and indirect impacts from action alternatives are evaluated.

Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable planned activities described in Appendix D, *Ongoing and Planned Activities Scenario*, without the Proposed Action serves as the future baseline for the evaluation of cumulative impacts.

ES.4.2 Alternative B – Proposed Action

Under the Proposed Action, the construction and installation, O&M, and eventual decommissioning of the Atlantic Shores South Project, which consists of two wind energy facilities (Project 1 and Project 2) on the OCS offshore of New Jersey, would be built within the range of the design parameters outlined in the Atlantic Shores South COP (Atlantic Shores 2024), subject to applicable mitigation measures. The Atlantic Shores South Project would include up to 200 wind turbine generators (WTGs) (between 105 and 136 for Project 1, and between 64 and 95 for Project 2), up to 10 offshore substations (OSSs) (up to 5 in each Project), up to 1 permanent meteorological (met) tower (Project 1), up to 4 temporary meteorological and oceanographic (metocean) buoys (up to 3 metocean buoys in Project 1, 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations. The proposed landfall locations are the Monmouth landfall in Sea Girt, New Jersey, with an onshore route to the existing Larrabee Substation Point of Interconnection (POI) and the Atlantic landfall in Atlantic City, New Jersey, with an onshore route to the existing Cardiff Substation, which would be upgraded to accommodate the Project's POI. Project 1 would have a capacity of 1,510 MW. Project 2's capacity is not yet determined, but Atlantic Shores has a goal of 1,327 MW, which would align with the interconnection service agreement it intends to execute for both projects with the RTO, PJM. The Proposed Action is summarized in Table ES-1 and Appendix C, *Project Design Envelope and Maximum-Case Scenario*. Refer to Volume I of the Atlantic Shores COP (Atlantic Shores 2024) for additional details on Project design.

Table ES-1. Summary of Project Design Envelope parameters

Project Parameter Details
General (Layout and Project Size)
• Up to 200 total WTGs ○ A minimum of 105 WTGs to a maximum of 136 WTGs for Project 1 ○ A minimum of 64 WTGs to a maximum of 95 WTGs for Project 2 • Up to 10 OSSs • Up to 1 permanent meteorological tower • Up to 4 temporary metocean buoys • Grid layout with east-northeast/west-southwest rows and approximately north/south columns
Foundations
• The foundations for the WTGs in Project 1 would be monopile; the foundations for the WTGs in Project 2 would be monopile or piled jacket; only one foundation type would be used for all WTGs in Project 2 • The foundations for small OSSs would be monopile, piled jacket, or suction bucket; the foundations for medium or large OSSs would be piled jacket, suction bucket jacket, or GBS • The foundation for the permanent met tower would be monopile, piled jackets, suction bucket jacket, mono suction buckets, or GBS • The scour protection around all foundations would vary based on foundation type
Wind Turbine Generators
• Rotor diameter up to 918.6 feet (280 meters) • Hub height up to 574.2 feet (175 meters) AMSL • Tip height up to 1,046.6 feet (319 meters) AMSL
Offshore Substations
• Up to 10 OSSs (10 small, 5 medium, or 4 large) • Total structure height of topside above MLLW up to 174.8 feet (53.3 meters) for a small OSS, up to 191.2 feet (58.3 meters) for a medium OSS, and up to 207.6 feet (63.3 meters) for a large OSS • Maximum length of 131.2 feet (40 meters) for a small OSS, up to 213.3 feet (65 meters) for a medium OSS, up to 295.3 feet (90 meters) for a large OSS • Small OSSs would be located at least 12 miles (19.3 kilometers) from shore, whereas medium and large OSSs would be located at least 13.5 miles (21.7 kilometers) from shore
Interarray Cables
• Target burial depth of 5 to 6.6 feet (1.5 to 2 meters) • Cables would be between 66 to 150 kV HVAC • Maximum total cable length would be 547 miles (880 kilometers) ○ Up to 274 miles (440 kilometers) of HVAC interarray cables for Project 1 ○ Up to 274 miles (440 kilometers) of HVAC interarray cables for Project 2 • Cable installation may involve jet trenching, plowing/ jet plowing, or mechanical trenching
Interlink Cables
• Target burial depth of 5 to 6.6 feet (1.5 to 2 meters) • Cables would be between 66 to 275 kV HVAC • Maximum total cable length would be 37 miles (60 kilometers) ○ Up to 18.6 miles (30 kilometers) of HVAC interlink cables for Project 1 ○ Up to 18.6 miles (30 kilometers) of HVAC interlink cables for Project 2

Project Parameter Details
• Cable installation may involve jet trenching, plowing/ jet plowing, or mechanical trenching
Offshore Export Cables
• Target burial depth of 5 to 6.6 feet (1.5 to 2 meters) • 230 to 275 kV HVAC cables and/or 320 to 525 kV HVDC cables • Two ECCs: Atlantic ECC and Monmouth ECC ○ Atlantic ECC: maximum total cable length would be 99.4 miles (160 kilometers) ○ Monmouth ECC: maximum total cable length would be 341.8 miles (550 kilometers) • Maximum of 4 HVAC cables per corridor • Maximum of 1 HVDC cables per corridor Cable installation may involve jet trenching, plowing/ jet plowing, or mechanical trenching
Landfall Sites
• HDD installation of cables at two landfall sites • Atlantic Landfall Site would be located in Atlantic City, New Jersey • Monmouth Landfall Site would be located within the Borough of Sea Girt in Monmouth County, New Jersey
Permanent Meteorological Tower and Metocean Buoys
• One permanent met tower would be installed within Project 1 in one of four potential locations ○ Maximum height would not exceed 16.5 feet (5 meters) above the hub height of the largest WTG installed, estimated to be 590.6 feet (180 meters) AMSL ○ The tower would be composed of square lattice consisting of tubular steel ○ The tower would be equipped with a deck that would be approximately 50 feet by 50 feet (15 meters by 15 meters) • Up to 4 temporary metocean buoys would be installed, 3 in Project 1 and 1 in Project 2
Onshore Facilities
• Atlantic Landfall Site would be connected to the approximately 12.4- to 22.6-mile (20.0- to 36.4-kilometer) Cardiff Onshore Interconnection Cable Route that would continue to the potential site for the Cardiff Substation and/or Converter Station and terminate at the Cardiff Substation POI • Monmouth Landfall Site would be connected to the approximate 9.8- to 23.0-mile (15.8- to 37.0-kilometer) Larrabee Onshore Interconnection Cable Route, which would continue to one of three potential sites for the Larrabee Substation and/or Converter Station and terminate at the Larrabee Substation POI • 230 to 275 kV HVAC cables and/or 320 to 525 kV HVDC cables
O&M Facility
• New facility proposed in Atlantic City, New Jersey

AMSL = above mean sea level; ECC = export cable corridor; GBS = gravity-based structure; HDD = horizontal directional drilling; HVAC = high-voltage alternating current; HVDC= High-voltage direct current; kV = kilovolt; MLLW = mean lower low water.

ES.4.3 Alternative C – Habitat Impact Minimization/Fisheries Habitat Impact Minimization

Under Alternative C, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the layout and maximum number of WTGs and OSSs would be adjusted to avoid and minimize potential impacts on important habitats. NMFS identified two areas of concern (AOCs) within the Lease Area that have pronounced bottom features and produce habitat value. AOC 1 is part of a designated recreational fishing area called “Lobster Hole.” AOC 2 is part of a sand ridge (ridge and trough) complex.

- **Alternative C1: Lobster Hole Avoidance**

  Alternative C1 would avoid and minimize the potential impacts on the Lobster Hole (AOC 1), a designated recreational fishing area, by removing up to 16 WTGs, 1 OSS, and associated interarray cables.

- **Alternative C2: Sand Ridge Complex Avoidance**

  Alternative C2 would avoid and minimize potential impacts on the sand ridge features in the southernmost portion of the Lease Area (AOC 2) by removing up to 13 WTGs and associated interarray cables within the NMFS-identified sand ridge complex.

- **Alternative C3: Demarcated Sand Ridge Complex Avoidance**

  Alternative C3 would remove up to 6 WTGs and associated interarray cables within 1,000 feet (305 meters) of the sand ridge complex area identified by NMFS, but further demarcated using NOAA's Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores.

- **Alternative C4: Micrositing**

  Alternative C4 was proposed by Atlantic Shores and would involve the micrositing of 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within both AOC 1 and AOC 2.

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

Under Alternative D, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, there would be no surface occupancy at select WTG positions to reduce the visual impacts of the proposed Project, as detailed in the following sub-alternatives.

- **Alternative D1: No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines**

  Alternative D1 would result in the exclusion of up to 21 WTG positions in Project 1 within 12 miles (19.3 kilometers) from shore. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) above mean sea level (AMSL) and maximum blade tip height of 932 feet (284 meters) AMSL.

- **Alternative D2: No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines**

  Alternative D2 would result in the exclusion of up to 31 WTG positions in Project 1 that are sited closest to shore. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.

- **Alternative D3: No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines**

  Alternative D3 would result in the exclusion of up to 6 WTG positions in Project 1 that are sited closest to shore. The remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.

ES.4.5 Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1

Under Alternative E, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to create a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback range between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation.

There would be no surface occupancy along the southern boundary of the Atlantic Shores South Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions, or relocation of up to 4 to 5 WTG positions, or some combination of exclusion and relocation of WTG positions, to allow for a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) buffer between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area.

ES.4.6 Alternative F – Foundation Structures

Under Alternative F, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. This includes a range of foundation types (monopile and piled jacket, mono-bucket and suction bucket jacket, and gravity-based) to assess the extent of potential impacts of each foundation type for up to 211 foundations (inclusive of WTGs, OSSs, and 1 permanent met tower [Project 1]). This Final EIS analyzes the following:

- **Alternative F1**: **Piled Foundations**

  Under Alternative F1, the use of monopile and piled jacket foundations only is analyzed for the maximum extent of impacts.

- **Alternative F2: Suction Bucket Foundations**

  Under Alternative F2, the use of the mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations only is analyzed for the maximum extent of impacts.

- **Alternative F3: Gravity-Based Foundations**

  Under Alternative F3, the use of gravity-pad tetrahedron and gravity-based structure (GBS) foundations only is analyzed for the maximum extent of impacts.

ES.4.7 Preferred Alternative

BOEM has identified Alternative B (Proposed Action), in combination with Alternative C4 (Habitat Impact Minimization/Fisheries Habitat Impact Minimization: Micrositing), Alternative D3 (No Surface Occupancy of Up to 10.8 Miles [17.4 Kilometers] from Shore: Removal of up to 6 Turbines), and Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1), as well as the two proposed mitigation measures that require WTG removal identified in Appendix G, Table G-3.

- BOEM-Proposed Mitigation Measure #5: No permanent structures will be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, met tower, and WTGs will be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.

- NOAA/NMFS-Proposed Mitigation Measure #1: Atlantic Shores must remove a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).

The Preferred Alternative would include up to 195 WTGs[5] (between 105 and 130 WTGs for Project 1, and between 64 and 93 WTGs for Project 2), up to 10 OSSs (up to 5 in each Project), up to 1 permanent met tower (Project 1), and up to 4 temporary metocean buoys (up to 3 metocean buoys in Project 1; 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations and/or converter stations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

The Preferred Alternative would require the proposed OSSs, met tower, and WTGs to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart; remove a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site); microsite 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within the NMFS-identified AOC 1 and AOC 2; restrict the height of WTGs in Project 1 to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL; and provide

[5] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

a minimum 0.81-nautical mile (1,500-meter) setback between the WTGs in Atlantic Shores South and the WTGs in Ocean Wind 1 (Lease Area OCS-A 0498) by removing two WTGs and micrositing one WTG from Project 1.

The Preferred Alternative is identified to let the public know which alternative BOEM, as the lead agency, is leaning toward before an alternative is selected for action when a ROD is issued. No final agency action is being taken by the identification of the Preferred Alternative, and BOEM is not obligated to select the Preferred Alternative.

ES.5 Environmental Impacts

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

BOEM analyzes the impacts of past and ongoing activities in the absence of the Project 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. In this analysis, the cumulative impacts of the No Action Alternative serve as the baseline against which the cumulative impacts of all action alternatives are evaluated. Table ES-2 summarizes the impacts of each alternative and the cumulative impacts of each alternative. Under the No Action Alternative, the environmental and socioeconomic impacts and benefits 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.

Chapter 4, *Other Required Impact Analyses,* describes potential unavoidable adverse impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction and installation phase and would be temporary. Chapter 4 also describes irreversible and irretrievable commitment of resources by resource area. The most notable of such commitments could include effects on habitat or individual members of protected species.

Appendix E, *Analysis of Incomplete and Unavailable Information* describes the incomplete or unavailable information that has been identified. BOEM considered whether the information was relevant to the assessment of impacts and essential to its analysis of alternatives based upon the resource analyzed.

Table ES-2. Summary and comparison of impacts among alternatives with no mitigation measures[6]

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.4.1 Air Quality							
Alternative Impacts[1]	Minor to moderate	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial
Cumulative Impacts[2]	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial
3.4.2 Water Quality							
Alternative Impacts[1]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts[2]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.5.1 Bats							
Alternative Impacts[1]	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Cumulative Impacts[2]	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
3.5.2 Benthic Resources							
Alternative Impacts[1]	Moderate	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	F1: Moderate; moderate beneficial F2 and F3: Minor; minor beneficial	Moderate; moderate beneficial
Cumulative Impacts[2]	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial
3.5.3 Birds							
Alternative Impacts[1]	Minor	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts[2]	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
3.5.4 Coastal Habitats and Fauna							
Alternative Impacts[1]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts[2]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.5.5 Finfish, Invertebrates, and Essential Fish Habitat							
Alternative Impacts[1]	Moderate	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts[2]	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial

[6] All sub-alternatives were deemed to have similar impacts unless otherwise stated within the applicable column.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.5.6 Marine Mammals							
Incremental Impacts[3]	None	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds
Alternative Impacts[1]	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds
Cumulative Impacts[2]	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds
3.5.7 Sea Turtles							
Alternative Impacts[1]	Minor	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts[2]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
3.5.8 Wetlands							
Alternative Impacts[1]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts[2]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.6.1 Commercial Fisheries and For-Hire Recreational Fishing							
Alternative Impacts[1]	Commercial fisheries: Major For-hire recreational fishing: Major	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial
Cumulative Impacts[2]	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial
3.6.2 Cultural Resources							
Alternative Impacts[1]	Moderate	Major	Major	Major	Major	Major	Major
Cumulative Impacts[2]	Major	Major	Major	Major	Major	Major	Major
3.6.3 Demographics, Employment, and Economics							
Alternative Impacts[1]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts[2]	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.6.4 Environmental Justice							
Alternative Impacts[1]	Minor	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts[2]	Moderate; minor beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial
3.6.5 Land Use and Coastal Infrastructure							
Alternative Impacts[1]	Minor; minor beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial
Cumulative Impacts[2]	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial
3.6.6 Navigation and Vessel Traffic							
Alternative Impacts[1]	Moderate	Major	Major	Major	Major	Major	Moderate
Cumulative Impacts[2]	Moderate	Major	Major	Major	Major	Major	Moderate
3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)							
Alternative Impacts[1]	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor
	Military and national security uses: Minor	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Moderate	Military and national security uses: Major	Military and national security uses: Moderate
	Aviation and air traffic: Negligible	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor
	Cables and pipelines: Negligible	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor
	Radar systems: Negligible	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate
	Scientific research and surveys: Moderate	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major
Cumulative Impacts[2]	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor
	Military and national security uses: Moderate	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Moderate	Military and national security uses: Major	Military and national security uses: Moderate
	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor
	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor
	Radar systems: Minor	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate
	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major
3.6.8 Recreation and Tourism							
Alternative Impacts[1]	Minor	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts[2]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.6.9 Scenic and Visual Resources							
Alternative Impacts[1]	Major	Major	Major	Major	Major	Major	Major
Cumulative Impacts[2]	Major	Major	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.
[1] Alternative impacts are inclusive of baseline conditions and impacts from ongoing activities for each resource as described in their respective sections in Chapter 3, *Affected Environment and Environmental Consequences*.
[2] Cumulative impacts represent alternative impacts (with the baseline) plus other foreseeable future impacts.
[3] Incremental impacts (i.e., alternative impacts without the baseline) were included at NMFS' request in order to support determinations under the Marine Mammal Protection Act.
[4] Impacts were assessed as major for the No Action Alternative and Proposed Action scenarios for North Atlantic right whale (NARW) because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species due to their low population numbers and continued state of decline.

Chapter 1

Introduction

This Final Environmental Impact Statement (EIS) assesses the potential impacts on physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance (O&M), and conceptual decommissioning of two wind energy facilities (Project 1 and Project 2). Collectively these projects are referred to as the Atlantic Shores Offshore Wind South Project (Atlantic Shores South), as proposed by Atlantic Shores Offshore Wind Project 1, LLC (Atlantic Shores Project 1 Company) and Atlantic Shores Offshore Wind Project 2, LLC (Atlantic Shores Project 2 Company) in their Construction and Operations Plan (COP) (Atlantic Shores 2024). As Atlantic Shores (Atlantic Shores Offshore Wind, LLC) is the owner and an affiliate of both the Atlantic Shores Project 1 Company and the Atlantic Shores Project 2 Company, for ease of reference, the term "Atlantic Shores" is used throughout the Final EIS to refer interchangeably to the Project Companies.[1] The COP and its appendices are incorporated in this Final EIS by reference and available on BOEM's website: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-south. The proposed Atlantic Shores South Project (consisting of Project 1 and Project 2) described in the COP and this Final EIS would be approximately 1,510 megawatts (MW) for Project 1; the number of MW is yet to be determined for Project 2. Atlantic Shores has a goal for Project 2 of 1,327 MW, which would align with the interconnection service agreements and interconnection construction service agreements Atlantic Shores intends to execute for both projects with the regional transmission organization (RTO), PJM. PJM is an RTO that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia.

The Atlantic Shores South Project is proposed to be located 8.7 miles (14 kilometers)[2] from the New Jersey shoreline at its closest point within the area covered by Renewable Energy Lease Number OCS-A 0499 (Lease Area). The Project is designed to meet the demand for renewable energy in New Jersey. This Final 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).

This Final EIS was prepared following the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321 et seq.) and implementing regulations (40 CFR Parts 1500 – 1508). The Council on Environmental Quality's (CEQ) current regulations contain a presumptive time limit of 2 years for completing EISs, and a presumptive page limit of 150 pages or fewer, or up to 300 pages for proposals of unusual scope or complexity. BOEM followed those limits in preparing this Final EIS in accordance with the current regulations. Additionally, this Final EIS was prepared consistent with the U.S. Department of the Interior's (DOI's) NEPA regulations (43 CFR Part 46); longstanding federal judicial and regulatory interpretations; and Administration priorities and policies, including Secretary's Order No. 3399 entitled *Department-Wide Approach to the Climate Crisis and Restoring Transparency and Integrity to the Decision-Making Process*, dated April 16, 2021, requiring bureaus and offices to not apply any of the provisions of the 2020 changes to CEQ regulations (85 *Federal Register* 43304-43376)

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[1] Atlantic Shores Offshore Wind, LLC is a joint venture between EDF-RE Offshore Development, LLC (a wholly owned subsidiary of EDF Renewables, Inc.) and Shell New Energies US LLC, each having 50 percent ownership.
[2] Equates to 7.6 nautical miles. 1 nautical mile = 1.1508 statute miles.

"in a manner that would change the application or level of NEPA that would have been applied to a proposed action before the 2020 Rule went into effect."[3]

1.1 Background

In 2009, DOI announced final regulations for the Outer Continental Shelf (OCS) Renewable Energy Program, which was authorized by the Energy Policy Act of 2005.[4] These implementing regulations, codified in 30 CFR Part 585, provide a framework for BOEM to issue renewable energy leases, easements, and rights-of-way (ROWs) for OCS activities (see Section 1.3, *Regulatory Overview*). BOEM's renewable energy program occurs in four distinct phases: (1) planning and analysis, (2) lease issuance, (3) site assessment, and (4) construction and operations. The history of BOEM's planning and leasing activities offshore New Jersey is summarized in Table 1-1.

Table 1-1. History of BOEM planning and leasing offshore New Jersey

Year	Milestone
2009	In 2009 BOEM formed the BOEM/New Jersey Renewable Energy Task Force for coordination among affected federal agencies and state, local, and tribal governments through the leasing process. The first Task Force meeting was held on November 24, 2009 with subsequent meetings occurring on May 12, 2010, November 19, 2010, December 18, 2012, January 28, 2014, April 22, 2014, and May 19, 2016. The BOEM New Jersey Task Force was integrated into the New York Bight Task Force in December 2017.
2011	On April 20, 2011, BOEM published a Call for Information and Nominations for Commercial Leasing for Wind Power on the OCS Offshore New Jersey (Call) in the *Federal Register* (76 Fed. Reg. 22130). The public comment period for the Call closed on June 6, 2011. In response, BOEM received 11 commercial indications of interest. After analyzing AIS data and holding discussions with stakeholders, BOEM removed OCS Blocks Wilmington NJ18–02 Block 6740 and Block 6790 (A, B, C, D, E, F, G, H, I, J, K, M, N) and Block 6840 (A) to alleviate navigational safety concerns resulting from vessel transits out of New York Harbor.
2012	On February 3, 2012, BOEM published in the *Federal Register* a Notice of Availability (NOA) of a Final EA and FONSI for commercial wind lease issuance and site assessment activities on the Atlantic OCS offshore New Jersey, Delaware, Maryland, and Virginia in the *Federal Register* (77 Fed. Reg. 5560).
2014	On July 21, 2014, BOEM published a Proposed Sale Notice in the *Federal Register* (79 Fed. Reg. 42361) requesting public comments on the proposal to auction two leases offshore New Jersey for commercial wind energy development.
2015	On September 25, 2015, BOEM published a Final Sale Notice, which stated a commercial lease sale would be held November 9, 2015, for the WEA offshore New Jersey. The New Jersey WEA was auctioned as two leases. RES America Developments, Inc. was the winner of Lease Area OCS-A 0498 and U.S. Wind, Inc. was the winner of Lease Area OCS-A 0499.
2016	On March 17, 2016, BOEM received a request to extend the preliminary term[5] for commercial lease OCS-A 0499, from March 1, 2017, to March 1, 2018. BOEM approved the request on June 10, 2016.

[3] Secretarial Order 3399 is available on DOI's website: https://www.doi.gov/sites/doi.gov/files/elips/documents/so-3399-508_0.pdf.
[4] Public Law No. 109-58, 119 Stat. 594 (2005).
[5] Per 30 CFR 585.235(a)(1), each commercial lease will have a preliminary term of 12 months, within which the Lessee must submit a Site Assessment Plan (SAP) or a combined SAP and COP. The preliminary term begins on the effective date of the lease.

Year	Milestone
2018	On January 29, 2018, BOEM received a second request to extend the preliminary term for commercial Lease Area OCS-A 0499, from March 1, 2018, to March 1, 2019. BOEM approved the request on February 14, 2018.
2018	On November 16, 2018, BOEM received an application from U.S. Wind, Inc. to assign 100 percent of Lease Area OCS-A 0499 to EDF Renewables Development, Inc. BOEM approved the assignment on December 4, 2018.
2019	On April 29, 2019, BOEM received an application from EDF Renewables Development, Inc. to assign 100 percent of commercial lease OCS-A 0499 to Atlantic Shores Offshore Wind, LLC. BOEM approved the assignment on August 13, 2019.
2021	On March 25, 2021, Atlantic Shores submitted its COP for the construction and installation, operations and maintenance, and conceptual decommissioning of the Project within the Lease Area. Updates to the COP, supporting appendices, and GIS data were submitted in August, September, October, and December 2021; January, March, April, August, September, October, November, and December 2022; January, February, March, April, May, August, September, October, November, and December 2023; and January, February, March, and May 2024.
2021	On December 8, 2019, Atlantic Shores Offshore Wind, LLC submitted a SAP for commercial wind lease OCS-A 0499, which was subsequently revised in February, March, April, August, September, and November 2020. BOEM approved the SAP on April 18, 2021. The SAP approval allowed for the installation of two buoys.
2021	On September 28, 2021, BOEM received an application from Atlantic Shores Offshore Wind, LLC to assign 100 percent interest of the southern portion of Lease Area OCS-A 0499 (which contains the Atlantic Shores South Project 1 and 2 areas) to Atlantic Shores Offshore Wind Project 1, LLC and Atlantic Shores Offshore Wind Project 2, LLC with each entity having a 50 percent interest.
2021	On September 30, 2021, BOEM published a Notice of Intent to Prepare an EIS for the Atlantic Shores Offshore Wind South Project offshore New Jersey.
2022	On April 19, 2022, BOEM approved a partial assignment that effected a segregation of lease OCS-A 0499. The northern portion of Lease Area OCS-A 0499 was retained by Atlantic Shores Offshore Wind, LLC and given a new lease number (OCS-A 0549) by BOEM, while the southern portion retains the original lease number assigned by BOEM: OCS-A 0499.
2023	On May 19, 2023, BOEM published an NOA of a Draft EIS in the *Federal Register* (88 Fed. Reg. 32242), initiating a 45-day public comment period for the Draft EIS.
2024	On May 31, 2024, BOEM published an NOA for a Final EIS initiating a minimum 30-day mandatory waiting period, during which BOEM is required to pause before issuing a Record of Decision.

AIS = Automatics Identification System; EA = Environmental Assessment; FLiDAR = floating light and detection ranging buoy; FONSI = Finding of No Significant Impact; GIS = geographic information system; SAP = Site Assessment Plan; WEA = Wind Energy Area.

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 "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."

As discussed in Table 1-1, Atlantic Shores acquired 100 percent interest in Renewable Energy Lease Number OCS-A 0499 covering an area offshore New Jersey (the Lease Area) by assignment effective December 4, 2018.[6] Under the terms of the lease, Atlantic Shores has the exclusive right to submit a COP for activities within the Lease Area, and it has submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of two offshore wind energy facilities in the Lease Area (the Atlantic Shores South Project) in accordance with BOEM's COP regulations under 30 CFR 585.626–628.

Atlantic Shores' goal is to develop two offshore wind energy generation facilities (referred to as Project 1 and Project 2) in the Lease Area to provide clean, renewable energy to the New Jersey grid. The Atlantic Shores South Project would include up to 200 total wind turbine generators (WTGs) (between 105 and 136 WTGs for Project 1, and between 64 and 95 WTGs for Project 2), up to 10 offshore substations (OSSs) (up to 5 in each Project), up to 1 permanent meteorological (met) tower, up to 4 temporary meteorological and oceanographic (metocean) buoys (up to 1 met tower and 3 metocean buoys in Project 1 and 1 metocean buoy in Project 2), interarray and interlink cables, up to 2 onshore substations, two points of interconnection (POIs), 1 O&M facility, and up to 8 transmission cables making landfall at 2 New Jersey locations.

The exact locations and numbers of OSSs, metocean buoy locations, and met tower location have not yet been finalized. The known locations of the elements of Project 1 and Project 2, as well as the potential locations of the met tower, can be found in Figure 1-1. Projects 1 and 2 would be in an approximately 102,124-acre (41,328-hectare) Wind Turbine Area (WTA) located in the Lease Area. Project 1 would be located in the western 54,175 acres (21,924 hectares) of the WTA and Project 2 would be located in the eastern 31,847 acres (12,888 hectares) of the WTA, with a 16,102-acre (6,516-hectare) Overlap Area that could be used by either Project 1 or Project 2. The Overlap Area is included in the event engineering or technical challenges arise at certain locations in the WTA, to provide flexibility for final selection of a WTG supplier for the Atlantic Shores South Project (which would determine the final number of WTG positions needed for Project 1 and Project 2), and for environmental or other considerations. The OSSs would be located along the same east-northeast to west-northwest rows as the WTGs, but sited within the north/south rows, as shown in Figure 1-2. Small OSSs would be located no closer than 12 miles (19.3 kilometers) from shore, whereas medium and large OSSs would be located at least 13.5 miles (21.7 kilometers) from shore.

The Atlantic Shores South Project would contribute to New Jersey's goal of 11 gigawatts (GW) of offshore wind energy generation by 2040 as outlined in New Jersey Governor's EO No. 307, issued on September 22, 2022. Project 1 would fulfill the New Jersey Board of Public Utilities (BPU) September 10, 2020 solicitation, and subsequent June 30, 2021 award to Atlantic Shores for 1,510 MW of offshore wind capacity (BPU Docket No. QO21050824, In the Matter of the Board of Public Utilities Offshore Wind Solicitation 2 for 1,200 to 2,400 MW – Atlantic Shores Offshore Wind Project 1, LLC). Atlantic Shores is

[6] Atlantic Shores retains interest in the area covered by Renewable Energy Lease Number OCS-A 0499 (now referred to as Atlantic Shores South) and also retains interest in the area covered by Renewable Energy Lease Number OCS-A 0549 (now referred to as Atlantic Shores North).

actively seeking additional Offshore Wind Renewable Energy Certificate (OREC) awards or purchase power agreements (PPA) for Project 2. Although Project 2’s capacity has not yet been determined, Atlantic Shores has a goal of 1,327 MW. The Atlantic Shores South Project is intended to contribute substantially to the region's electrical reliability and help New Jersey achieve its renewable energy goals.

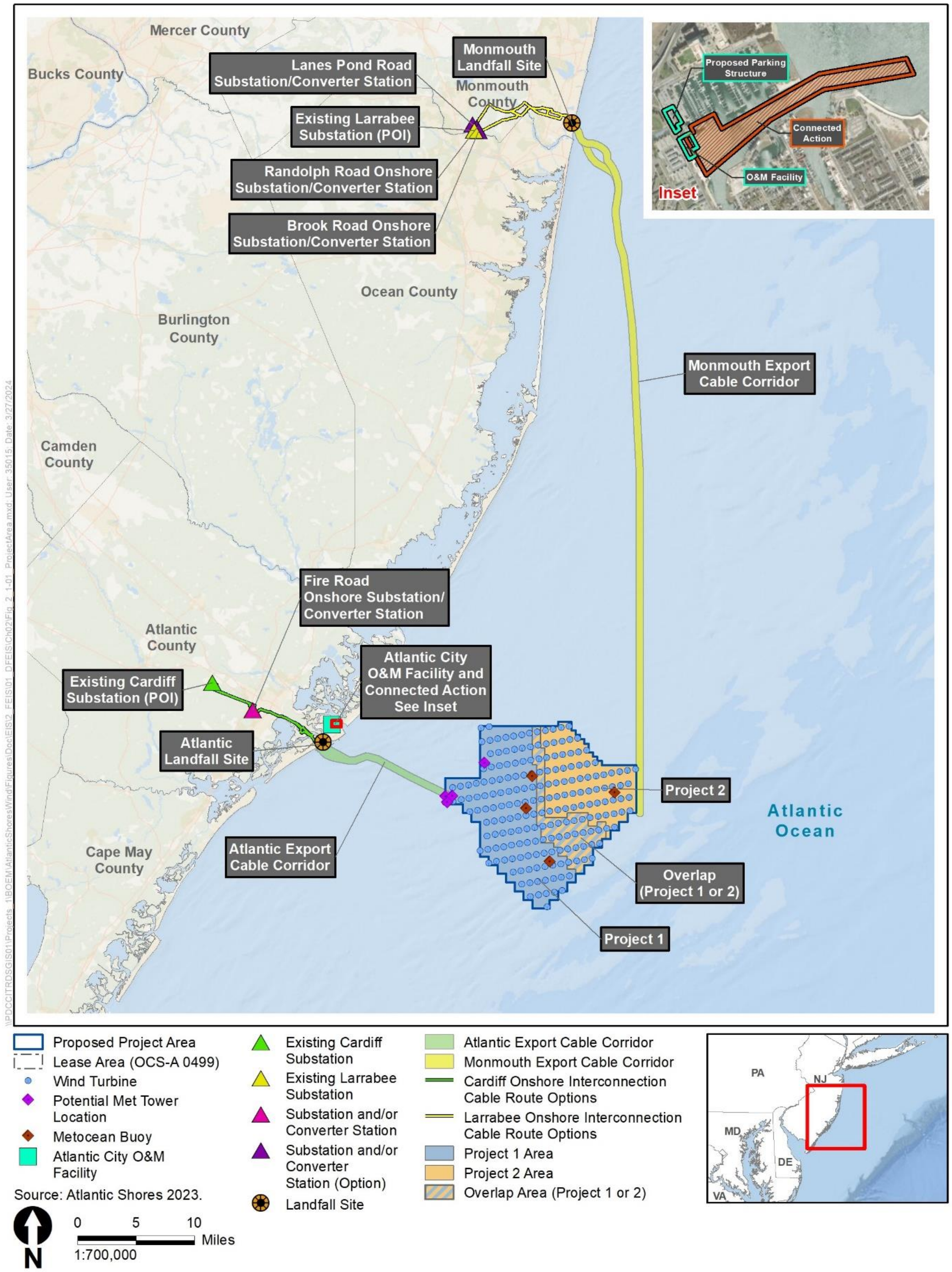

Figure 1-1. Atlantic Shores South Project Area

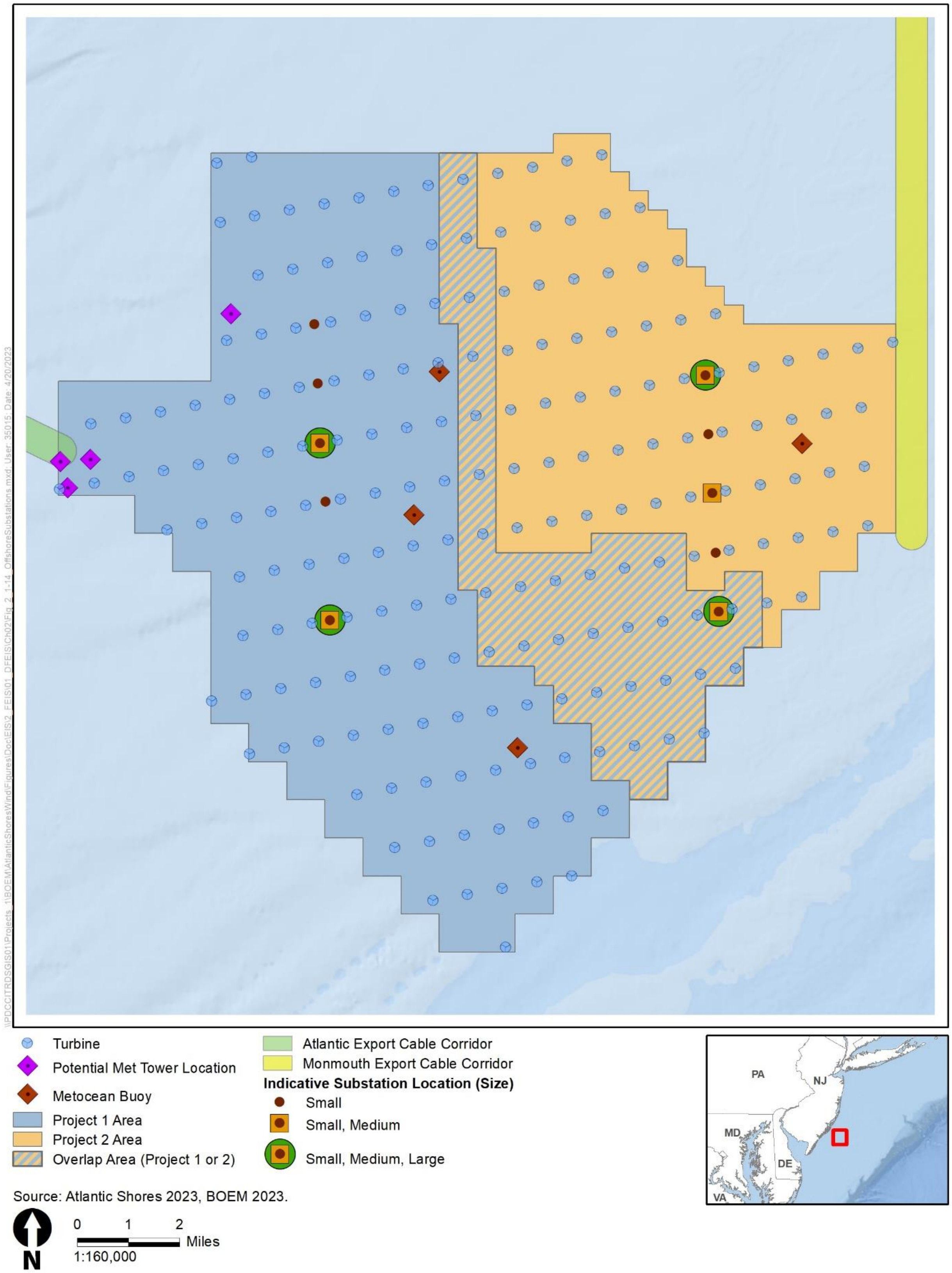

Figure 1-2. Offshore Project structures

The BPU Order identifies 1,510 MW[7] of offshore wind as the required capacity of Project 1. The BPU Order also requires as a Term and Condition of the award that Project 1 be funded through OREC as defined by the New Jersey Offshore Wind Economics Development Act 2010. For each MW-hour (MWh) delivered to the transmission grid, Project 1 will be credited, and subsequently compensated, for one OREC. Atlantic Shores' annual OREC allowance is 6,181,000 MWh per year per the 2021 award by BPU. According to the BPU Order, any unmet OREC allowances in a given year may be carried forward to the next year, and the total allowance cannot be reduced or increased without mutual consent of BPU and Atlantic Shores. Atlantic Shores' stated goal is to routinely meet the OREC allowance in order to obtain the maximum possible annual payment from BPU for the operations of Project 1.

Based on BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA)[8] to authorize renewable energy activities on the OCS; EO 14008; the shared goals of the federal agencies to deploy 30 GW of offshore wind energy capacity in the United States by 2030, while protecting biodiversity and promoting co-ocean use;[9] and in consideration of Atlantic Shores' goals; the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Atlantic Shores' COP. BOEM will make this determination after weighing the factors in subsection 8(p)(4) of the 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 in accordance with the applicable regulations in 30 CFR Part 585, which require BOEM to make a decision on Atlantic Shores' plan to construct and operate two commercial-scale offshore wind energy facilities within the Lease Area.

In addition, the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) received a request for authorization to take marine mammals incidental to activities related to the Atlantic Shores South Project, which NMFS may authorize under the Marine Mammal Protection Act (MMPA). NMFS' issuance of an MMPA incidental take authorization is a major federal action, and in relation to BOEM's action, is considered a connected action (40 CFR 1501.9(e)(1)). The purpose of the NMFS action—which is a direct outcome of Atlantic Shores' request for authorization to take marine mammals incidental to specified activities associated with the Atlantic Shores South Project (e.g., pile driving)—is to evaluate Atlantic Shores' request pursuant to specific requirements of the MMPA and its implementing regulations administered by NMFS, and to decide whether to issue the authorization. NMFS needs to render a decision regarding the request for authorization due to NMFS' responsibilities under the MMPA (16 USC 1371(a)(5)(A and 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 Final EIS to support that decision and to fulfill its NEPA requirements.

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[7] The New Jersey Board of Public Utilities awarded an OREC to Atlantic Shores for 1,509.6 MW, which solely for convenience is rounded up to 1,510 MW throughout the COP.
[8] 43 USC 1331 *et seq*.
[9] Fact Sheet: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs | Interior, Energy, Commerce, and Transportation Departments Announce New Leasing, Funding, and Development Goals to Accelerate and Deploy Offshore Wind Energy and Jobs | The White House. Available: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

The U.S. Army Corps of Engineers (USACE) Philadelphia District received requests for authorization of a permit action to be undertaken through authority delegated to the District Engineer by 33 CFR 325.8, pursuant to Section 10 of the Rivers and Harbors Act (RHA) of 1899 (33 USC 403) and Section 404 of the Clean Water Act (CWA) (33 USC 1344). In addition, USACE received a request for "Section 408 permission," which is required pursuant to Section 14 of the RHA (33 USC 408) for any proposed alterations that have the potential to alter, occupy, or use any federally authorized civil works projects. USACE's Regulatory Branch and its Section 408 Program perform distinct but concurrent reviews for the permits and the Section 408 permission, respectively. In addition, if applicable, USACE would issue a permit for the ocean disposal of dredged materials under Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). USACE considers issuance of permits under these four delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)).

The need for the Project as provided by the Applicant in Atlantic Shores' COP and reviewed by USACE for NEPA purposes is to provide two commercially viable offshore wind energy facilities within Lease Area OCS-A 0499 to meet New Jersey's need for clean energy. The Project's basic purpose, as determined by USACE for Section 404(b)(1) guidelines (40 CFR Part 230) evaluation, is offshore wind energy generation. The overall Project's purpose for Section 404(b)(1) guidelines evaluation, as determined by USACE, is the construction and operation of two commercial-scale offshore wind energy projects, including transmission lines, for renewable energy generation in Lease Area OCS-A 0499 and transmission to the New Jersey energy grids.

The purpose of the USACE Section 408 action, as determined by Engineer Circular 1165-2-220, *Policy and Procedural Guidance for Processing Requests to Alter U.S. Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408,* issued September 10, 2018, is to evaluate the Applicant's request and determine whether the proposed alterations are injurious to the public interest or impair the usefulness of the USACE civil works project. USACE Section 408 permission is needed to ensure that congressionally authorized civil works projects continue to provide their intended benefits to the public.

USACE intends to adopt BOEM's EIS to support its decision on any permits and permissions requested under Sections 10 and 14 of the RHA, Section 404 of the CWA, and Section 103 of the MPRSA. USACE would adopt the EIS per 40 CFR 1506.3 if, after its independent review of the document, it concludes that the EIS satisfies USACE's comments and recommendations. Based on its participation as a cooperating agency and its consideration of the Final EIS, 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 OCSLA 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 delegated this authority to the former Minerals Management Service, and later to BOEM. Final regulations implementing the authority for renewable energy leasing under OCSLA were promulgated on April 22, 2009. By final rule published on January 31, 2023, the renewable energy regulations pertaining to safety, environmental oversight, and inspections that were under BOEM's responsibility in 30 CFR Part 585 were transferred to the Bureau of Safety and Environmental Enforcement's (BSEE) responsibility and became BSEE provisions in 30 CFR Part 285.[10] The regulations retained by BOEM prescribe BOEM's responsibility for determining whether to approve, approve with modifications, or disapprove Atlantic Shores' COP.[11]

Section 2 of BOEM's Renewable Energy Lease OCS-A 0499 provides the lessee with an exclusive right to submit a COP to BOEM for approval. Section 3 provides that BOEM will decide whether to approve a COP in accordance with applicable regulations in 30 CFR Part 585, noting that BOEM retains the right to disapprove a 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 subsection 8(p)(4) of OCSLA (43 USC 1337(p)(4)), or for other reasons provided by BOEM under 30 CFR 585.628(f). Section 3 of the lease also provides that BOEM reserves the right to approve a COP with modifications, as well as 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 USC 1531–1544). The analyses in this Final EIS will inform BOEM's decision under 30 CFR 585.628 for the COP that was initially submitted to BOEM on March 25, 2021, and later updated with new information in August, September, October, and December 2021; January, March, April, August, September, October, November, and December 2022; January, February, March, April, May, August, September, October, November, and December 2023; and January, February, March, and May 2024.

BOEM is required to coordinate with federal agencies and state and local governments and ensure that renewable energy development occurs in a safe and environmentally responsible manner. In addition, BOEM's authority to approve activities under OCSLA extends only to approval of activities on the OCS. Appendix A, *Required Environmental Permits and Consultations,* outlines the federal, state, regional, and local permits and authorizations that are required for the Atlantic Shores South Project and the status of each permit and authorization. Appendix A also provides a description of BOEM's consultation efforts during development of the Final EIS.

1.4 Relevant Existing NEPA and Consulting Documents

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

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[10] Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 *Federal Register* 19638–19871 (April 29, 2009); Reorganization of Title 30 - Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 88 *Federal Register* 6413 (January 31, 2023).
[11] See 30 CFR 585.628.

- 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).

  This programmatic EIS examined the potential environmental consequences of implementing the Alternative Energy and Alternate Use Program on the OCS and established initial measures to mitigate environmental consequences. As the program evolves and more is learned, the mitigation measures may be modified or new measures developed.

- 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 prepared this Environmental Assessment (EA) to determine whether issuance of leases and approval of Site Assessment Plans (SAPs) within the Wind Energy Areas (WEAs) offshore New Jersey, Delaware, Maryland, and Virginia would lead to reasonably foreseeable significant impacts on the environment, and, thus, whether an EIS should be prepared before a lease is issued.

- Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement, OCS EIS/EA BOEM 2021-0012 (BOEM 2021a).

  BOEM prepared this document for the COP submitted by Vineyard Wind, LLC. The Final EIS analyzes the potential environmental impacts of the COP (the Proposed Action) and alternatives to the Proposed Action.

- South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement, OCS EIS/EA BOEM 2020-057 (BOEM 2021b).

  BOEM prepared this document for the COP submitted by South Fork Wind, LLC. The Final EIS analyzes the potential environmental impacts of the COP (the Proposed Action) and alternatives to the Proposed Action.

- Atlantic Shores Offshore Wind South Biological Assessment for the United States Fish and Wildlife Service (BOEM 2023a).

  BOEM prepared this document pursuant to Section 7 of the ESA to evaluate potential effects of the Proposed Action on ESA-listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).

- Atlantic Shores Offshore Wind: Atlantic Shores South Project Biological Assessment for National Marine Fisheries Service (BOEM 2023b).

  BOEM prepared this document pursuant to Section 7 of the ESA to evaluate potential effects of the Proposed Action on ESA-listed species under the jurisdiction of NMFS.

- Atlantic Shores Offshore Wind South Project: Essential Fish Habitat Assessment with NOAA Trust Resources (BOEM 2023c).

  BOEM prepared this document pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to evaluate the potential effects of the Proposed Action on essential fish habitat (EFH) and EFH species under the jurisdiction of NMFS.

Additional environmental studies conducted to support decisions concerning 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

Atlantic Shores proposes to develop the Atlantic Shores South Project using the Project Design Envelope (PDE) concept. This concept allows Atlantic Shores to define and bracket proposed 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 Final EIS assesses the impacts of the PDE that is described in the Atlantic Shores South COP 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 Final 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.[12] This Final EIS considers the interrelationship between aspects of the PDE rather than simply viewing each design parameter independently. Certain resources may have 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 Final EIS could reasonably occur.

1.6 Methodology for Assessing Impacts

This Final EIS assesses past, present (ongoing), and reasonably foreseeable future (planned) actions that could occur during the life of the Atlantic Shores South Project. Ongoing and planned actions occurring within the geographic analysis area include (1) other offshore wind energy development activities; (2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (3) tidal energy projects; (4) marine minerals use and ocean-dredged material disposal; (5) military use;

[12] 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.

(6) marine transportation (commercial, recreational, and research-related); (7) fisheries use, management, and monitoring surveys; (8) global climate change; (9) oil and gas activities; and (10) onshore development activities. Appendix D, *Ongoing and Planned Activities Scenario*, describes the actions that BOEM has identified as potentially contributing to the existing baseline, and the actions potentially contributing to cumulative impacts when combined with impacts from the alternatives over the specified spatial and temporal scales.

1.6.1 Past and Ongoing Activities and Trends (Existing Baseline)

Each resource-specific *Environmental Consequences* section in Chapter 3, *Affected Environment and Environmental Consequences,* of this Final EIS includes a description of the baseline conditions of the affected environment. The existing baseline considers past and present activities in the geographic analysis area, including those related to offshore wind projects with an approved COP (e.g., Vineyard Wind 1, South Fork, Ocean Wind 1,[13] and Revolution Wind) and approved past and ongoing site assessment surveys, as well as other non-wind activities (e.g., Navy military training, existing vessel traffic, climate change). The existing condition of resources as influenced by past and ongoing activities and trends comprises the existing baseline condition for impact analysis. Other factors currently affecting the resource, including climate change, are also analyzed for that resource and are included in the impact-level conclusion.

1.6.2 Cumulative Impacts of Ongoing and Planned Activities

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

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[13] On October 31, 2023, Ørsted publicly announced their decision to cease development of Ocean Wind 1 (Lease Area OCS-A 0498) and Ocean Wind 2 (Lease Area OCS-A 0532). However, Ocean Wind LLC (the Lessee for Ocean Wind 1) has not withdrawn their COP for Lease Area OCS-A 0498, and Ørsted North America Inc. (the Lessee for Ocean Wind 2) has not relinquished or reassigned Lease Area OCS-A 0532. On Thursday, February 29, 2024, pursuant to 30 CFR § 585.418, BOEM approved a 2-year suspension of the operations term of Ocean Wind LLC's (the Lessee) commercial lease (Renewable Energy Lease Number OCS-A 0498), lasting until February 28, 2026. This suspension was approved in response to the Lessee's January 19, 2024, request for a suspension of the operations term for the lease, submitted pursuant to Section 8(p)(5) of the OCSLA, 43 USC § 1337(p)(5) and BOEM's implementing regulations at 30 CFR § 585.416. As of May 2024, the lessees still hold the leases for Lease Areas OCS-A 0498 and 0532. Therefore, BOEM has analyzed the Ocean Wind 1 Project as described in the approved COP and has analyzed development of the Ocean Wind 2 Lease Area consistent with the assumptions identified in the Planned Activities Scenario.

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Chapter 2

Alternatives

This chapter: (1) describes the alternatives carried forward for detailed analysis in this Final 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 conceptual decommissioning of the proposed Atlantic Shores South Project; and (3) presents a summary and comparison of impacts between alternatives and resources affected.

2.1 Alternatives Analyzed in Detail

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. Alternatives were reviewed using BOEM's screening criteria, presented in Section 2.2, *Alternatives Considered but Not Analyzed in Detail*. Alternatives that did not meet the screening criteria (i.e., were found to be infeasible or did not meet the purpose and need) were dismissed from detailed analysis in the EIS. The alternatives carried forward for detailed analysis in this Final EIS are summarized in Table 2-1 and described in detail in Sections 2.1.2 through 2.1.6. Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.2.

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

The alternatives listed in Table 2-1 are not mutually exclusive. BOEM may "mix and match" multiple listed EIS alternatives or sub-alternatives, to result in the Preferred Alternative identified in Section 2.1.7 of this Final EIS, provided that: (1) the design parameters are compatible, (2) the Preferred Alternative still meets the purpose and need, and (3) the Preferred Alternative does not exceed the PDE. The number of WTGs that could be removed may be reduced if an alternative is selected and combined with another alternative that requires removal of additional WTG positions and, if that combination of alternatives would fail to meet the purpose and need, including any awarded offtake agreement(s). The offtake agreements (PPAs or ORECs) are awarded by the state and subject to the state's determination and processes as to whether a separate environmental review is warranted.

NMFS and USACE are serving as cooperating agencies and intend to adopt the Final EIS if they deem it sufficient, after an independent review and analysis, to meet their NEPA compliance requirements. Under the Proposed Action and other action alternatives, NMFS' action alternative is to issue the requested Letter of Authorization (LOA) to the Applicant 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. USACE is required to analyze alternatives to the proposed Atlantic Shores South Project to satisfy NEPA and the CWA 404(b)(1) Guidelines. The analysis in this Final EIS considers a reasonable range of alternatives, including cable route options within the PDE and alternatives considered but dismissed.

BOEM decided to use the NEPA substitution process for National Historic Preservation Act (NHPA) Section 106 purposes, in accordance with 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. Avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties are presented in Appendix G, *Mitigation and Monitoring*, and Appendix I, *Finding of Adverse Effect for the Atlantic Shores Offshore Wind South Project Construction and Operation Plan,* which includes the Section 106 Memorandum of Agreement (MOA) in Attachment A. Ongoing consultation with consulting parties may result in additional measures or changes to these measures. The Section 106 MOA documenting final avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties will be executed prior to issuance of the ROD.

The Proposed Action is developed based on a PDE as described in the COP, and explained in Section 1.5, *Methodology for Assessing the Project Design Envelope*, and Appendix C.

Table 2-1. Alternatives considered for analysis

Alternative	Description
Alternative A – No Action	Under Alternative A, BOEM would not approve the COP, the Project's construction and installation, O&M, and eventual 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. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization to the applicant under the MMPA. The current resource conditions, trends, and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all action alternatives are evaluated. Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable future activities described in Appendix D, *Ongoing and Planned Activities Scenario,* without the Proposed Action serves as the baseline for the evaluation of cumulative impacts.
Alternative B – Proposed Action	Under Alternative B (Figure 2.1-1), the construction and installation, O&M, and eventual decommissioning of the Atlantic Shores South Project, which consists of two wind energy facilities (Project 1 and Project 2) on the OCS offshore of New Jersey, would be built within the range of the design parameters outlined in the Atlantic Shores South COP (Atlantic Shores 2024), subject to applicable mitigation measures. The Atlantic Shores South Project would include up to 200 total WTGs (between 105 and 136 WTGs for Project 1, and between 64 and 95 WTGs for Project 2), up to 10 OSSs (up to 5 in each Project), up to 1 permanent met tower, and up to 4 temporary meteorological and

Alternative	Description
	oceanographic (metocean) buoys (up to 1 met tower and 3 metocean buoys in Project 1, and 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations, 1 O&M facility, and up to 8 transmission cables making landfall at 2 New Jersey locations. The proposed landfall locations are the Monmouth landfall in Sea Girt, New Jersey with an onshore route to the existing Larrabee Substation POI and the Atlantic landfall in Atlantic City, New Jersey, with an onshore route to the existing Cardiff Substation, which would be upgraded to accommodate the Project's POI. Project 1 would have a capacity of 1,510 MW. Project 2's capacity is not yet determined, but Atlantic Shores has a goal of 1,327 MW, which would align with the interconnection service agreement Atlantic Shores intends to execute for both projects with the RTO, PJM.[1]
Alternative C – Habitat Impact Minimization/Fisheries Habitat Impact Minimization[2]	Under Alternative C, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the layout and maximum number of WTGs and OSSs would be adjusted to avoid and minimize potential impacts on important habitats. NMFS identified two areas of concern (AOCs) within the Lease Area that have pronounced bottom features and produce habitat value. AOC 1 is part of a designated recreational fishing area called "Lobster Hole." AOC 2 is part of a sand ridge (ridge and trough) complex. • **Alternative C1: Lobster Hole Avoidance** (Figure 2.1-8) Up to 16 WTGs, 1 OSS, and associated interarray cables within the Lobster Hole designated area as identified by NMFS would be removed. • **Alternative C2: Sand Ridge Complex Avoidance** (Figure 2.1-9) Up to 13 WTGs and associated interarray cables within the NMFS-identified sand ridge complex would be removed. • **Alternative C3: Demarcated Sand Ridge Complex Avoidance** (Figure 2.1-10) Up to 6 WTGs and associated interarray cables within 1,000 feet (305 meters) of the sand ridge complex area identified by NMFS, but further demarcated through the use of the NOAA's Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores, would be removed. • **Alternative C4: Micrositing** This alternative consists of micrositing 29 WTGs, 1 OSS, and associated interarray cables outside of 1,000-foot (305-meter) buffers of ridges and swales within AOC 1 and AOC 2.
Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts[2]	Under Alternative D, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the no

[1] Atlantic Shores plans to enter into interconnection service agreements and interconnection construction service agreements with PJM to fund improvements to the onshore Cardiff and Larrabee substations, along with required grid updates. These agreements are distinct from PPAs (applicable in Connecticut, Massachusetts, and Rhode Island) and ORECs (applicable in Maryland, New Jersey, and New York). An OREC represents the environmental attributes of one MWh of electric generation from an offshore wind project. BPU awards ORECs through a competitive bidding process and they represent a long-term contract with the State of New Jersey.

[2] The number of WTGs that could be removed may be reduced if this alternative is selected and combined with another alternative that requires removal of additional WTG positions, and if that combination of alternatives would fail to meet the purpose and need, including any awarded offtake agreement(s).

Alternative	Description
	surface occupancy would occur at select WTG positions to reduce the visual impacts of the proposed Project. • **Alternative D1: No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines** (Figure 2.1-11) This alternative would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs from Project 1 and associated interarray cables. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) above mean sea level (AMSL) and maximum blade tip height of 932 feet (284 meters) AMSL. • **Alternative D2: No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines** (Figure 2.1-12) The up to 31 WTGs sited closest to shore would be removed, as well as the associated interarray cables. The remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. • **Alternative D3: No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines** (Figure 2.1-13) The up to 6 WTGs sited closest to shore would be removed, as well as the associated interarray cables. The remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.
Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1[2]	Under Alternative E (Figure 2.1-14), the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to create a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback range between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation. There would be no surface occupancy along the southern boundary of the Atlantic Shores South Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions to allow for a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) separation between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area.
Alternative F – Foundation Structures	Under Alternative F, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. This includes a range of foundation types (of monopile and piled jacket, suction bucket, and gravity-based). To assess the extent of potential impacts of each foundation type for up to 211 foundations (inclusive of WTGs, OSSs, and 1 permanent met tower [Project 1]), this Final EIS analyzes the following: • **Alternative F1: Piled Foundations** The use of monopile and piled jacket foundations only is analyzed for the maximum extent of impacts. • **Alternative F2: Suction Bucket Foundations**

Alternative	Description
	The use of the mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations only is analyzed for the maximum extent of impacts. • **Alternative F3: Gravity-Based Foundations** The use of gravity-pad tetrahedron and gravity-based structure foundations only is analyzed for the maximum extent of impacts.
Preferred Alternative	Under the Preferred Alternative, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of design parameters outlined in the COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to require the proposed OSSs, met tower, and WTGs to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart; remove a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site); microsite 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within the NMFS-identified AOC 1 and AOC 2, restrict the height of WTGs in Project 1 to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL, and provide a minimum 0.81-nautical mile (1,500-meter) setback between the WTGs in Atlantic Shores South and the WTGs in Ocean Wind 1 (Lease Area OCS-A 0498) by removing two WTGs and micrositing one WTG from Project 1.

2.1.1 Alternative A – No Action

Under the No Action Alternative, BOEM would not approve the COP. The Atlantic Shores South Project's construction and installation, O&M, and eventual 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. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization to the applicant under the MMPA. The current resource conditions, trends, and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all direct and indirect impacts from action alternatives are evaluated.

Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable planned activities described in Appendix D, *Ongoing and Planned Activities Scenario*, without the Proposed Action, serves as the future baseline for the evaluation of cumulative impacts.

2.1.2 Alternative B – Proposed Action

Under the Proposed Action, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore of New Jersey would occur within the range of design parameters outlined in Volume I of the COP (Atlantic Shores 2024), which are summarized in Appendix C, *Project Design Envelope and Maximum-Case Scenario.* Project 1 would have a capacity of 1,510 MW. Project 2's capacity has not yet been determined. Atlantic Shores has a goal of 1,327 MW for Project 2, which would align with the interconnection service agreement it intends to execute for both projects with the RTO, PJM.[3] A description of construction and installation, O&M, and decommissioning activities to be undertaken for the Proposed Action is included in Sections 2.1.2.1 through 2.1.2.3. Refer to Volume I of the COP (Atlantic Shores 2024) for additional details on the Project's design.

[3] Atlantic Shores plans to enter into interconnection service agreements and interconnection construction service agreements with PJM to fund improvements to the onshore Cardiff and Larrabee substations, along with required grid updates. These agreements are distinct from PPAs (applicable in Connecticut, Massachusetts, and Rhode Island) and ORECs (applicable in Maryland, New Jersey, and New York). An OREC represents the environmental attributes of one MWh of electric generation from an offshore wind project. BPU awards ORECs through a competitive bidding process and they represent a long-term contract with the State of New Jersey.

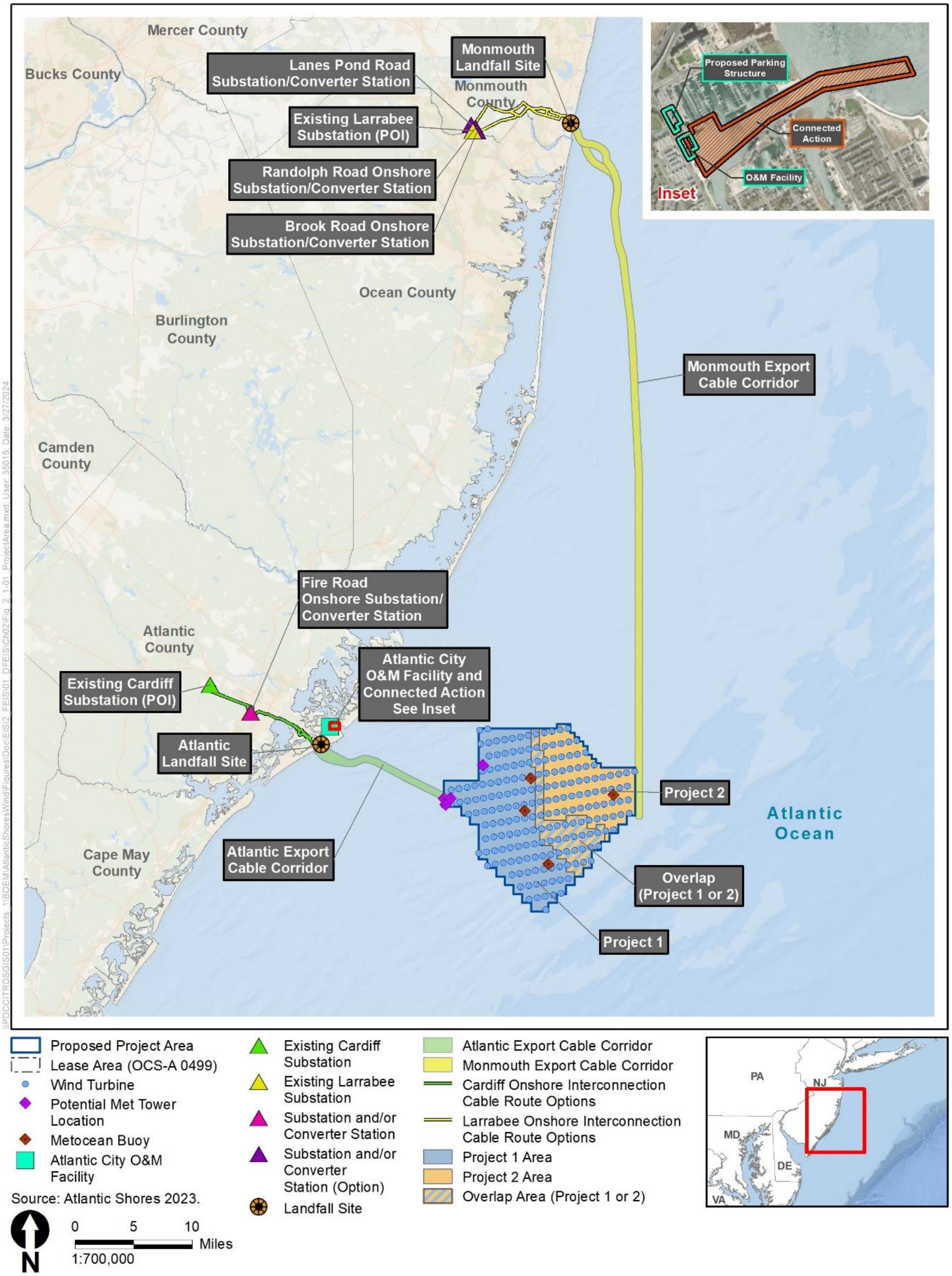


Figure 2.1-1. Atlantic Shores South Offshore Wind Project

Atlantic Shores has committed to environmental protection measures (EPMs) as part of its Proposed Action to avoid, minimize, and otherwise mitigate impacts on physical, biological, socioeconomic, and cultural resources (summarized at the end of each section of COP Volume II; Atlantic Shores 2024). These measures are described in Appendix G and are incorporated as part of the Proposed Action and applicable action alternatives in this Final EIS. Consultations and authorizations under the MMPA, Section 7 of the ESA, the MSA, and Coastal Zone Management Act (CZMA), as well as the submission of applications for and issuance of other necessary permits and authorizations under applicable statutes and regulations, may result in additional measures or changes to these measures.

Atlantic Shores has also committed to comprehensive monitoring of fisheries and benthic habitat conditions throughout the phases of the Project's life-cycle. These monitoring activities will document baseline environmental conditions relevant to fisheries and benthic resources in the WTA, and monitoring of those conditions will continue throughout construction and installation, O&M, and decommissioning of the Proposed Action. These surveys will allow Atlantic Shores to measure Project-related disturbances and monitor the recovery of habitats and biological communities. Atlantic Shores' Fisheries Monitoring Plan will utilize survey gear including clam dredges, demersal fish trawls, and fish traps/pots. Benthic monitoring surveys will utilize gear types including benthic grab samplers, multibeam echosounders, and underwater video cameras.

2.1.2.1 Construction and Installation

The Proposed Action would include the construction and installation of both onshore and offshore facilities. Construction and installation is expected to begin in 2024 and be completed in 2028. Atlantic Shores anticipates initiating land-based construction before beginning the construction of offshore components. The construction of Project 1 and Project 2 would follow a similar schedule up until the activity of WTG Installation and Commissioning. An anticipated Proposed Action schedule is summarized in Table 2-2.

Table 2-2. Anticipated Proposed Action construction schedule

Activity	Expected Timeframe	
	Project 1	Project 2
Onshore Interconnection Cable Installation	2025–2027	
Onshore Substation and/or Converter Station Construction	2025–2028	
Cofferdam Installation and Removal	2025–2026	
Export Cable Installation	2027–2028	
OSS Installation and Commissioning	2026–2027	
WTG Foundation Installation	2026–2028	
Interarray Cable Installation	2026–2028	
WTG Installation and Commissioning	2026–2027	2028

Source: COP Volume I, Chapter 4, Table 4.1.1; Atlantic Shores 2024.

Construction of the Proposed Action is anticipated to begin with the installation of onshore interconnection cables and construction of onshore substations and/or converter stations. Temporary cofferdams are expected to be installed prior to export cable installation. Construction of the offshore facilities is expected to begin with installation of the export cables and the WTG and OSS foundations (including scour foundation). Once the OSS foundations are installed, the topsides can be installed and commissioned, and the interlink cables (if used) can be installed. At each WTG position, after the foundation is installed, the associated interarray cables and WTGs can be installed. Given the number of WTG and OSS positions, there is expected to be considerable overlap in the various equipment installation periods. Installation of the Atlantic Shores South Project's onshore and offshore facilities may occur over a period of up to 4 years (to accommodate weather or seasonal work restrictions); offshore construction is expected to last approximately 3 years, with the exception of high resolution geophysical and geotechnical (G&G) surveys, which are expected to last 5 years. The surveys would be conducted prior to offshore construction commencing and would continue throughout Project construction. In addition, geophysical surveys would be conducted post-construction to ensure proper installation of the Project components.

Onshore Activities and Facilities

Proposed Onshore Project elements include the landfall sites for the submarine export cables, onshore export cable routes, onshore substations (if high-voltage alternating current [HVAC] export cables are used) and/or converter stations (if high-voltage direct current [HVDC] export cables are used), and the interconnection cables linking the onshore substations and/or converter stations to the POIs to the existing grid. Appendix C describes the PDE for onshore activities and facilities, and the COP Volume I provides additional details on construction and installation methods (Atlantic Shores 2024). These onshore elements of the Proposed Action are included in BOEM's analysis in this Final EIS to support the analysis of a complete Project; however, BOEM's authority under the OCSLA extends only to the activities on the OCS.

The Atlantic Landfall Site for the submarine Atlantic Export Cable Corridor (ECC), would be located in Atlantic City, New Jersey on a site currently consisting of a paved public parking lot. The proposed landfall site is located at the eastern terminus of South California Avenue adjacent to the Atlantic City Boardwalk. The site is bounded by Pacific, South Belmont, and South California Avenues and is owned by Atlantic Shores. Export cables may also make landfall within the roadway on South Iowa Avenue, located one block southeast of the parcel adjacent to South California Avenue. Both landfall locations are shown on Figure 2.1-2 as the Atlantic Landfall Site. The landfall site would include underground transition vaults associated with the Atlantic export cables (one vault per cable export). An offset would be instituted around an existing outfall pipe at the proposed location.

The landfall would be connected to the approximately 12.4- to 22.6-mile (20.0- to 36.4-kilometer) Cardiff Onshore Interconnection Cable Route that would continue northwest under urban residential, commercial, and industrial areas to the potential site for the Cardiff Substation and/or Converter Station and terminate at the Cardiff Substation, owned by Atlantic City Electric (ACE). The potential substation and/or converter station site, shown on Figure 2.1-2, is a vacant lot located in Egg Harbor Township, approximately 20 acres (8 hectares) in size and bordered by Fire Road (County Road 651) to the north and Hingston Avenue to the south.

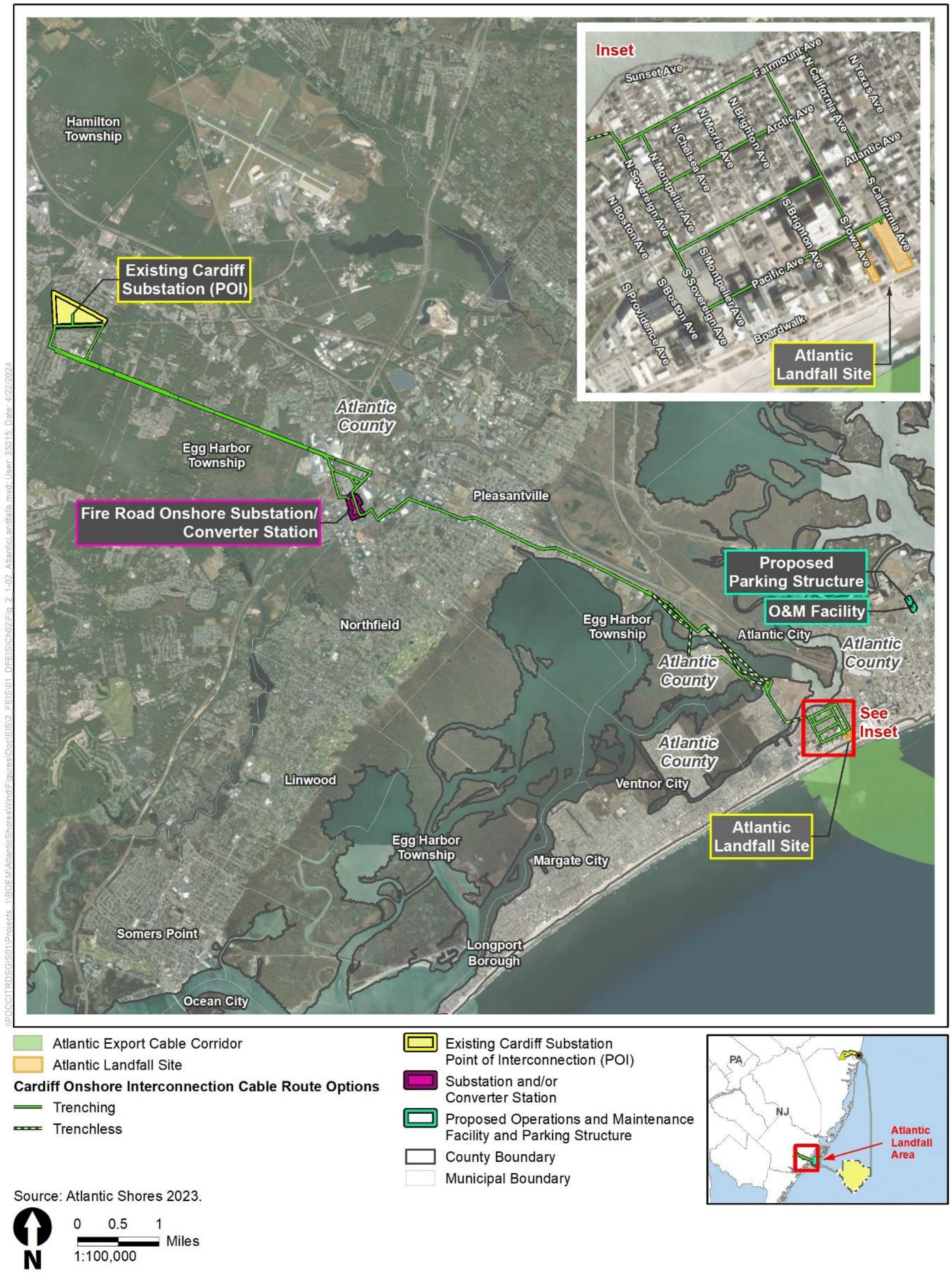


Figure 2.1-2. Onshore Project elements: Atlantic Landfall Site to Cardiff Substation POI

The onshore substation and/or converter station would contain transformers and other electrical gear, and the transmission voltage would be increased or decreased in preparation for grid interconnection at the Cardiff Substation POI. Modifications to the substation would be required to accommodate the interconnection of the Atlantic Shores South Project. Upgrades would be contained on ACE's property and would include expanding the existing substation by building new 230-kilovolt (kV) gas-insulated switchgear equipment. Atlantic Shores would support the construction of the new equipment on behalf of ACE. The substation would remain an asset owned, maintained, and operated by ACE.

If construction of the cable landings is to occur during a scheduled state and/or federal beach nourishment project, Atlantic Shores would coordinate with the New Jersey Department of Environmental Protection (NJDEP), Office of Coastal Engineering and USACE.

The Monmouth Landfall Site for the submarine Monmouth ECC would be located in Sea Girt, New Jersey, at the U.S. Army National Guard Training Center (NGTC), as seen on Figure 2.1-3. The underground transition vaults (one per export cable) would be located in the southeast corner of the NGTC property in a previously disturbed area. This area currently serves as a staging and access location for a federal beach nourishment project, and, as such, Atlantic Shores would coordinate all planned activities at this location with USACE and NJDEP, Office of Coastal Engineering. The landfall would be connected to the approximately 9.8- to 23.0-mile (15.8- to 37.0-kilometer) Larrabee Onshore Interconnection Cable Route, which would continue west to one of three potential sites for the Larrabee Substation and/or Converter Station and terminate at the Larrabee Substation POI owned by Jersey Central Power & Light (JCP&L). The three potential substation and/or converter station sites, shown on Figure 2.1-3, are the approximately 16.3-acre (6.6-hectare) Lanes Pond Road Site, located at the southeast intersection of Lanes Pond Road and Miller Road; the approximately 24.6-acre (10-hectare) Randolph Road Site, located east of Lakewood Farmingdale Road and north of Randolph Road; and the approximately 99.4-acre (40.2-hectare) Brook Road Site, located west of Brook Road and south of Randolph Road.[4] All three sites are located in Howell Township, New Jersey.

The PDE includes the proposed onshore substation and/or converter stations and cable routes as options, and therefore, will be analyzed collectively as part of the Proposed Action. However, the Brook Road Site is expected to be prepared and developed as part of the State of New Jersey's State Agreement Approach (SAA) to support multiple offshore wind generation projects that the state will procure in the future.[5] New Jersey's third offshore solicitation requires bidders to utilize the state's transmission provider and their infrastructure (to be developed by the SAA-awardee) in their bids. If Atlantic Shores receives the award on behalf of the Atlantic Shores South Project, Atlantic Shores will route to the SAA-awardee's prepared site (the Brook Road Site).

[4] New Jersey's Third Solicitation for Offshore Wind Renewable Energy Certificates (OREC), released March 6, 2023, https://www.nj.gov/bpu/pdf/boardorders/2023/20230306/8D%20ORDER%20OSW%20Third%20Solicitation.pdf.
[5] PJM State Agreement Approach: New Jersey's 2021 Offshore Wind Transmission Competitive Solicitation under PJM State Agreement Approach, https://www.nj.gov/bpu/about/divisions/ferc/saa.html.

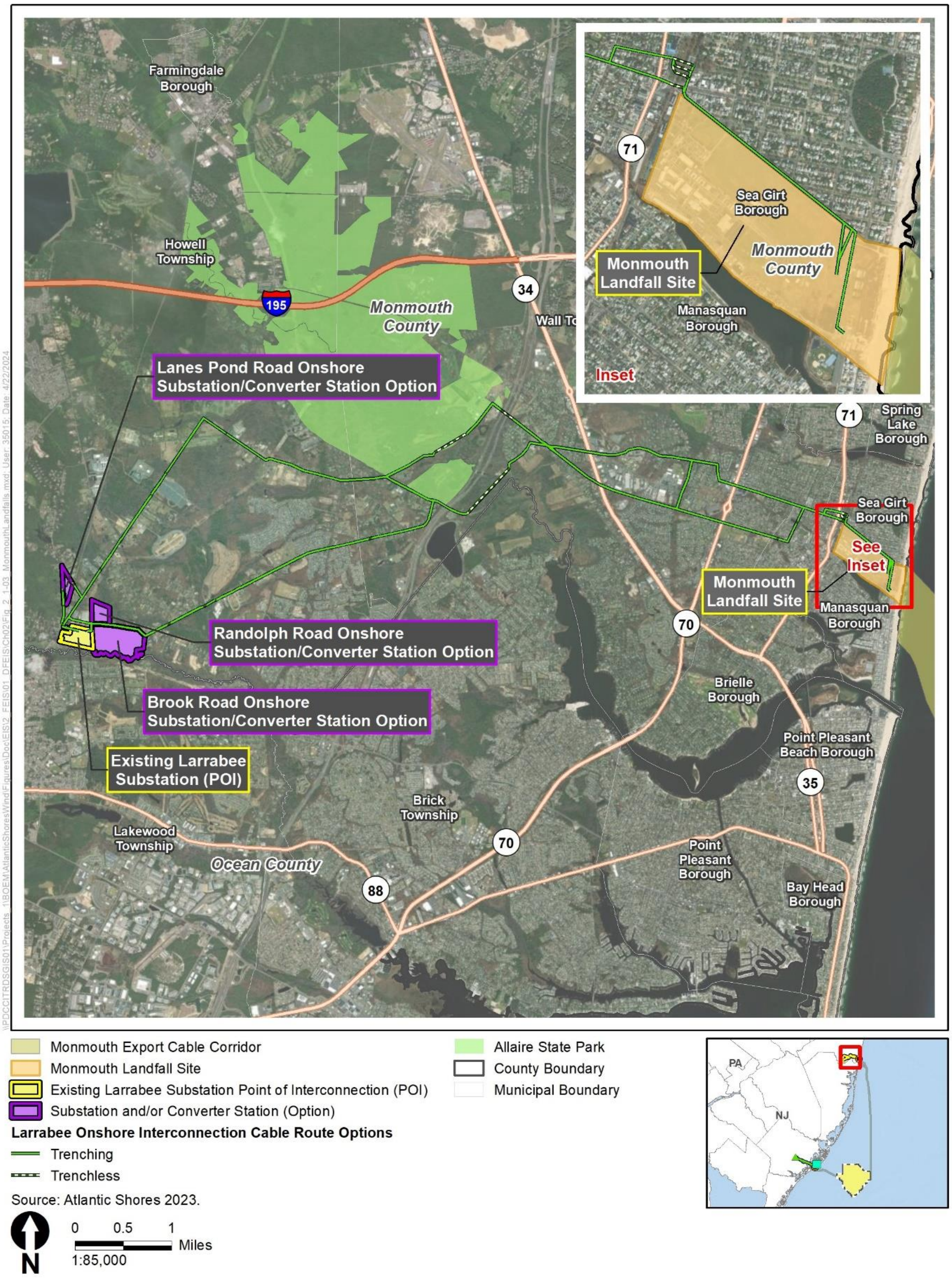


Figure 2.1-3. Onshore Project elements: Monmouth Landfall Site to Larrabee Substation POI

All siting, environmental review, permitting, and other preparation activities at the Brook Road Site are to be completed by the SAA-awardee (or the designated lead state or federal agency, as appropriate) and are thereby not included in the environmental analysis of this Final EIS, except as part of the cumulative impacts analysis. If Atlantic Shores does not receive the award to utilize the Brook Road Site, Atlantic Shores will utilize either the Lanes Pond Road Site or the Randolph Road Site. Additional details regarding the state's development of the Brook Road Site can be found in Appendix D, Table D-8.

The onshore substation and/or converter station would contain transformers and other electrical gear, and the transmission voltage would be increased or decreased in preparation for grid interconnection at the existing Larrabee Substation POI. Modifications to the POI would be required to accommodate the interconnection of the Atlantic Shores South Project. The scope of the modifications is expected to include upgrading the existing substation by adding an additional breaker bay(s). JCP&L would be responsible for the design and construction of the required upgrades on the existing electrical grid, including the upgrades to the Larrabee Substation.

The onshore interconnection cables would be contained within buried concrete duct banks. The installation of the duct banks and encased cables within the cable routes would be completed via open trenching except in areas where resources are present and need to be avoided. Both the Cardiff and Larrabee Onshore Interconnection Cable Routes include several wetland and waterway crossings. Techniques such as horizontal directional drilling (HDD), pipe jacking, or jack-and-bore methodologies would be utilized to avoid direct surface disturbance. Atlantic Shores is coordinating with USACE to ensure the proposed HDD depth and distance would meet USACE requirements.

To support construction of the Cardiff Onshore Interconnection Cable Route and Larrabee Onshore Interconnection Cable Route, a Traffic Management Plan (TMP) would be developed to avoid and minimize traffic impacts and would adhere to seasonal construction restrictions near the shoreline. Subject to ongoing coordination with local authorities, no onshore construction would occur during the summer (generally Memorial Day to Labor Day) for the Cardiff Onshore Interconnection Cable Route and a portion of the Larrabee Onshore Interconnection Cable Route.

Offshore Activities and Facilities

Proposed Offshore Project components include up to 200 WTGs and their foundations, up to 10 OSSs and their foundations, up to 1 permanent met tower and its foundation, scour protection for foundations, interarray cables and offshore export cables, and up to 4 temporary metocean buoys (these elements collectively compose the Offshore Project area). The proposed Offshore Project elements would be located on the OCS as defined in the OCSLA, except that a portion of the offshore export cables would be located within state waters (Figure 2.1-4). Appendix C describes the PDE for offshore activities and facilities, and COP Volume I, Section 4.0 provides additional details on construction and installation methods (Atlantic Shores 2024).

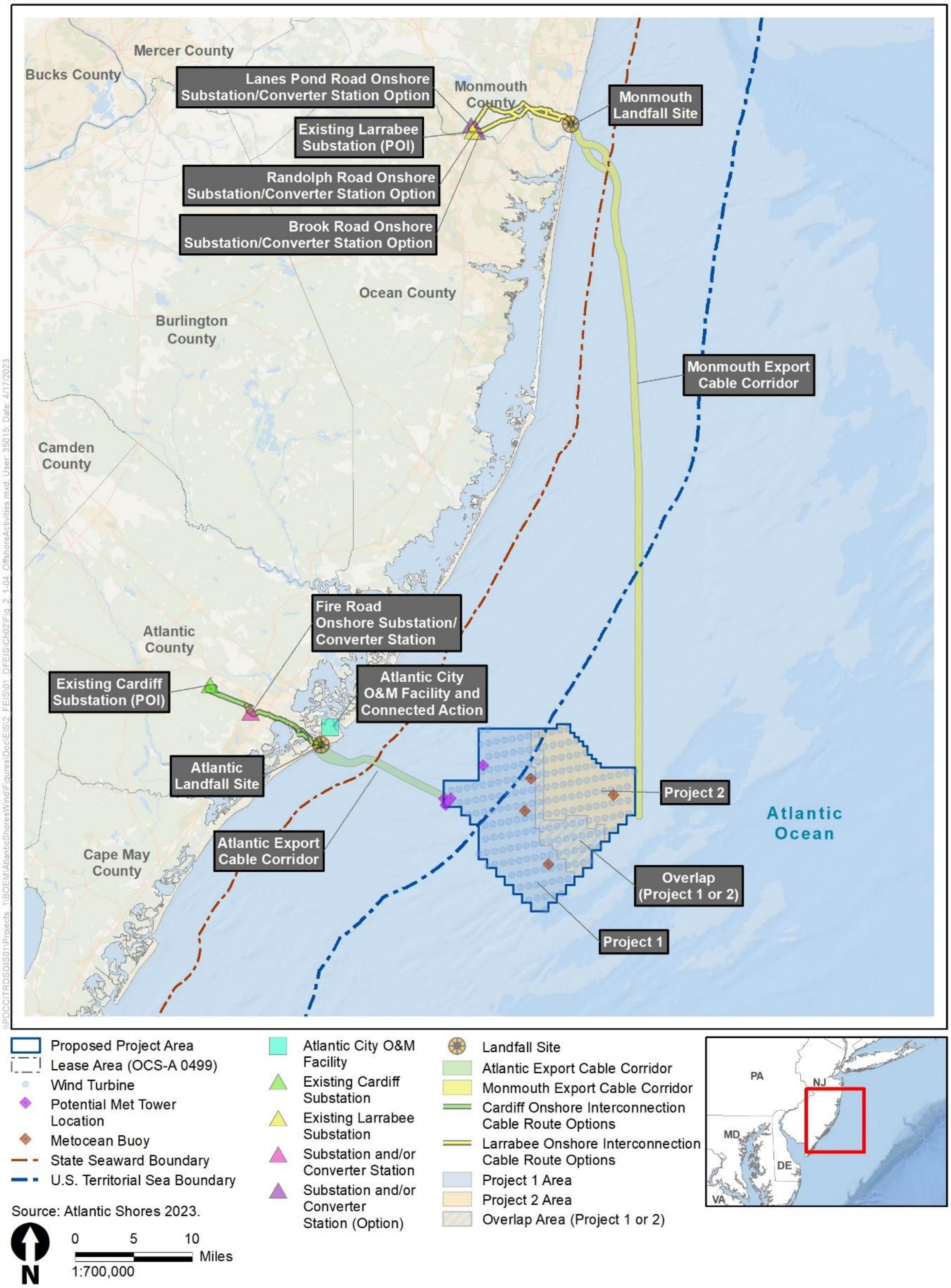
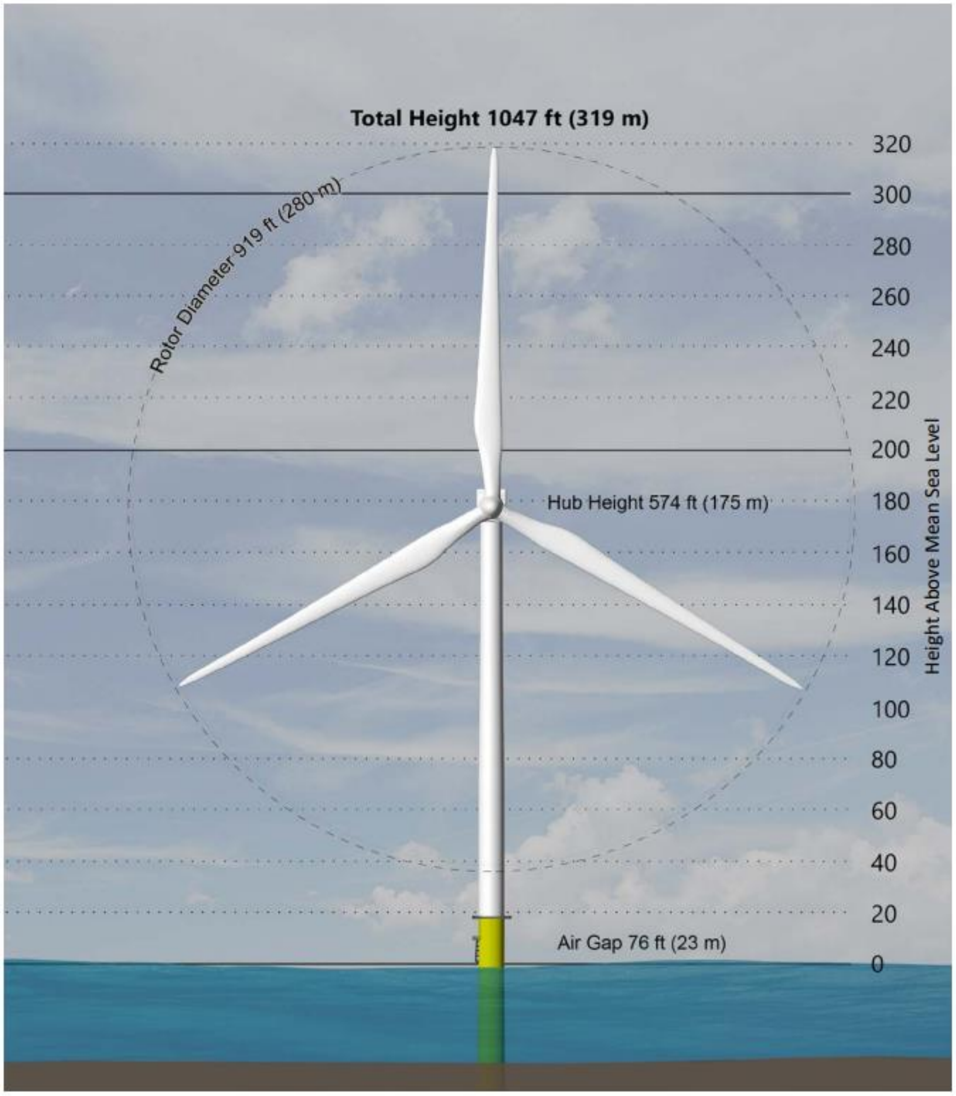


Figure 2.1-4. Offshore activities and facilities and state and U.S. territorial sea boundaries

Atlantic Shores proposes the installation of a maximum of 200 WTGs (inclusive of the 31 WTGs in the Overlap Area); this would include a minimum of 105 WTGs to a maximum of 136 WTGs for Project 1 and a minimum of 64 WTGs to a maximum of 95 WTGs for Project 2, within the approximately 102,124-acre (41,328-hectare) WTA. The WTGs would extend to a maximum height of up to approximately 1,046.6 feet (319.0 meters) AMSL. The WTG dimensions on Figure 2.1-5 are indicative of the maximum dimensions of WTGs anticipated to be commercially available within the Atlantic Shores South Project's expected development schedule. The WTGs would be placed in a uniform grid along east-northeast/west-southwest rows spaced 1.0 nautical mile (1.9 kilometers) apart and north/south columns spaced 0.6 nautical mile (1.1 kilometers) apart. Atlantic Shores would mount the WTGs on monopile foundations for Project 1 and monopile or piled jacket foundations for Project 2. All WTGs within each project would be on the same type of foundation (i.e., all monopile or all piled jacket foundations for WTGs in Project 2).



Source: Atlantic Shores 2024

Figure 2.1-5. Maximum wind turbine generator dimensions AMSL

Once the WTG dimensions have been established, Atlantic Shores will coordinate with the National Weather Service (NWS) to conduct a required analysis by the Radar Operations Center on potential data contamination for the NEXRAD Weather Surveillance Radar, 1988 Doppler (WSR-88D) and Federal Aviation Administration (FAA) Terminal Doppler Weather Radar (DWR). Offshore installation of WTGs would likely involve a jack-up WTG installation vessel assisted by feeder barges or jack-up feeder vessels.

The Atlantic Shores South Project would include up to 10 OSSs that would serve as common collection points for power from the WTGs as well as the origin for the export cables that deliver power to shore. Atlantic Shores is considering three sizes of OSS. Depending on the final OSS design, there would be up to ten small OSSs, up to five medium OSSs, or up to four large OSSs in Project 1 and Project 2 combined. The breakdown of OSSs per project can be found in Table 2-3. OSSs would be located along the same east-northeast/ west-southwest rows as the WTGs but sited within the north/south rows of the WTGs, as shown in Figure 2.1-6. This placement of permanent structures between the WTGs is referred to as "off-grid." Small OSSs would be located at least 12 miles (19.3 kilometers) from shore, whereas medium and large OSSs would be located at least 13.5 miles (21.7 kilometers) from shore. More information on installation can be found in COP Volume I, Section 4.4 (Atlantic Shores 2024).

Table 2-3. Types of OSS needed per project

Projects	Small OSS	Medium OSS	Large OSS
Project 1	Up to 5	Up to 2	Up to 2
Project 2	Up to 5	Up to 3	Up to 2

Source: COP Volume I, Section 4.1.1, Project Design Envelope Overview; Atlantic Shores 2024.

Atlantic Shores is planning to leave the option open to include one of three categories of OSS foundations: piled, suction bucket, or gravity-based foundations. The type of foundation would depend on the size of the OSS itself. The foundations for small OSSs would be piled (monopile or piled jacket) or suction bucket (suction bucket jacket). The foundations for medium or large OSSs would be piled (piled jacket), suction bucket (suction bucket jacket), or gravity-based structures (GBS). The breakdown of OSS foundation types can be found in Table 2-4 in Section 2.1.6, *Alternative F – Foundation Structures*. Power generated by the WTGs would be transmitted to the OSSs via 66 kV to 150 kV interarray cables, which would connect to circuit breakers and transformers located within the OSS topsides. These transformers would increase the voltage level to the export cable voltage (230 kV to 275 kV HVAC cables or 320 kV to 525 kV HVDC cables). From the OSSs, the export cables would transmit electricity to shore.

During construction and operation, the OSSs would be lighted and marked in accordance with FAA, U.S. Coast Guard (USCG), and BOEM guidelines to aid safe navigation within the WTA. Atlantic Shores does not currently anticipate installing helicopter pads on the OSSs, though this feature may be added depending on the O&M strategy employed. If a helicopter pad is installed, it would be designed to support a USCG helicopter, including appropriate lighting and marking as required.

Up to eight export cables would be installed to deliver electricity from the OSSs to the landfall sites. The export cables from each Project have the potential to utilize either ECC or be co-located in the same ECC. Both Project 1 and Project 2 would also include electrically distinct interarray cables to connect strings of WTGs to an OSS and may include interlink cables to connect OSSs to each other. Project 1 and

Project 2 would each include HVAC and/or HVDC export cables. If HVAC cables are used, the voltage would be between 230 kV and 275 kV; if HVDC cables are used, the voltage would be between 320 kV and 525 kV. Furthermore, if HVDC cables are used, it is anticipated that a closed-loop cooling system would be utilized, pending technical suitability and commercial availability of the technology.

Atlantic Shores proposes to construct separate submarine export cables, with approximately 328–820 feet (100–250 meters) between each cable, for Project 1 and Project 2 within the submarine ECCs identified in the COP and shown on Figure 2.1-1. The approximately 12-mile (19-kilometer) Atlantic ECC would travel from the western tip of the WTA westward to the Atlantic Landfall Site. The approximately 61-mile (98-kilometer) Monmouth ECC would travel north from the eastern corner of the WTA along the eastern edge of the Lease Area to the Monmouth Landfall Site.

The interarray and interlink cables could be installed using one or more of the following methods: simultaneous lay and burial, post-lay burial, or pre-lay trenching. Atlantic Shores is carefully evaluating available cable installation tools to select techniques that are appropriate for the site and that would maximize the likelihood of achieving the target cable burial depth of 5 to 6.6 feet (1.5 to 2.0 meters).

Most of the export, interarray, and interlink cables would be installed using jet trenching (either simultaneous lay and burial or post-lay burial) or jet plowing, with limited areas of mechanical trenching. It is estimated that 80 to 90 percent of the offshore cables would be installed with a single pass of the cable installation tool. However, in limited areas expected to be more challenging for cable burial (along up to 10 to 20 percent of the export, interarray, and interlink cable routes), an additional one to three passes of the cable installation tool may be required to further lower the cable to its target burial depth.

In areas where burial of the cables to the target depth (5 to 6.6 feet [1.5 to 2 meters]) is not feasible, cable protection would be installed on the seabed above the cable as a secondary measure to protect the cables. Proposed types of cable protection include the following:

- Rock placement: Up to three layers of rock, with rock size increasing in higher layers.
- Concrete mattresses: High-strength concrete blocks cast around mesh.
- Rock Bags: Rock-filled filter unit enclosed by polyester mesh.
- Grout-filled bags: Woven fabric filled with grout.
- Half-shell pipes: Composite materials or cast iron that is fixed around a cable.

The cables are proposed to be routed around federal aids to navigation (ATONs) where practical. However, where existing obstructions (such as artificial reefs and sand borrow areas) did not allow for avoidance, Atlantic Shores surveyed around the aids to navigation and will coordinate with USCG on potential repositioning of an aid to navigation.

The width of each ECC would correspond to the width of the surveyed corridors, in which the potential cable easements would be located, and would range from approximately 3,300 to 4,200 feet (1,000 to

1,280 meters) for all of the Monmouth ECC and most of the Atlantic ECC, though the Atlantic ECC widens to approximately 5,900 feet (1,800 meters) near the Atlantic Landfall Site. The proposed width of each ECC accommodates the planned export cable options as well as the associated cable installation vessel activities and would allow for avoidance of resources such as shipwrecks, artificial reefs, and sensitive habitats. Variations in width at the landfall sites are needed to accommodate the construction vessel activities necessary to support the landfall of each export cable via HDD. Up to eight temporary cofferdams, four at each landfall site, may be constructed. The cofferdams would be approximately 98.4 feet by 26.2 feet (30 meters by 8 meters). Following the installation of the HDD conduit and export cable, the seabed would be restored, and the cofferdam removed. Atlantic Shores would conduct vibration monitoring at the Atlantic Landfall Site during HDD activities to ensure minimal impacts to the existing outfall pipe at the proposed location.

Atlantic Shores would survey all cable crossings, and if a cable being crossed is active, Atlantic Shores would develop a crossing agreement with its owner. At each crossing, before installation, Atlantic Shores would clear the area around the crossing of any marine debris. Depending on the status of the existing cable and its location, such as burial depth and substrate characteristics, cable protection may be placed between the existing cable and Atlantic Shores' overlying cable. However, if sufficient vertical distance exists, such protection may be avoided. The presence of an existing cable may prevent Atlantic Shores' cable from being buried to its target burial depth. In this case, cable protection may be required on top of the proposed cable at the crossing location. Following installation of the proposed cables, Atlantic Shores would survey the cable crossing again. Additionally, Atlantic Shores is coordinating with Ocean Wind, LLC (Ocean Wind), the developer of the proposed neighboring Ocean Wind 1 Offshore Wind Farm Project (Ocean Wind 1) to develop a mutually acceptable crossing agreement to govern proposed cable crossings.

A single permanent met tower up to 590.6 feet (180 meters) AMSL may be installed within the WTA during construction of Project 1. Up to four locations for the met tower, all located within Project 1, are under consideration. All four potential locations (shown on Figures 2.1-4 and 2.1-6) fall outside of the WTG gridded layout pattern and are located on or near the western perimeter of the WTA so as to minimize potential interference with navigation, as shown in Figure 2.1-6. The met tower would not replace a WTG location. The foundation options for the met tower include piled (monopile or piled jacket), suction bucket (suction bucket jacket or mono-bucket), and GBS. The met tower would be composed of square lattice consisting of tubular steel and would be equipped with an approximately 50-foot by 50-foot (15-meter by 15-meter) deck.

Up to four metocean buoys (three for Project 1 and one for Project 2) may be installed within the WTA during construction. These buoys, shown in Figure 2.1-4, would be temporary and used to monitor weather and sea state conditions during construction. The buoys would be anchored to the seafloor using a steel chain connected to a steel chain weight and possibly an additional bottom weight associated with a water level sensor. Once construction is completed, the buoys would be decommissioned in accordance with 30 CFR Part 285, Subpart I.

Indicative locations of the up to ten small OSSs, up to five medium OSSs, and up to four large OSSs, as well as the four potential met tower locations and four metocean buoy locations are shown on Figure 2.1-6.

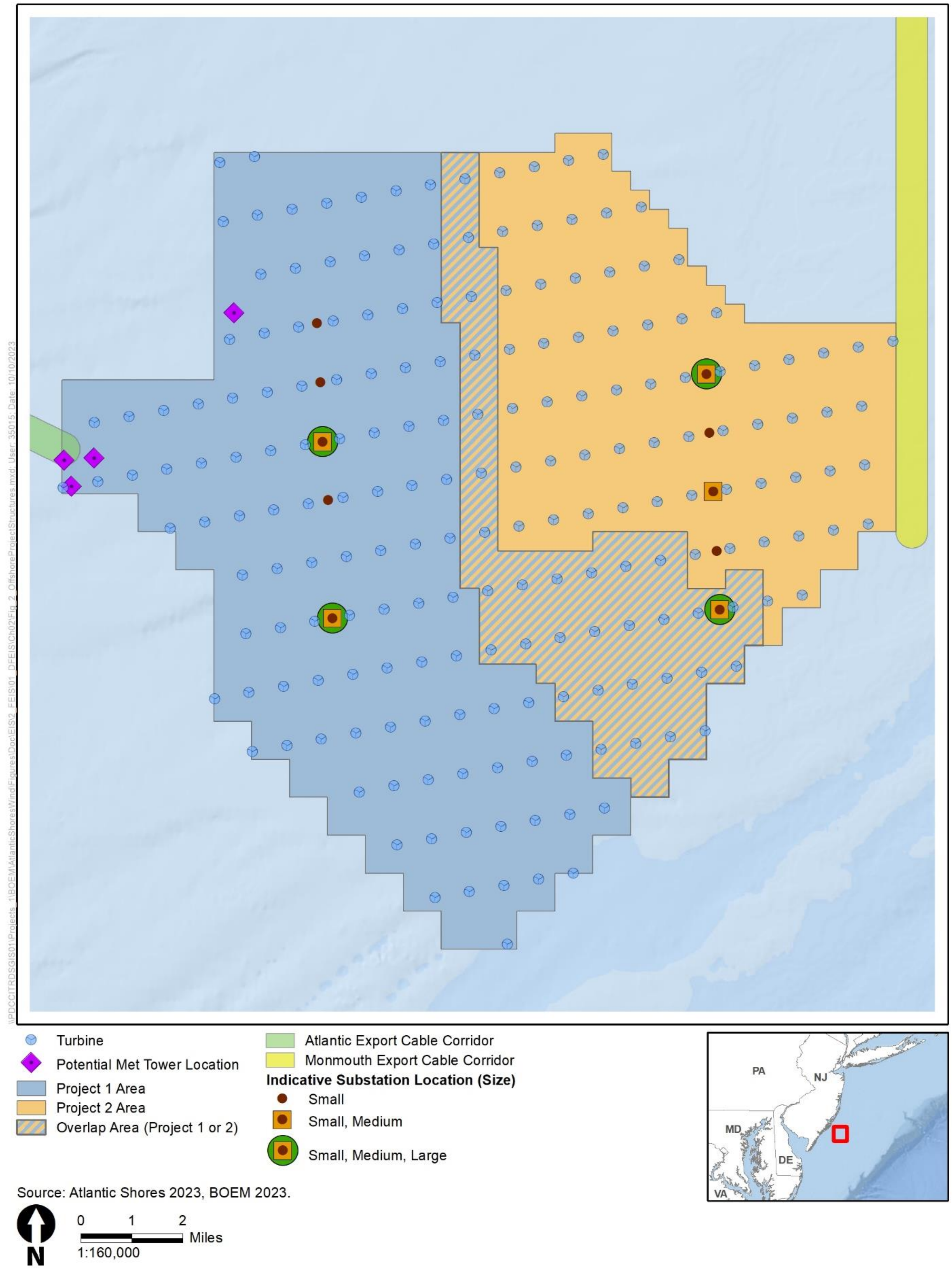


Figure 2.1-6. Offshore Project structures

2.1.2.2 Operations and Maintenance

Once installed and commissioned, both Project 1 and Project 2 are designed to operate for up to 30 years.[6] O&M activities would ensure that Project 1 and Project 2 function safely and efficiently. To minimize equipment downtime and maximize energy generation, the Project would conduct O&M activities through scheduled, predictive, and remotely controlled activities. Remotely controlled activities include remotely turning on and off Project equipment to accommodate maintenance activities, requests from grid operators or USCG, or other activities, and continuous remote monitoring of the status, production, and health of offshore structures, cables, and equipment.

The Project's facilities would operate autonomously without onsite attendance by technicians. Project 1 and Project 2 would be equipped with a supervisory control and data acquisition (SCADA) system, which would provide an interface between each Project's facilities and all environmental and condition monitoring sensors and would provide detailed performance and system information. The operator would monitor the status, production, and health of the Project 24 hours a day. As part of the Proposed Action, an O&M facility would be constructed in Atlantic City, New Jersey, on a 1.38-acre (0.56-hectare) vacant site previously used for vessel docking or other port activities (Figure 2.1-7). Construction of the O&M facility would involve construction of a new building and potentially an associated parking structure, repairs to the existing docks, and installation of new dock facilities. The O&M facility may utilize the parking lot on South California Avenue at the Atlantic Landfall Site or other existing surface lots in Atlantic City supported by shuttles to and from the O&M facility. The new O&M facility may include installation of a communication antenna with a height up to 120 feet (36.6 meters). Repair or installation of a new bulkhead and maintenance dredging in coordination with Atlantic City's dredging of the adjacent basins would be conducted regardless of the construction and installation of the Proposed Action. However, the bulkhead and dredging are necessary for the use of the O&M facility included in the Proposed Action. Therefore, the bulkhead repair/installation and dredging activities are considered to be a connected action under NEPA (Section 2.1.2.4). As shown in Figure 2.1-7, the dock repair and installation area overlaps with the area associated with the connected action activities.

Scheduled maintenance would be performed on a fixed, predetermined schedule (e.g., annually) and may consist of remote monitoring, inspections, testing, replacement of consumables, and preventative maintenance. As part of the scheduled maintenance, self-inspections would be conducted in accordance with 30 CFR 285.824 and 285.825. Scheduled maintenance of offshore facilities would be performed during non-winter months when accessibility would be highest. The frequency of inspections, tests, and maintenance would be based on industry standards and best practices.

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[6] For analysis purposes, BOEM assumes in this Final EIS that the proposed project would have an operating period of 30 years. Atlantic Shores' lease with BOEM (Lease OCS-A 0499) has an operational term of 25 years that commences on the date of COP approval. (See https://www.boem.gov/sites/default/files/documents/oil-gas-energy/OCS-A%200499%20Lease.pdf; see also 30 CFR 585.235(a)(3).) Atlantic Shores would need to request and be granted a renewal of the operations term of its lease under BOEM's regulations at 30 CFR 585.425 et seq. in order to operate the proposed Atlantic Shores South Project for 30 years. While Atlantic Shores has not made such a request, this Final EIS uses the longer period in order to avoid the possibility of underestimating any potential effect.

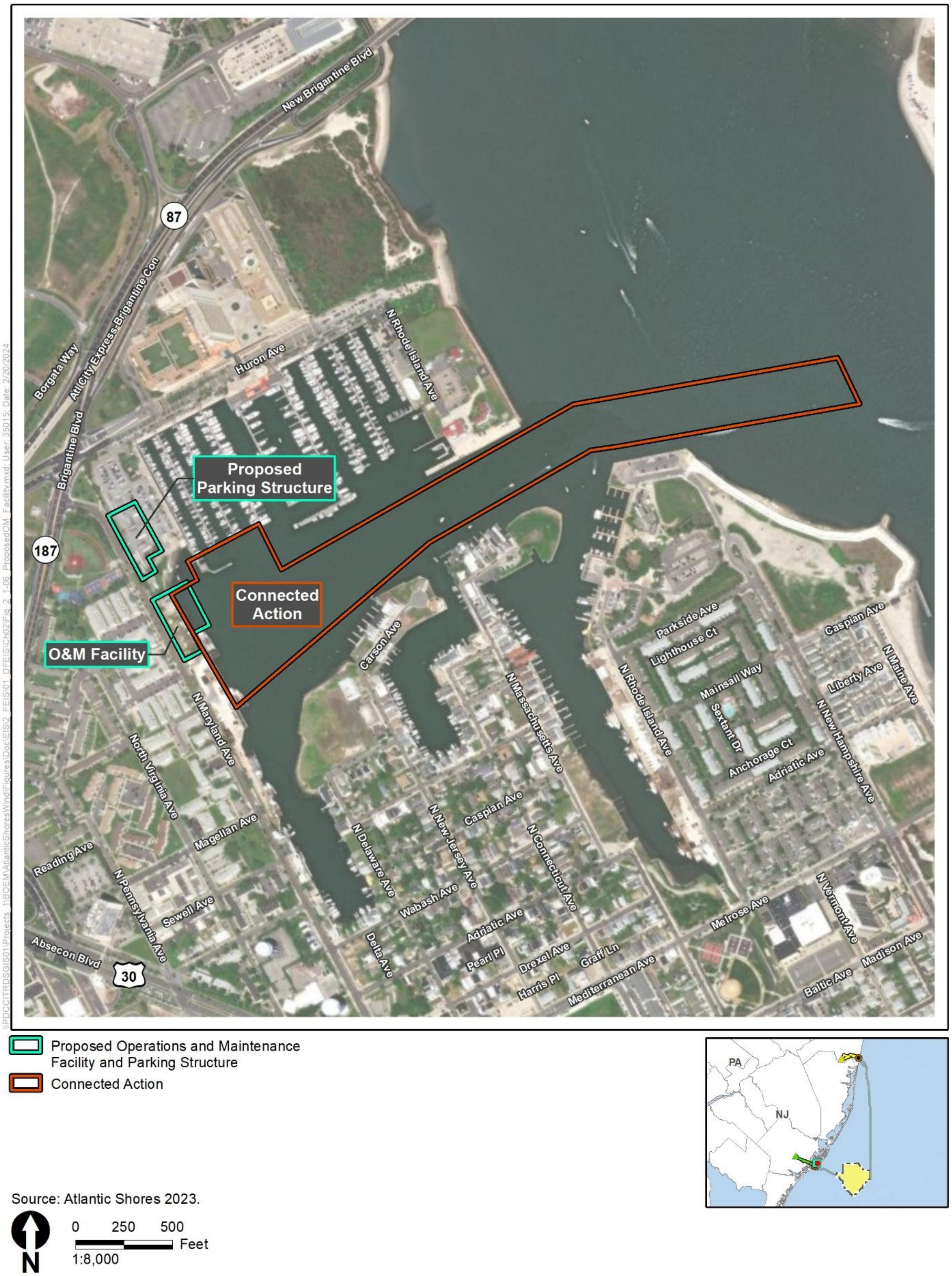


Figure 2.1-7. Proposed operations and maintenance facility

Unscheduled maintenance would be performed in response to a sensor alarm or fault indicating a component malfunction or in response to an event that causes accidental damage. Unscheduled maintenance may involve inspections, troubleshooting, and corrective maintenance, and would occur at any time of the year. Atlantic Shores would conduct a post-event inspection after an event that causes damage to a structure (e.g., a ship allision) or after a storm during which measured environmental conditions exceeded specified conditions (e.g., a hurricane or significant storm event).

Onshore Activities and Facilities

The onshore substations and/or converter stations, onshore export cables, and grid POIs would be inspected regularly and may require preventative maintenance and, as needed, corrective maintenance. Electrical systems at the onshore substations and/or converter stations—such as transformers, switchgear, harmonic filters, reactive power equipment, revenue meters, protection and control systems, and auxiliary services—would be regularly monitored. Scheduled maintenance of the onshore interconnection cables would also be performed; any necessary maintenance would be accessed through manholes and completed within the installed transmission infrastructure.

Offshore Activities and Facilities

Scheduled maintenance of WTGs would include regularly scheduled inspections and routine maintenance of mechanical and electrical components. The types and frequency of inspections and maintenance activities would be based on detailed original equipment manufacturer specifications. Annual maintenance campaigns would be dedicated to general upkeep (e.g., bolt tensioning, crack and coating inspection, safety equipment inspection, cleaning, high-voltage component service, and blade inspection) and replacement of consumable components (e.g., lubrication, oil changes). Best management practices would be employed to reduce the risk of spills, discharges, and accidental releases of lubricants, oils, and fuels during these activities.

OSSs would undergo annual maintenance to both medium-voltage and high-voltage systems, auxiliary systems, and safety systems as well as topside structural inspections. Portions of the topsides may require the reapplication of corrosion-resistant coating. Routine maintenance and refueling would also be performed on diesel generators located on the OSSs.

WTG, OSS, and met tower foundations would be inspected both above and underwater at regular intervals to check their condition, including checking for corrosion, cracking, and marine growth. Scheduled maintenance of foundations would also include safety inspections and testing; coating touch up; preventative maintenance of cranes, electrical equipment, and auxiliary equipment; and removal of marine growth.

The offshore cables would be continuously monitored using a distributed temperature system (DTS), a distributed acoustic sensing (DAS) system, or online partial discharge (OLPD) monitoring. In addition, cable surveys would be performed at regular intervals to identify any issues associated with potential scour and depth of burial. Annual surveys would be performed for the first two to five years of operation. Atlantic Shores would determine inspection intervals based on trends established from inspection and measurement data collected during these annual surveys and updated throughout the life of the Project as new inspections are completed. Additional surveys would be performed, as appropriate, in response to abnormal conditions or significant events, such as major storms, marine incidents in the area, or major maintenance activities. In addition, monitoring systems would be installed on all major components, which would alert Atlantic Shores to potential issues and may trigger additional surveys. Cable terminations and hang-offs would be inspected and maintained during scheduled maintenance of foundations, OSSs, and WTGs. Any unusual observations made during routine maintenance and inspection activities may also trigger additional surveys.

2.1.2.3 Conceptual Decommissioning

Under 30 CFR Part 285 and commercial Renewable Energy Lease OCS-A 0499, Atlantic Shores would be required to remove or decommission all facilities, projects, cables, and pipelines, and clear the seafloor of all obstructions created by the proposed Atlantic Shores South Project (see COP Volume I, Section 6.2; Atlantic Shores 2024). All foundations would need to be removed 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)). Absent permission from BSEE, Atlantic Shores would have to achieve complete decommissioning within 2 years of termination of the lease and either reuse, recycle, or responsibly dispose of all materials removed. Atlantic Shores has submitted a conceptual decommissioning plan as part of the COP, and the final decommissioning application would outline Atlantic Shores' process for managing waste and recycling proposed Project components (COP Volume I, Section 6.0; Atlantic Shores 2024). Although the proposed Atlantic Shores South Project is anticipated to have an operational life of 30 years, it is possible that some installations and components may remain fit for continued service after this time. Atlantic Shores would need to request and be granted a renewal of the operations term of its lease under BOEM's regulations at 30 CFR 585.425 et seq. if it wanted to operate the proposed Atlantic Shores South Project for more than the 25-year operations term stated in its lease.

BSEE would require Atlantic Shores 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 the commercial activities on the commercial lease; or 90 days after cancellation, relinquishment, or other termination of the lease (see 30 CFR 285.905). Upon completion of the technical and environmental reviews, BSEE 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. Atlantic Shores would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Atlantic Shores South 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, Atlantic Shores would have to submit financial assurance (e.g., a bond) prior to installation that would be held by the U.S. government to cover the cost of decommissioning the entire facility in the event that Atlantic Shores would not be able to decommission the facility, as outlined under 30 CFR Part 585 Subpart E.

Onshore Activities and Facilities

Depending on future environmental assessments and consultations with state and municipal agencies, onshore facilities (e.g., onshore substations and buried duct banks) would either be retired in place or reused for other purposes. For example, because removing buried concrete duct banks would require excavations similar to those involved with installation, leaving these conduits in place for other infrastructure could be less disruptive and beneficial. Even if duct banks are left in place for future use, the onshore cables would likely be removed from the conduits and recycled accordingly.

Offshore Activities and Facilities

Decommissioning of the WTGs and OSSs would be a “reverse installation” process, with turbine components or the OSS topside structure removed prior to foundation removal (scour). The procedures used for decommissioning the WTG and OSS foundations would depend on the type of foundation. Piled foundations would be cut below the mudline and would be completely removed above that cut. Suction bucket foundations would be injected with water essentially reversing the installation process, enabling the complete removal of the foundation. The gravity foundations would have the ballasts within the foundations removed and the foundations would be floated away. If it is not possible to re-float the gravity foundation, it would be disassembled onsite, and all components removed.

Similar to WTGs and OSS topsides, the met tower would be disassembled and removed from its foundation using cranes, shipped to shore, and recycled or scrapped.

Export cables, interarray cables, and interlink cables (if present) would either be retired in place or removed from the seabed. The decision regarding whether to remove these cables and any overlying cable protection would be made based on future environmental assessments and consultations with federal, state, and municipal resource agencies.

2.1.2.4 Connected Action

This Final EIS analyzes the planned bulkhead repair and/or replacement and maintenance dredging activities as a connected action under NEPA per 40 CFR 1501.9(e)(1). The bulkhead site and dredging activities would be conducted within an approximately 20.6-acre (8.3-hectare) site within Atlantic City’s Inlet Marina area. Available records indicate that the area was historically dredge-maintained during the 1950s and 1980s (USACE 2022).

The existing bulkhead is an approximately 250-foot (76-meter) structure consisting of multiple sections that are made from steel sheet piles, timbers, and concrete. The bulkhead is missing sections, leading it to become unstable and increasing the potential for erosion. Repair and/or replacement of the existing bulkhead is required in order to stabilize the shoreline and prevent additional erosion and would be necessary regardless of whether the Proposed Action is implemented. Independently of the Proposed Action, Atlantic Shores is pursuing a Nationwide Permit 13 to install an approximately 541-foot (165-meter) bulkhead composed of corrugated steel sheet pile. The new bulkhead will be sited externally of the existing bulkhead, as the existing bulkhead will remain in place, unless removal of specific sections is required to safely install the new bulkhead. It is anticipated that the new bulkhead will be supported by anchor piles. The final design and scope of the anticipated bulkhead replacement work, including dimensions, areas, volumes, construction methodologies, mitigation measures, and other details are subject to change following ongoing design work and permit review and approval. Final details will be included in the approved permit.

The City of Atlantic City obtained a USACE approval (CENAP-OPR-2021-00573-95) and a NJDEP Dredge Permit (No. 0102.20.0001.1 LUP 210001) to perform 10-year maintenance dredging of 13 city waterways, inclusive of the area associated with the proposed O&M facility: Clam Creek and Farley's Marina Fuel. Atlantic City's maintenance dredging program targets substantial shoaling that has built up over the last century and would include dredging 122,710 cubic yards (93,818 cubic meters) of shoaled sediments from a 17.75-acre (7.18-hectare) section of Clam Creek and dredging 20,113 cubic yards (15,378 cubic meters) of shoaled sediments from the 2.86-acre (1.16-hectare) footprint of Farley's Marina Fuel.

The City's maintenance dredging program would reestablish a water depth of 15 feet (4.6 meters) below the plane of Mean Low Water (MLW) plus 1.0 foot (0.3 meter) of allowable overdredge and 4:1 slide slopes within the site. Dredging would be accomplished via hydraulic cutterhead dredge with pipeline or mechanical dredge. The hydraulic cutterhead dredge would be the primary dredge method, with the mechanical dredge utilized to access small marina, canal, or lagoon areas. The hydraulic dredge pipeline will be marked in accordance with USCG regulations and would be sunken, except where submerged aquatic vegetation is encountered, in which case the pipeline would be floated. All resultant dredged material at the site would be removed and disposed of at Dredged hole (DH) #86, a subaqueous borrow pit restoration site, in Beach Thorofare in Atlantic City, New Jersey, and in accordance with Department of the Army Permit Number NAP-2020-00059-95. DH #86 is owned and maintained by New Jersey Department of Transportation, Office of Maritime Resources (NJDOT-OMR). Placement of dredged material into DH #86 is contingent upon execution of a use agreement between Atlantic City and NJDOT-OMR. Each maintenance dredging event included within the permit anticipates a duration of approximately 12 weeks, including mobilization and demobilization, dredging, and material placement activities.

The maintenance dredging activities would serve to maintain safe navigational depths for transiting vessels by re-establishing in-water depths consistent with depths historically maintained in collaboration with dredging activities of adjacent harbors and waterways. These activities would be implemented independently from the Proposed Action.

2.1.3 Alternative C – Habitat Impact Minimization/Fisheries Habitat Impact Minimization

Alternative C was developed through the scoping process for the EIS in response to comments received from the Mid-Atlantic Fishery Management Council (MAFMC), New England Fishery Management Council (NEFMC), NMFS, and the Environmental Protection Agency (USEPA). Alternative C includes four sub-alternatives, which would avoid entirely, or in part, two AOCs identified by NMFS within the Lease Area that have pronounced bottom features and produce valuable habitat. AOC 1 is part of a designated recreational fishing area called "Lobster Hole," and AOC 2 is part of a sand ridge (ridge and swale) complex. The layout and number of WTGs and OSSs would be adjusted to avoid and minimize potential impacts on these identified habitats.

Generally, sand ridge and trough features are physical features that are found throughout the OCS in the mid-Atlantic and provide habitat for various species. Ridge and swale habitat provide complex physical structures that affect the composition and dynamics of ecological communities, with increased structural complexity often leading to greater species diversity, abundance, overall function, and productivity. In the mid-Atlantic sand ridges and troughs are areas of biological significance for migration and spawning of mid-Atlantic fish species, many of which are recreationally targeted in those specific areas. A more detailed analysis by resource can be found in Section 3.5, *Biological Resources*. Although the overall artificial reef effect would be decreased by reducing the total number of WTGs in the Lease Area, the biological benefits of preserving natural fish habitat may be beneficial. Each of the sub-alternatives may be individually selected or combined with any or all other alternatives, subject to the combination meeting the purpose and need.

2.1.3.1 Alternative C1 – Lobster Hole Avoidance

Alternative C1 would avoid and minimize the potential impacts on the Lobster Hole (AOC 1), a designated recreational fishing area, by removing up to 16 WTGs, 1 OSS, and associated interarray cables, as shown on Figure 2.1-8.

2.1.3.2 Alternative C2 – Sand Ridge Complex Avoidance

Alternative C2 would avoid and minimize potential impacts on the sand ridge features in the southern-most portion of the Lease Area (AOC 2) by removing up to 13 WTGs and associated interarray cables within the NMFS-identified sand ridge complex (Figure 2.1-9).

2.1.3.3 Alternative C3 – Demarcated Sand Ridge Complex Avoidance

Alternative C3 would remove up to 6 WTGs and associated interarray cables within 1,000 feet (305 meters) of the sand ridge complex area identified by NMFS, but further demarcated using NOAA's Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores (Figure 2.1-10).

2.1.3.4 Alternative C4 – Micrositing

Alternative C4 was proposed by Atlantic Shores and would involve the micrositing of 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within both AOC 1 and AOC 2. Micrositing would be undertaken to reduce impacts on complex habitat but would not materially change the grid layout[7] (e.g., generally within 500 feet [152 meters] of

[7] Micrositing would not materially change the grid layout. No microsited permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern.

foundation locations) that is necessary to preserve safe navigation conditions and USCG Search and Rescue (SAR) missions.

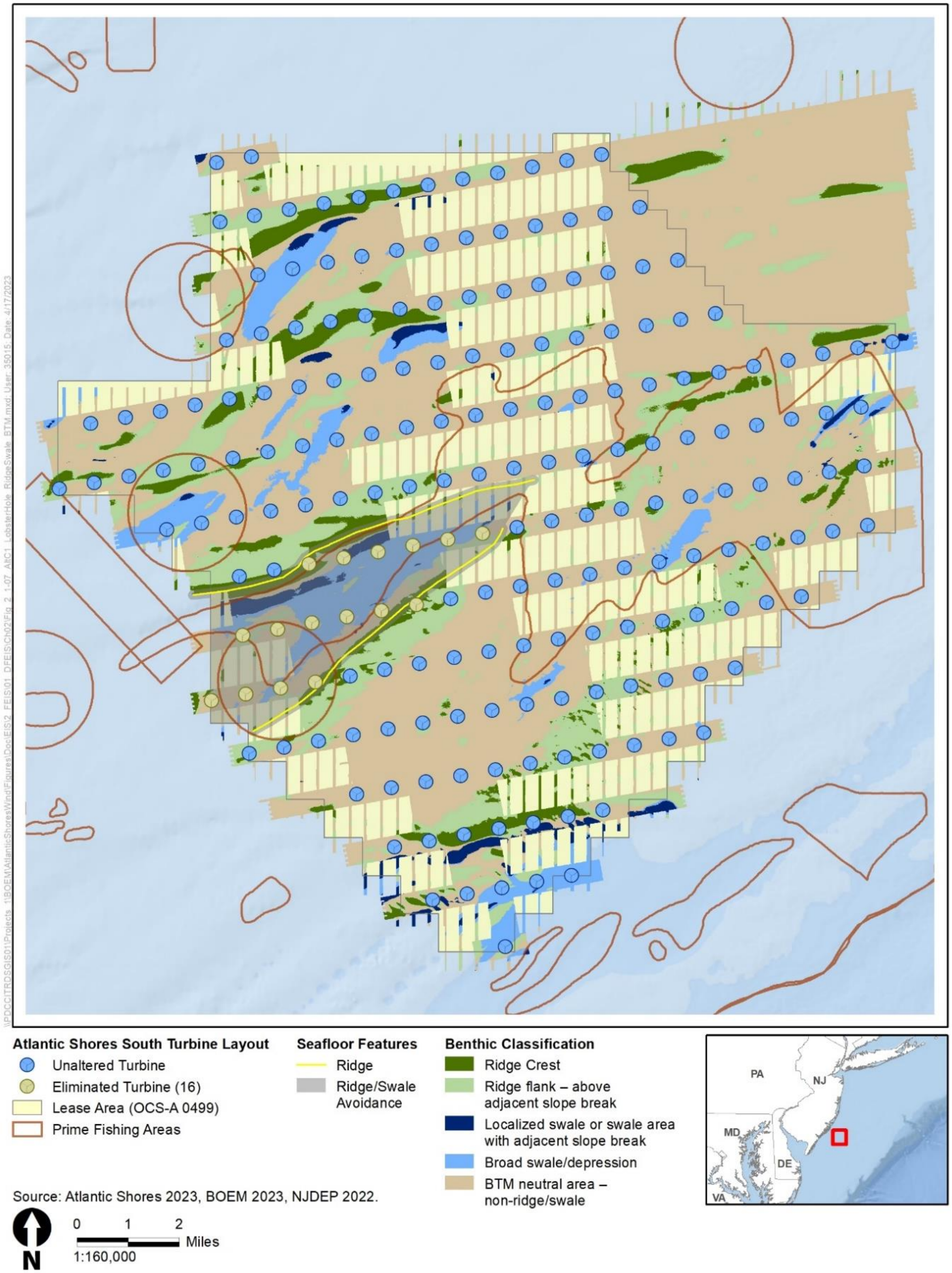


Figure 2.1-8. Alternative C1 – Lobster Hole Avoidance

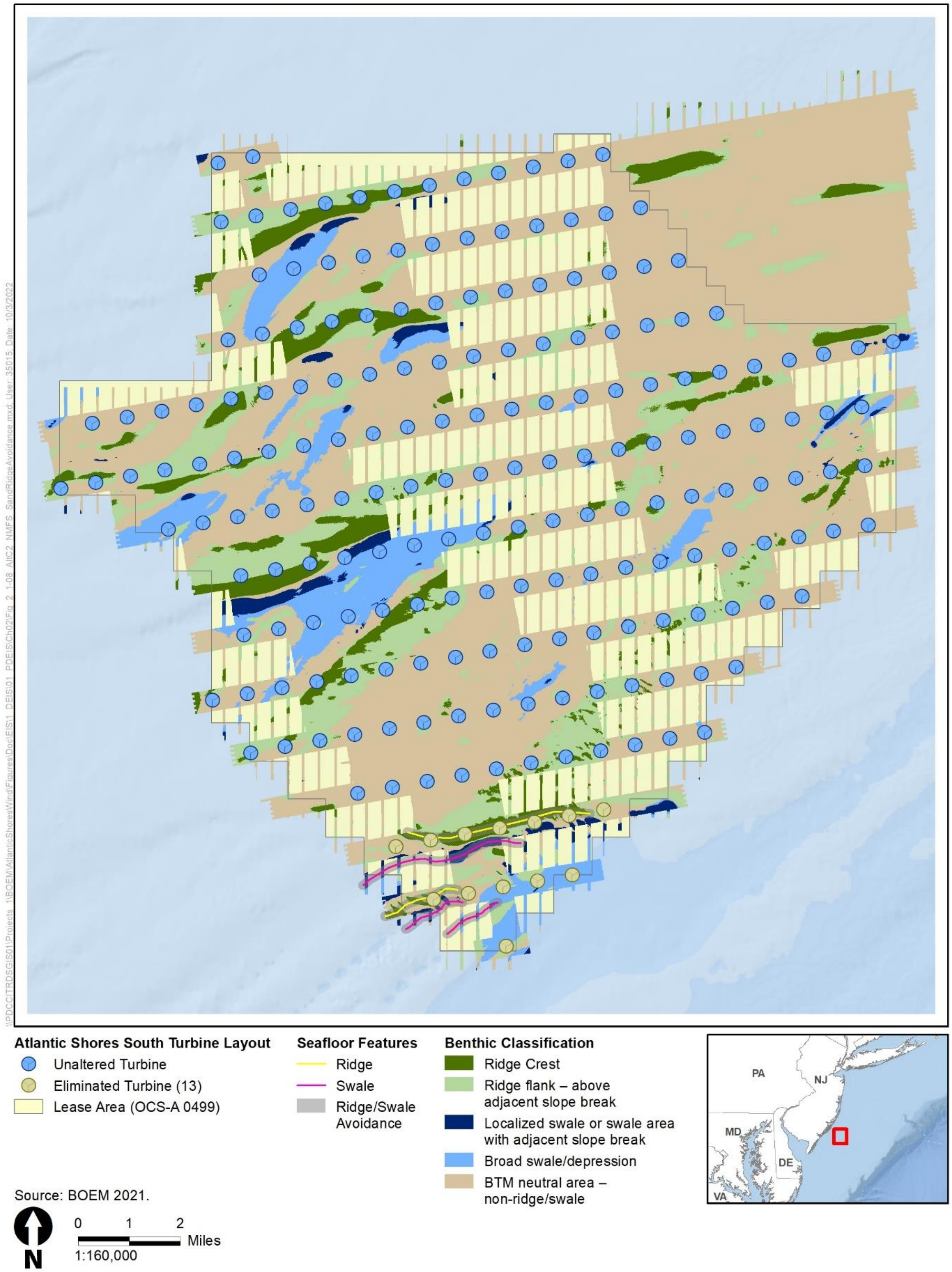


Figure 2.1-9. Alternative C2 –Sand Ridge Complex Avoidance

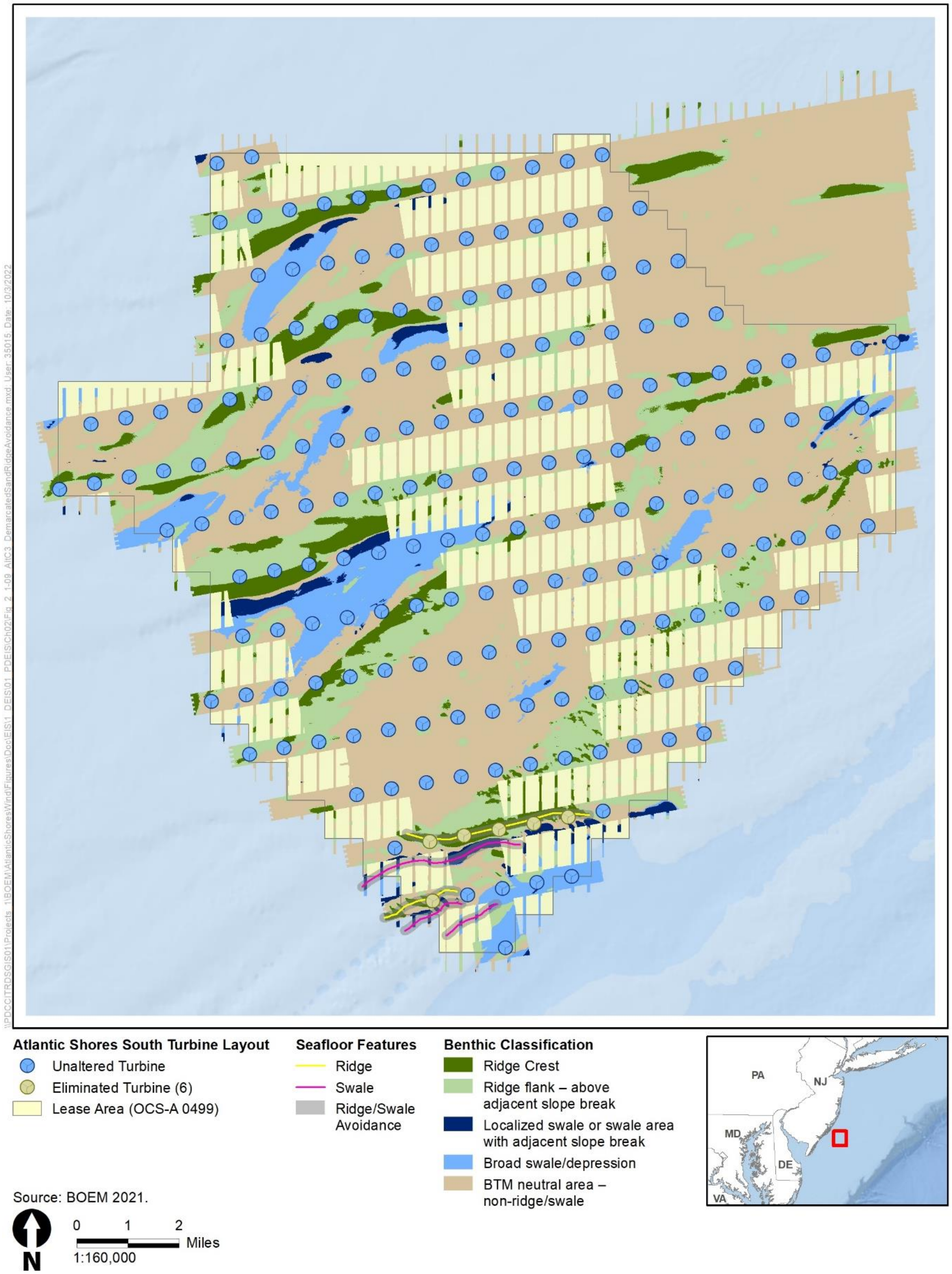


Figure 2.1-10. Alternative C3 – Demarcated Sand Ridge Complex Avoidance

2.1.4 Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts

Alternative D was developed through the scoping process for the EIS in response to public comments concerning the visual impacts of the Atlantic Shores South Project. Under Alternative D, no surface occupancy would occur within defined distances to shore to reduce the visual impacts of the proposed Project. The remaining range of design parameters for Project components and activities to be undertaken for construction and installation, O&M, and conceptual decommissioning would be the same as described in the Proposed Action. Alternative D includes three sub-alternatives where the number of WTGs and turbine heights would be adjusted to reduce visual impacts. Each of the sub-alternatives may be individually selected or combined with any or all other alternatives, subject to the combination meeting the purpose and need.

2.1.4.1 Alternative D1 – No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines

Alternative D1 would result in the exclusion of up to 21 WTG positions in Project 1 within 12 miles (19.3 kilometers) from shore (Figure 2.1-11). The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. The overall exclusion of WTG positions would result in a reduced annual energy production and BOEM is continuing to assess the energy production impact and feasibility of this alternative. The final number of WTG positions considered for exclusion in the Final EIS may be reduced to fewer than 21 to ensure consistency with the 1,510-MW nameplate capacity and annual allowance awarded to Atlantic Shores by BPU, and any additional offtake agreements that are finalized prior to the Final EIS.

2.1.4.2 Alternative D2 – No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines

Alternative D2 would result in the exclusion of up to 31 WTG positions in Project 1 that are sited closest to shore (Figure 2.1-12). The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. The overall exclusion of WTG positions would result in reduced annual energy production and BOEM is continuing to assess the energy production impact and feasibility of this alternative. The final number of WTG positions considered for exclusion in the Final EIS may be reduced to fewer than 31 to ensure consistency with the 1,510-MW nameplate capacity and annual allowance awarded to Atlantic Shores by BPU, and any additional offtake agreements that are finalized prior to the Final EIS.

2.1.4.3 Alternative D3 – No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines

Alternative D3 would result in the exclusion of up to 6 WTG positions in Project 1 that are sited closest to shore (Figure 2.1-13). The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.

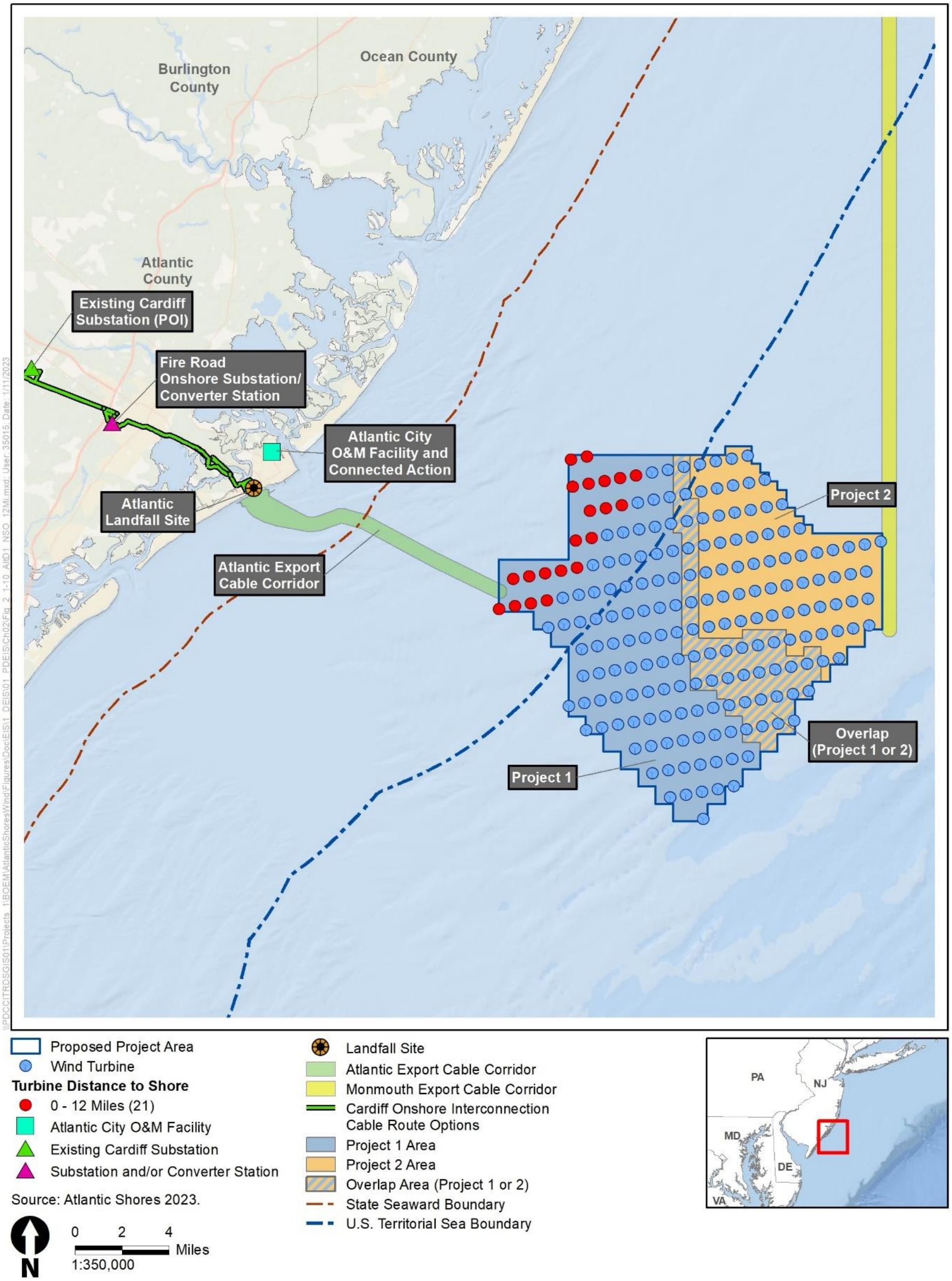


Figure 2.1-11. Alternative D1 – No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines

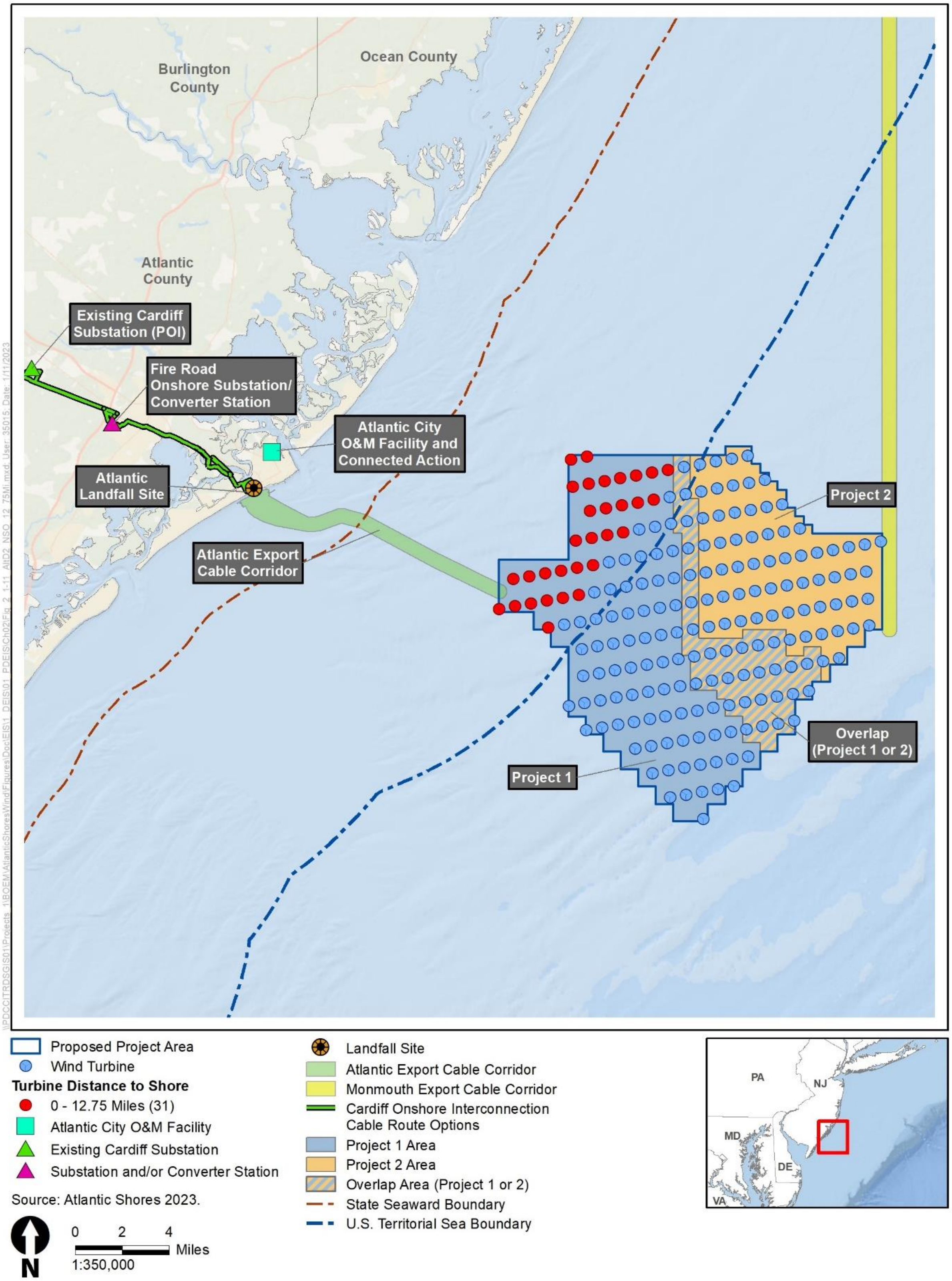


Figure 2.1-12. Alternative D2 – No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines

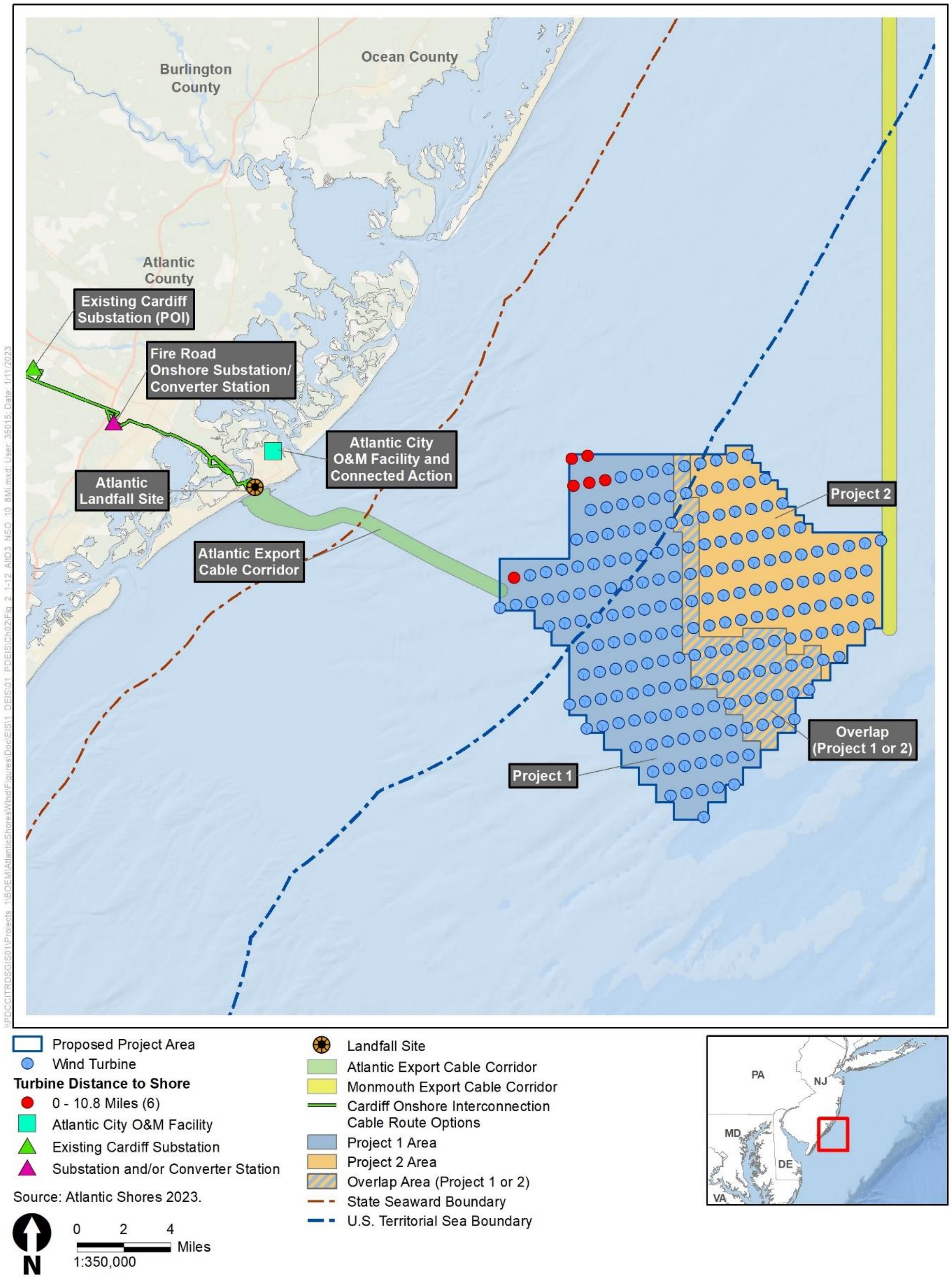


Figure 2.1-13. Alternative D3 – No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines

2.1.5 Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1

Alternative E was developed through the scoping process for the EIS in response to comments received from the Responsible Offshore Development Alliance (RODA) concerning the different layouts between the Atlantic Shores South and Ocean Wind 1 projects and the need for a setback between the adjacent areas. Modifications would be made to the wind turbine array layout to create a 0.81-nautical- mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and the WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation (Figure 2.1-14).

This alternative would result in no surface occupancy along the southern boundary of the Atlantic Shores South Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions. Ocean Wind 1 is currently proposing a layout[8] with a goal of creating a total buffer distance of 0.81 nautical mile (1,500 meters) between WTGs in both projects; however, Ocean Wind 1 would need to modify its wind turbine layout in order to create a total buffer distance greater than 0.81 nautical mile (1,500 meters). This Final EIS only analyzes the portion of the setback within the Atlantic Shores South Lease Area. A setback would provide a clear visual distinction between the separate projects and provide for sufficient maneuvering space for both surface and aerial (helicopter) navigation.

The range of design parameters for Project components and activities to be undertaken for construction and installation, O&M, and conceptual decommissioning would be the same as described for the Proposed Action.

[8] Ocean Wind, LLC and Atlantic Shores Offshore Wind, LLC in coordination with USCG, developed a mutually agreeable scenario for the Ocean Wind 1 and Atlantic Shores South Projects, which was documented in a joint letter signed by both developers on July 21, 2022. This scenario is covered in the setback range identified in Alternative E.

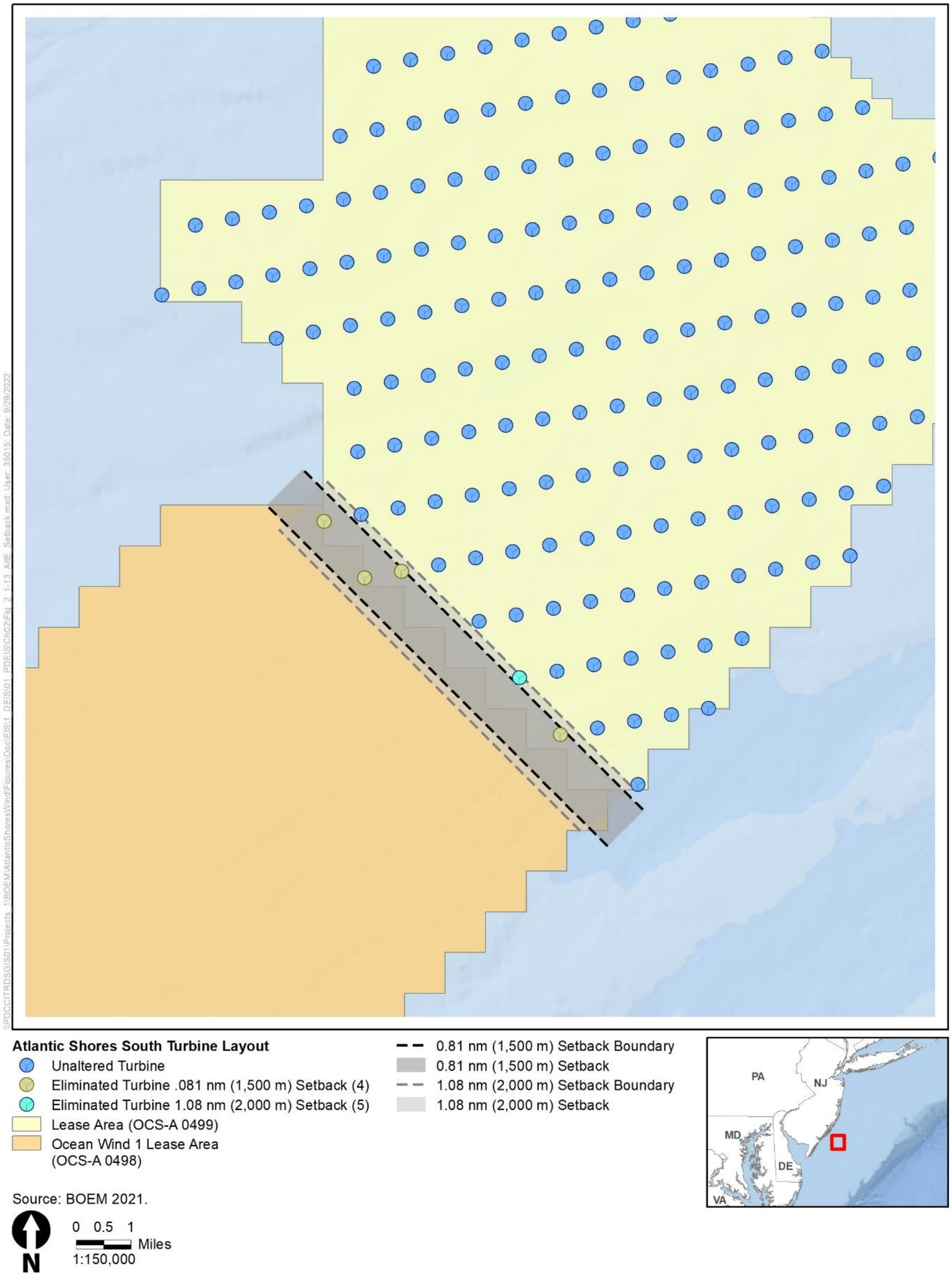


Figure 2.1-14. Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1

2.1.6 Alternative F – Foundation Structures

Alternative F was developed through the scoping process for the EIS in response to comments, as well as options posed in the COP. Alternative F addresses the possibility for one or more foundation types to be utilized for WTGs, OSSs, and the permanent met tower, and includes three sub-alternatives that detail the different foundation structures. Depending on the final OSS design, there would be up to five small OSSs, two medium OSSs, or two large OSSs for Project 1; and up to five small OSSs, three medium OSSs, or two large OSSs for Project 2. The type of OSS foundation used depends on the size of the OSS itself as shown in Table 2-4. For the small OSS, the PDE for each foundation type is identical to the PDE for the WTG foundations. The total foundation footprint, temporary seabed impacts, and combined impacts are all higher for the large OSSs; however, the total temporary seabed disturbance area is slightly higher for the small OSSs. The foundation options for the met tower include all options under consideration for WTG foundations, and the construction methodologies for the met tower are assumed to be the same as those for the WTG foundations. Different foundation types could be used for Project 1 and Project 2 and for different components within each project. The foundation type selected for the WTGs may be different from the foundation type selected for OSSs.

Table 2-4. OSS foundation types

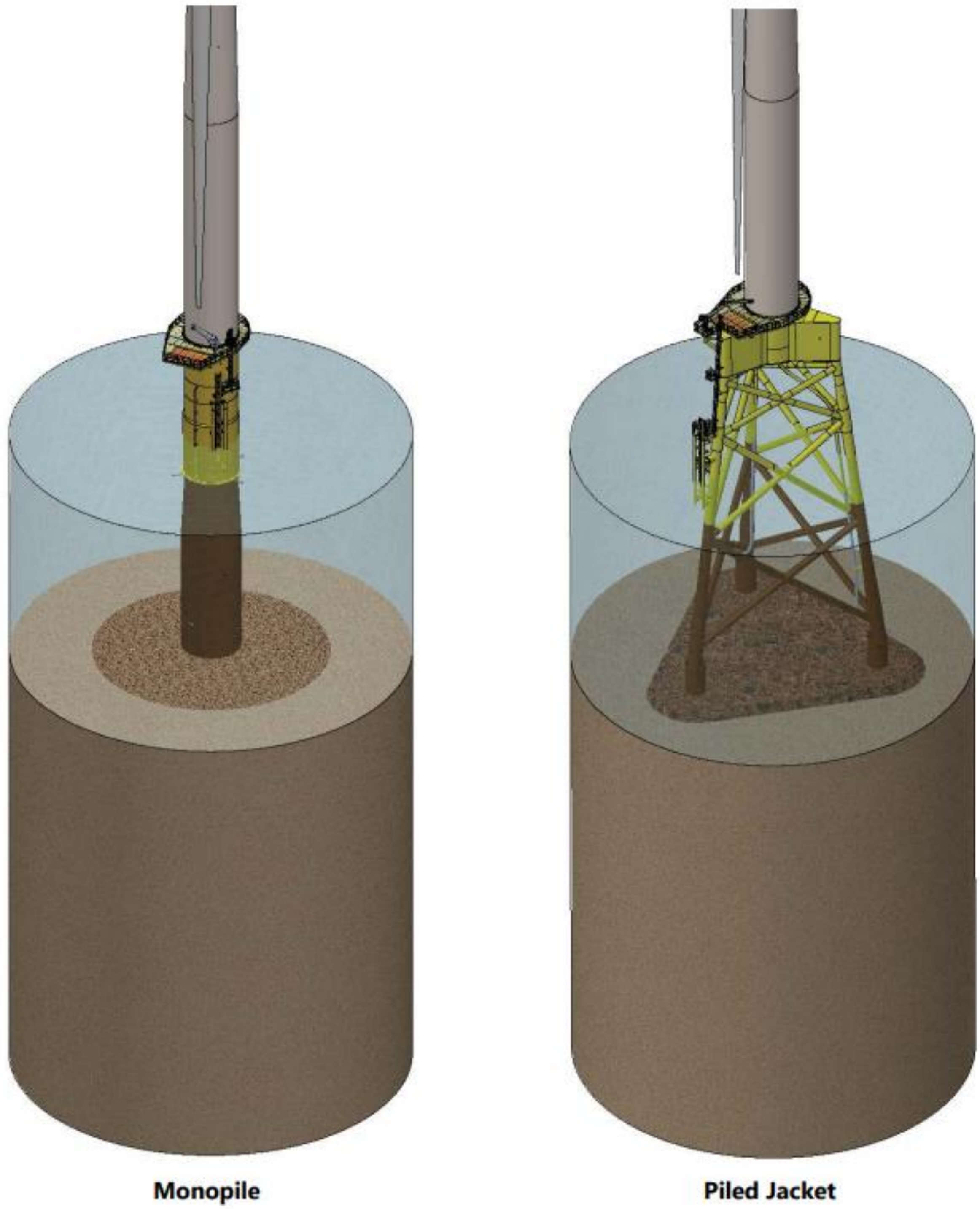
Foundation Types		Small OSS	Medium OSS	Large OSS
Piled	Monopile	•		
	Piled Jacket	•	•	•
Suction Bucket	Mono-Bucket	•		
	Suction Bucket Jacket	•	•	•
Gravity	GBS	•	•	•

Source: COP Volume I, Table 4.4-1; Atlantic Shores 2024.

This Final EIS analyzes the maximum potential impacts on each environmental resource from each type of foundation: piled, suction bucket, and gravity-based at a project level. A representation of the impacts that could occur given the choice of foundation type per project can be found in Table 2-5. The table looks at the maximum extent of how each foundation type used within Project 1, and separately Project 2, could affect a resource. Once combined, the combined configuration of foundations for Project 1 and Project 2 would not exceed 211 (200 turbines, 10 OSSs, and 1 met tower).

2.1.6.1 Alternative F1 – Piled Foundations

Under Alternative F1, the use of the monopile and piled jacket foundation structures (Figure 2.1-15) for up to 200 WTGs, 1 permanent met tower (Project 1), and either up to 10 small OSSs (monopile or piled jacket), up to 5 medium OSSs (piled jacket), or 4 large OSSs (piled jacket) for Project 1 and Project 2 would be analyzed for the extent of impacts.

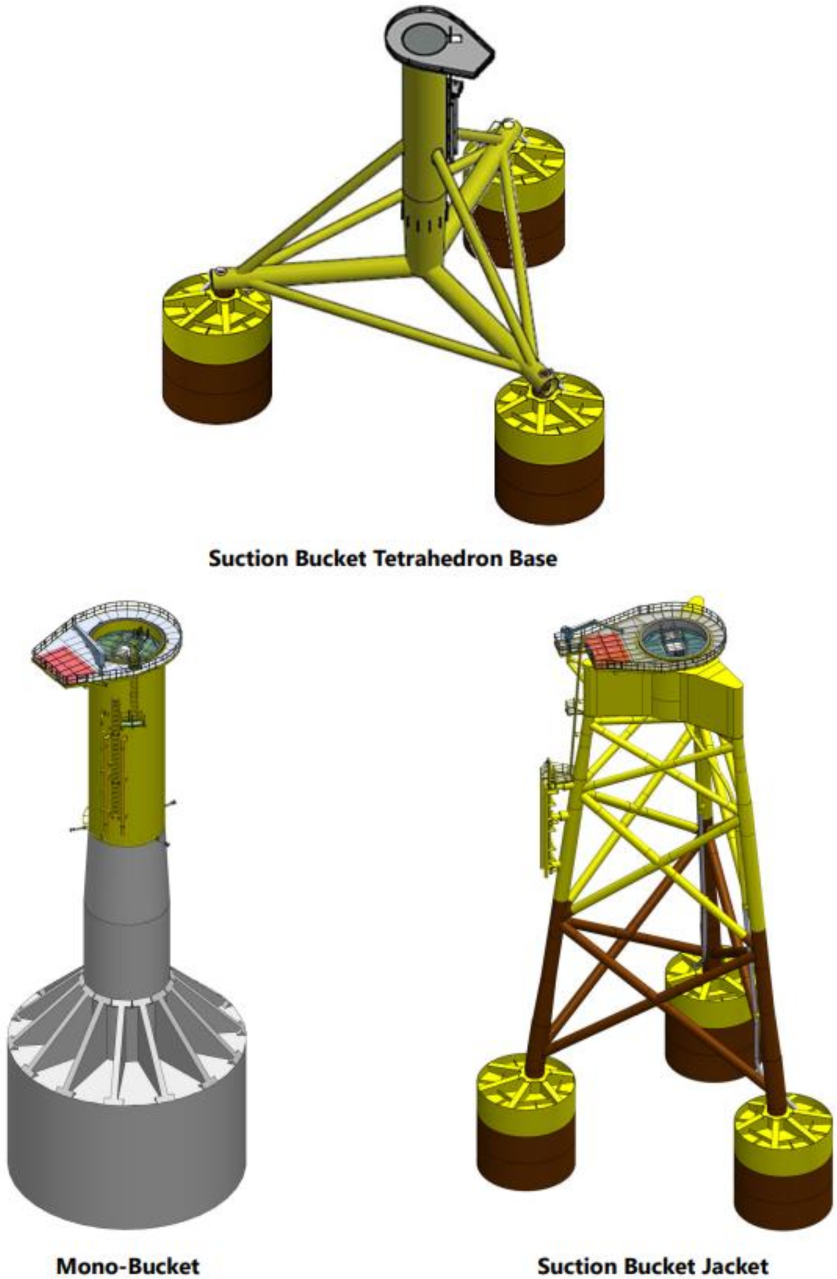


Source: Atlantic Shores 2024.

Figure 2.1-15. Piled foundations

2.1.6.2 Alternative F2 – Suction Bucket Foundations

Under Alternative F2, the use of mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations (Figure 2.1-16) for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs (mono-bucket or suction bucket jacket), up to 5 medium OSSs (suction bucket jacket), or up to 4 large OSSs (suction bucket jacket), for Project 1 and Project 2 would be analyzed for the extent of impacts.

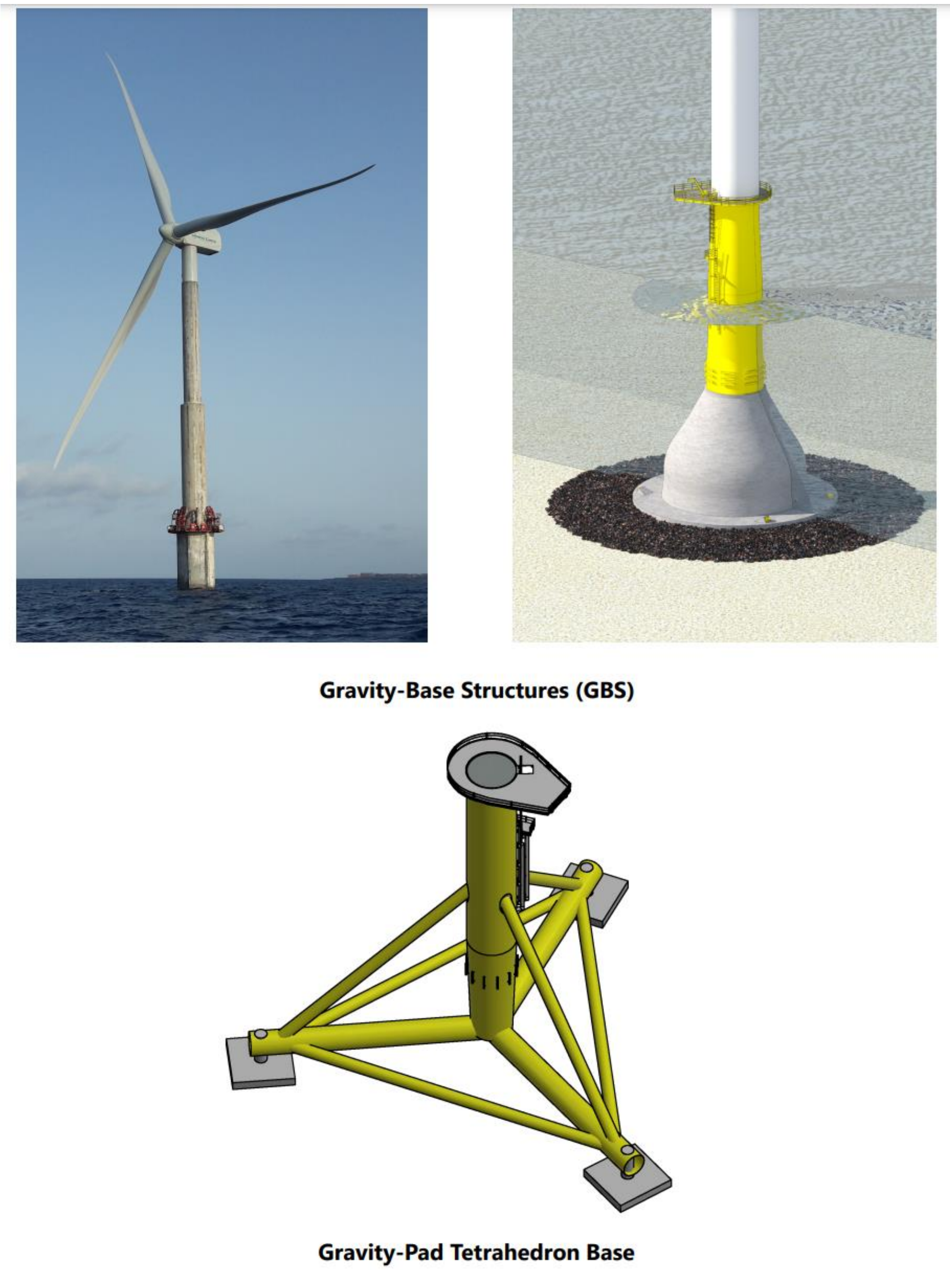


Source: Atlantic Shores 2024.

Figure 2.1-16. Suction bucket foundations

2.1.6.3 Alternative F3 – Gravity-Based Foundations

Under Alternative F3, the use of gravity-pad tetrahedron and GBS foundations (Figure 2.1-17) for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs, up to 5 medium OSSs, or up to 4 large OSSs for Project 1 and Project 2 would be analyzed for the extent of impacts.



Source: Atlantic Shores 2024.

Figure 2.1-17. Gravity foundations

Table 2-5. Resource effects by foundation type

Resource Affected	Foundation Types: Monopile and Piled Jacket — Project 1 (Maximum 136 Turbines, 1 Permanent Met Tower,[1] and 2 Large OSSs)	Monopile and Piled Jacket — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)
Habitat Loss: • Species displacement or mortality • Soft-bottom habitat loss	In general, foundations would be positioned or sized to avoid or reduce seabed preparation where possible. This will include the area of habitat conversion due to the number of foundations and scour protection. Maximum area of seabed preparation per WTG foundation[2] is 72,377 square feet. Maximum permanent footprint area per foundation (foundation + scour protection + mud mats [post-piled jackets only]) for the piled jacket, large OSS is 136,954 square feet.	Similar to Project 1 but reduced given the lower number of foundations and area of scour protection. Maximum area of seabed preparation per foundation[2] is 72,377 square feet. Maximum permanent footprint area per foundation (foundation + scour protection + mud mats [post-piled jackets only]) for the piled jacket, large OSS is 136,954 square feet.	Greatest area of habitat conversion due to scour protection. Maximum area of seabed preparation per foundation[2] is 111,988 square feet. Maximum permanent footprint area per foundation for the suction bucket jacket, large OSS is 282,961 square feet.	Greatest area of habitat conversion due to scour protection. Maximum area of seabed preparation per foundation[2] is 111,988 square feet. Maximum permanent footprint area per foundation for the suction bucket jacket, large OSS is 282,961 square feet.	Soft bottoms may be removed during seabed preparation. Maximum area of seabed preparation per foundation is 81,133 square feet. Maximum permanent footprint area per foundation for the GBS, large OSS is 241,111 square feet.	Soft bottoms may be removed during seabed preparation. Maximum area of seabed preparation per foundation is 81,133 square feet. Maximum permanent footprint area per foundation for the GBS, large OSS is 241,111 square feet.
Artificial Reefs and Attraction: • Introduction of organisms that grow on the surfaces of foundations • Increased food source and increased source of prey • Refuge/resting areas for sheltering from currents or predation • Increased predation rates due to higher predator abundance	Increased aggregation of fish near structures; more opportunities around piled jackets than monopiles. The amount of scour protection present may also increase aggregation. Each piled jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each piled jacket large OSS will have a maximum of 8 legs (up to 3 pin piles per leg)/ discrete contact points with the seabed.	Similar to Project 1 but reduced given the lower number of foundations. Each piled jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each piled jacket large OSS will have a maximum of 8 legs (up to 3 pin piles per leg)/discrete contact points with the seabed.	Similar to the piled jacket, the suction bucket tetrahedron base and jacket provide an increased area for aggregation. Each suction bucket jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each suction bucket jacket large OSS will have a maximum of 8 legs/discrete contact points with the seabed.	Similar to Project 1 but reduced given the lower number of foundations. Each suction bucket jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each suction bucket jacket large OSS will have a maximum of 8 legs/discrete contact points with the seabed.	Similar to the piled jacket, the gravity-pad tetrahedron would have an increased opportunity for aggregation. Each gravity-based WTG foundation will have a maximum of 3 legs/discrete contact points. Each large OSS will have a maximum of 2 legs/discrete contact points with the seabed.	Similar to Project 1 but reduced given the lower number of foundations. Each gravity-based WTG foundation will have a maximum of 3 legs/discrete contact points. Each large OSS will have a maximum of 2 legs/discrete contact points with the seabed.
Invasive Species Spread Effects • Introduction of invasive species	Impacts may be widespread and permanent where the species are able to establish populations. Colonization would be limited to the surface area of the foundations and scour protection.	Impacts would be similar to Project 1 but reduced given the lower number of foundations and area of scour protection.	Similar risk to the monopile and piled jacket but with increased surface area associated with the associated foundation legs and area of scour protection.	Impacts would be similar to Project 1 but reduced given the lower number of foundations and area of scour protection.	Larger risk given the increased surface area of the foundations and sour protection.	Impacts would be similar to Project 1 but reduced given the lower number of foundations and area of scour protection.
Wake and Scour: • Increased concentration or availability of prey in wakes • Altered conditions can affect recruitment of larvae of benthic species, suspended sediment concentration, availability of food, oxygen, and waste removal	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 56,844 square feet. The additional volume of scour protection for each large OSS is estimated to be about 666,999 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 56,844 square feet. The additional volume of scour protection for each large OSS is estimated to be about 666,999 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 111,988 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,485,370 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 111,988 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,485,370 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 58,239 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,186,572 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 58,239 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,186,572 cubic feet.

Resource Affected	Foundation Types: Monopile and Piled Jacket — Project 1 (Maximum 136 Turbines, 1 Permanent Met Tower,[1] and 2 Large OSSs)	Monopile and Piled Jacket — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)
Release of Suspended Sediment and Sediment Deposition: • Decreased water quality due to increased suspended sediment • Smothering of species and habitats by deposited sediment • Avoidance of area by species due to increase sediments • Changes in organic matter content in sediments associated with sediment particle size • Exposure to toxic contaminants within sediment	Not expected to require seabed preparation unless the seabed is not sufficiently level. Maximum area of seabed preparation per WTG and met tower foundation is 72,377 square feet.	Not expected to require seabed preparation unless the seabed is not sufficiently level. Maximum area of seabed preparation per WTG foundation is 72,377 square feet.	The majority of suction bucket foundations are not expected to require seabed preparation unless the seabed it is not sufficiently level. Maximum area of seabed preparation per WTG and met tower foundation is 111,988 square feet.	The majority of suction bucket foundations are not expected to require seabed preparation unless the seabed it is not sufficiently level. Maximum area of seabed preparation per WTG foundation is 111,988 square feet.	3–4 days to prepare the seabed through sediment removal. Maximum area of seabed preparation per WTG and met tower foundation is 81,133 square feet.	3–4 days to prepare the seabed through sediment removal. Maximum area of seabed preparation per WTG foundation is 81,133 square feet.
Avoidance Effects: • Displacement of species from the WTA • Disruption of migration routes	During installation, there may be temporary displacement of species in the area. There is an estimated total of 201 piling days for WTGS. See *Acoustic* for installation timeframes.	Similar to Project 1 but with a lower number of required piles.	Similar to the monopile and piled jacket, but the temporary displacement may be more related to the scour protection installation.	Similar to Project 1 but with a lower number of required foundations and scour protection.	Similar to the monopile and piled jacket, but the temporary displacement may be more related to the scour protection installation.	Similar to Project 1 but with a lower number of required foundations and scour protection.
Acoustic: • Mortality or physical injury from noise • Behavioral alterations like startling, fleeing, or hiding • Masking of biologically significant sounds	During the installation, activities that create noise and vibrations may harm or displace marine animals, birds, benthic invertebrates, and finfish. Impact pile driving will last from approximately 3–4 hours per day (piled jacket) to 7–9 hours a day (monopile) with a maximum of two (monopile) to four (piled jacket) installed in a day given the number of piles. The estimated maximum duration to drive one pile for the OSSs is 3–4 hours per day with a maximum of 4 piles driven per day. Other potential anthropogenic sound sources were not quantitatively modeled as they are expected to be much less than impulsive pile driving.	Similar to Project 1 but with a lower number of required piles.	Suction bucket foundation installation is nearly noise free, and the non-impulsive pile installation method is expected to result in low peak pressure noise unlikely to induce injury in fish or pelagic invertebrates. The foundation has the potential to be completely removed upon decommissioning.	Suction bucket foundation installation is nearly noise free, and the non-impulsive pile installation method is expected to result in low peak pressure noise unlikely to induce injury in fish or pelagic invertebrates. The foundation has the potential to be completely removed upon decommissioning.	Other sounds related to the construction, O&M, and decommissioning of the Project are expected to be much less than impulsive pile driving.	Other sounds related to the construction, O&M, and decommissioning of the Project are expected to be much less than impulsive pile driving.

[1] The foundation options for the met tower include all options under consideration for WTG foundations, and the construction methodologies are assumed to be the same as those for WTG foundations.
[2] In a limited number of foundation positions, up to 19.7 feet (6 meters) of seabed leveling could be required. Piled and suction bucket foundations are not expected to require seabed preparation unless the seabed is not sufficiently level.

2.1.7 Preferred Alternative

The CEQ NEPA regulations require the identification of a preferred alternative in the Final EIS. BOEM has identified Alternative B (Proposed Action), in combination with the following, as its Preferred Alternative:

- BOEM-Proposed Mitigation Measure #5 (Appendix G, Table G-3): No permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers)[9] by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, meteorological tower, and WTGs would be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.
- NOAA/NMFS-Proposed Mitigation Measure #1 (Appendix G, Table G-3): Removal of a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).
- Alternative C4 (Habitat Impact Minimization/Fisheries Habitat Impact Minimization: Micrositing),
- Alternative D3 (No Surface Occupancy of Up to 10.8 Miles [17.4 Kilometers] from Shore: Removal of Up to 6 Turbines), and
- Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1).

The Preferred Alternative, as shown in Figure 2.1-18, would include up to 195[10] WTGs (between 105 and 130 WTGs for Project 1, and between 64 and 93 WTGs for Project 2), up to 10 OSSs (up to 5 in each Project), up to 1 permanent met tower (Project 1), and up to 4 temporary metocean buoys (up to 3 metocean buoys in Project 1; 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations and/or converter stations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. No permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern and the removal of a single turbine approximately 150 to 200 feet (46 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).The total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

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[9] USCG has determined that 0.6 nautical mile (1.1 kilometers) is the minimum spacing between WTGs for vessels to safely maneuver within a wind farm (USCG 2020).

[10] 195 WTGs assumes that 197 total positions are available, and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

The Preferred Alternative would require the proposed OSSs, met tower, and WTGs to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart; remove a single turbine approximately 150–200 feet (45.8–61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site); microsite 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within the NMFS-identified AOC 1 and AOC 2, restrict the height of WTGs in Project 1 to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL, and provide a minimum 0.81-nautical mile (1,500-meter) setback between the WTGs in Atlantic Shores South and the WTGs in Ocean Wind 1 (Lease Area OCS-A 0498) by removing two WTGs and micrositing one WTG from Project 1.

The Preferred Alternative is identified to let the public know which alternative BOEM, as the lead agency, is leaning toward before an alternative is selected for action when a ROD is issued. No final agency action is being taken by the identification of the Preferred Alternative, and BOEM is not obligated to select the Preferred Alternative.

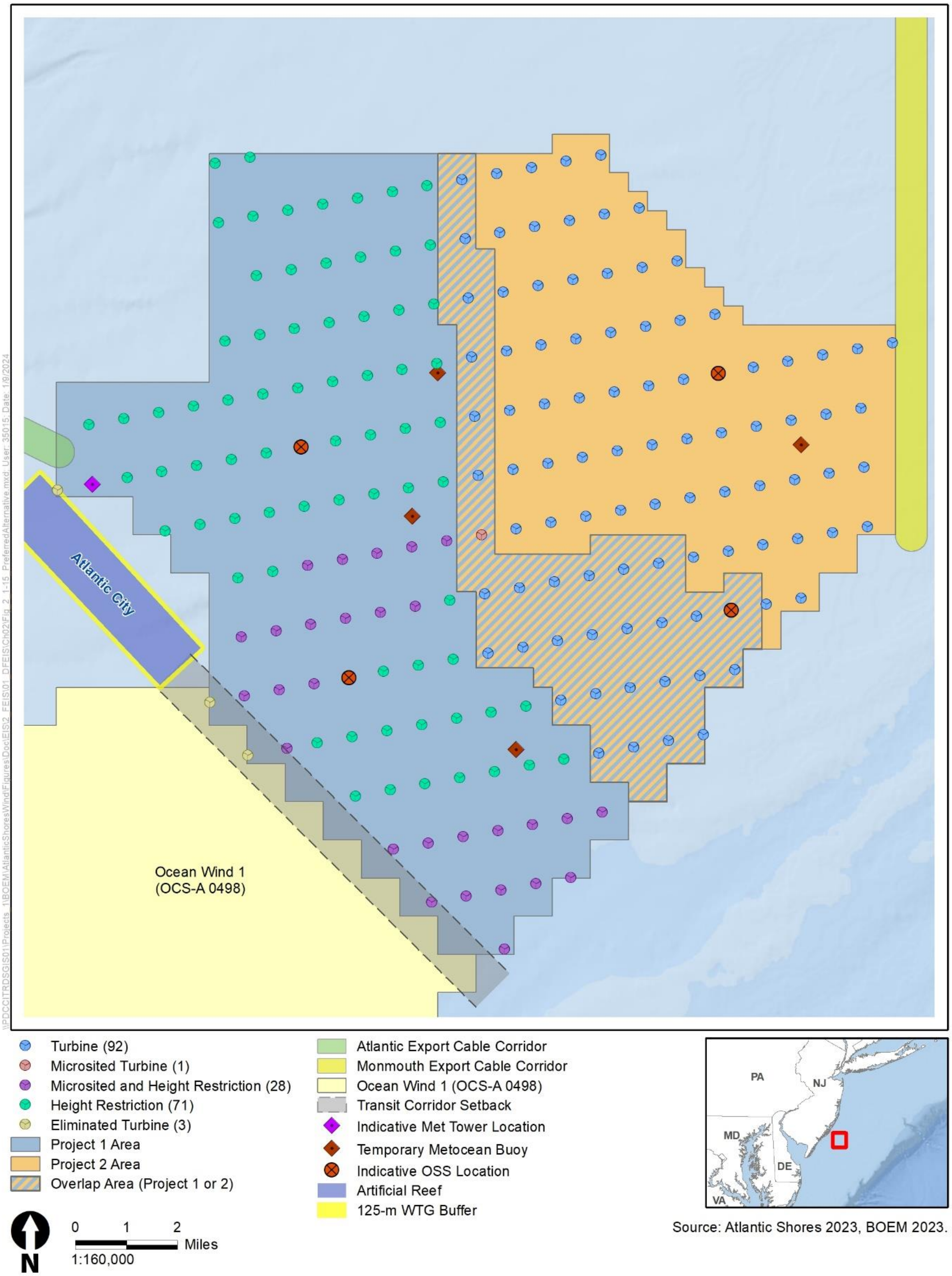

Figure 2.1-18. Preferred Alternative

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 DOI has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action."[11] There should also be evidence that each alternative would avoid or substantially lessen one or more potential, specific, and significant socioeconomic or environmental effects of the project.[12] Therefore, 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 identified 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 identified, and dismissed from further consideration the alternatives that did not meet BOEM's screening criteria.[13] Consistent with the screening criteria, an alternative was considered but not analyzed in detail if it met any of the following criteria:

- It does not respond to BOEM's purpose and need.
- 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 is inconsistent with the federal and state policy goals below:
    - The United States' policy under the OCSLA to make OCS energy resources available for expeditious and orderly development, subject to environmental safeguards.
    - EO 14008, Tackling the Climate Crisis at Home and Abroad, issued on January 27, 2021.
    - The shared goal of the Departments of Interior, Energy and Commerce to deploy 30 GW of offshore wind in the United States by 2030, while protecting biodiversity and promoting ocean co-use.
    - The goals of affected states, including state laws that establish renewable energy goals and mandates, where applicable.

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[11] 43 CFR 46.420(b)
[12] 43 CFR 46.415(b)
[13] See BOEM's *Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act (NEPA)* published June 22, 2022, and available at: https://www.boem.gov/sites/default/files/documents/renewable-energy/BOEM%20COP%20EIS%20Alternatives-2022-06-22.pdf.

- It is inconsistent with existing law, regulation, or policy; a state or federal agency would be prohibited from permitting activities required by the alternative.
- It does not meet the primary goals of the applicant.[14]
    - It proposes relocating a majority of the project outside of the area proposed by the applicant.
    - It results in the development of a project that would not allow the developer to satisfy contractual offtake obligations.
- 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 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 and economic experts.
- It is environmentally infeasible, meaning implementation of the alternative would not be allowed by another agency from which a permit or approval is required, or implementation results in an obvious and substantial increase in impacts on the human environment that outweighs potential benefits.
- The implementation of the alternative is remote or speculative; or it is too conceptual in that it lacks sufficient detail to meaningfully analyze impacts; or there is insufficient available information to determine whether the alternative is technically feasible.
- It has a substantially similar design to another alternative that is being analyzed in detail.
- It would have a substantially similar effect as an alternative that is analyzed in detail.

Table 2-6 presents the alternatives considered but not analyzed in detail with a brief discussion of the reasons for their elimination in accordance with CEQ regulations at 40 CFR 1502.14(a), DOI regulations at 43 CFR 46.420(b)-(c).

[14] For a project without an existing offtake agreement, such as Project 2 within the Atlantic Shores South Project, BOEM should determine whether the project is currently being reviewed as part of a competitive offtake award, or whether it plans to compete for an award during the EIS development, and identify the minimum nameplate capacity required to remain eligible for these awards. This minimum nameplate capacity may be used as an applicant's primary goal. Atlantic Shores has established a target size of 1,327 MW for Project 2, which aligns with the interconnection service agreements and interconnection construction service agreements Atlantic Shores intends to execute with PJM.

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

Alternative Dismissed	Justification for Dismissal
Wind Farm Location and Generating Capacity	
Project Relocation to the Hudson South Lease Area or farther offshore	Commenters suggested BOEM relocate the Project or turbines. This would be covered under the No Action Alternative. Atlantic Shores has been granted the right to submit a COP for a project located within the geographic area identified as Lease Area OCS-A 0499. Evaluating an alternate location for the wind energy facility outside of the Lease Area would constitute a new Proposed Action and would not meet BOEM's purpose and need to respond to Atlantic Shores' proposal and 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 BOEM to analyze Atlantic Shores' proposal to build commercial-scale wind energy facilities in the Lease Area. BOEM would consider proposals on other existing leases through a separate regulatory process. This alternative would effectively be the same as selecting the No Action Alternative.
Wind Turbine Array Layout and Spacing	
Realistic Minimum Design scenario required to meet the purpose and need of the Project while minimizing negative impacts on the environment	A commenter requested that BOEM analyze alternative projects of differing sizes and designs. This alternative would not address a specific environmental or socioeconomic concern and it would likely have substantially similar effects when analyzed in detail as other action alternatives (e.g., habitat and visual minimization). It is also too conceptual and speculative in that it lacks sufficient detail to enable BOEM to meaningfully analyze impacts.
Restrict WTG Locations within the Southern Portion of the Lease Area within the range of 17.3 to 19.3 miles (27.8 and 31.1 kilometers) from shore	In order to mitigate visual impacts and reduce noise in the North Atlantic right whale migration corridor, commenters suggested that BOEM restrict siting of the WTGs to between 17.3 and 19.3 miles (27.8 and 31.1 kilometers) from the shoreline. This alternative, restricting turbines between 17.3 and 19.3 miles (27.8 and 31.1 kilometers) from shore, would retain 31 turbines (Figure 2.2-1). This would lead to an 85% reduction in turbines. This alternative was not carried forward for detailed analysis because it would negate Atlantic Shores' ability to fulfill the terms of BPU Order (Docket Nos. QO20080555 and QO21050824) for 1,510 MW and would not meet the purpose and need.
Restrict WTG Locations within the Southern Portion of the Lease Area to beyond 17.3 miles (27.8 kilometers) from shore	To mitigate visual impacts, commentors suggested that BOEM prohibit placing the WTGs within 17.3 miles (27.8 kilometers) from shore. This alternative, restricting turbines to be located more than 17.3 miles (27.8 kilometers) from the shoreline, would retain 98 turbines (Figure 2.2-2). This would lead to a 51% reduction in turbines. This alternative was not carried forward for detailed analysis because it would negate Atlantic Shores' ability to fulfill the terms of BPU Order (Docket Nos. QO20080555 and QO21050824) for 1,510 MW and would not meet the purpose and need.
Minimum WTG Spacing Using a 2-Nautical-Mile (3,704-Meter) by 2-Nautical-Mile (3,704-Meter) Wind Turbine Layout to provide safe access for fishing vessels	Commenters suggested that BOEM analyze an alternative WTG layout with 2-nautical-mile (3,704-meter) spacing between WTGs. As illustrated on Figure 2.2-3, 2-nautical-mile (3,704-meter) spacing would provide for 38 WTG positions. This would lead to an 81% reduction in turbines. This alternative was not carried forward for detailed analysis because it would negate Atlantic Shores' ability to fulfill the terms of BPU Order (Docket Nos. QO20080555 and QO21050824) for 1,510 MW and would not meet the purpose and need.

Alternative Dismissed	Justification for Dismissal
Consistent Wind Turbine Spacing and Layout with Ocean Wind 1 and Adjacent Projects to provide consistent straight-line routes for mariners	One commenter requested that BOEM consider an alternative that would create a uniform turbine spacing and layout across the adjacent Atlantic Shores South and Ocean Wind 1 projects to help facilitate navigation safety, consistent and continuous marking and lighting, search and rescue, and, where necessary, other uses such as commercial fishing. However, the turbine layouts and spacing within the Atlantic Shores South and Ocean Wind 1 Lease Areas were designed to accommodate the predominant vessel traffic patterns unique to each Lease Area. Vessel traffic patterns differ for each Lease Area, and a uniform grid spacing across the adjacent projects would not maintain the predominant vessel traffic patterns established by users within each Lease Area. Atlantic Shores evaluated layout orientations that minimized impacts on existing maritime uses and evaluated the technical consideration of the wind resource and power production in determining the proposed layout. To achieve the objectives of providing a distinct visual separation and facilitating safe navigation across the two adjacent projects, while also maintaining the layout of the Proposed Action, which accommodates predominant vessel traffic patterns, BOEM, in consultation with USCG, developed Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1), which analyzes a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South and the WTGS in the Ocean Wind 1 Lease Areas. Alternative E addresses the need for a setback in the absence of uniform grid spacing, while maintaining a layout that accommodates the predominant vessel traffic patterns in the Lease Area. This alternative would have a substantially similar design and effect as Alternative E and would be less responsive to local traffic patterns and USCG input than Alternative E, while also requiring a disruptive and inefficient redesign of the proposed Project layout; therefore, uniform grid spacing was eliminated from detailed consideration.
2.2-Nautical-Mile (4,074-Meter) to 4-Nautical-Mile (7,408-Meter) Separation between the Atlantic Shores South and Ocean Wind 1 Projects	One commenter recommended that a 2.2-nautical-mile (4,074-meter) to 4-nautical-mile (7,408-meter) transit corridor be established between the Atlantic Shores South and Ocean Wind 1 projects to preserve traditional transit paths through the Lease Areas to access fishing grounds. BOEM evaluated separation distances between the Atlantic Shores South and Ocean Wind 1 projects. As the length traveled along the boundary between the Atlantic Shores South and Ocean Wind 1 projects would be approximately 7 nautical miles (12,964 meters) and there would be additional paths along the predominant inshore-offshore routes through the array to allow for traffic dispersal, BOEM, through coordination with USCG, determined that a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) separation between the WTGs in the Atlantic Shores South and the WTGs in the Ocean Wind 1 projects, as analyzed in Alternative E, was adequate to accommodate inshore-offshore vessel traffic, as well as changes in path or orientation as vessels transit between the two adjacent projects. According to USCG, 0.8 nautical mile (1,500 meters) to 1.08 nautical miles (2,000 meters) is also an acceptable distance for its sea and air assets to adjust their path as they move between the two adjacent projects. Alternative E analyzes a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South and Ocean Wind 1 Lease Areas with the intent that both Atlantic Shores South

Alternative Dismissed	Justification for Dismissal
	and Ocean Wind 1 would implement wind turbine layout modifications to result in a combined separation distance of 0.81 nautical mile (1,500 meters) to 1.08 nautical miles (2,000 meters). Alternative E addresses the aim to reduce impacts on navigation and access to commercial and recreational fishing grounds. In addition, as illustrated in Figures 2.2-4 and 2.2-5, this alternative would result in a 6 to 14% reduction of turbines within the Atlantic Shores South Lease Area. Alternative E analyzes a buffer while maintaining a layout orientation that accommodates the predominant vessel traffic patterns in the Atlantic Shores South Lease Area. Therefore, this alternative was not carried forward for detailed analysis.
Artificial Reef Avoidance Buffers for WTG Installation	Comments received from MAFMC and NEFMC recommended that the Project be sited to avoid the Atlantic City Reef. No WTGs would be placed within 410 feet (125 meters) of the Atlantic City Reef. This alternative would lead to the removal or relocation of 1 WTG (Figure 2.2-6). BOEM determined that this alternative would be more suitable to address as a Project mitigation measure. Refer to Appendix G for BOEM's recommended measures to avoid or minimize impacts on artificial reefs through WTG installation.
Artificial Reef Avoidance Buffers for Cable Installation	Comments received from MAFMC and NEFMC recommended that the project be sited to avoid the Atlantic City Reef. A 246-foot (75-meter) buffer would be established for cable installation around artificial reef sites to reduce potential impacts on the artificial reefs from turbidity and sedimentation (Figure 2.2-7). The export cable to the Monmouth Landing site would not be placed within 246 feet (75 meters) of the Manasquan Inlet or the Axel Carlson artificial reefs. A 246-foot (75-meter) buffer would allow a total of approximately 1,640 feet (500 meters) for Atlantic Shores to install up to five export cables as part of the proposed Monmouth ECC. However, 1,640 feet (500 meters) does not provide adequate cable spacing (328–656 feet [100–200 meters] between each cable) to account for cable repairs or localized cable routing that may be required. A 246-foot (75-meter) buffer could prevent the use of the Monmouth ECC and thereby make the interconnection of Project 1 or Project 2 to the Larrabee Substation infeasible, which in turn, would make the Project technically infeasible. The Project's proposed ECCs are sited to avoid significant marine constraints and protected resources, including the boundaries of the artificial reefs. In addition, the proposed ECCs are sited to ensure cable constructability and reliability, as well as minimize impacts on marine users. See *Export Cable Corridors that Minimize Navigational Conflicts* rationale below for additional justification.
Wind Turbine Technology	
Vertical Turbine Design in which the towers revolve without moving blades	A commenter recommended that BOEM explore the use of the vertical turbine design for the planned WTGs. As this technology is unproven and has not been fully researched or used in a commercial project, it is not technically feasible to analyze as an alternative.

Alternative Dismissed	Justification for Dismissal
Project Alteration	
Approve Only Project 1 or Only Project 2, But Not Both Projects	BOEM considered an alternative under which BOEM would approve only Project 1 or Project 2, but would not approve both projects. Atlantic Shores' proposal for two projects relies on economies of scale, including: procurement of components and services for two similarly designed projects in similar geographic and environmental conditions; shared execution contractors; enabling sharing of design, engineering, and project management costs across two projects; coordinated pre- and post-construction environmental and geophysical and geotechnical survey campaigns; fewer separate mobilizations and de-mobilizations. Further, the uncertainty regarding (1) the boundary between Projects 1 and 2; (2) which WTG and OSS positions would be allocated to which Project; and (3) the POIs and export cable routes available for interconnection among the two Projects necessitates their joint analysis by federal agencies because agency decisions regarding Project 1 will directly influence the final PDE for Project 2. To illustrate, Atlantic Shores has made financially significant firm commitments as part of the Atlantic Shores Project 1 Interconnection Services Agreement and Interconnection Construction Studies Agreements to connect at the Cardiff POI, which would be forfeited if Project 1 were not approved while Project 2 was approved. Project 2 could not be simply substituted for Project 1 in this scenario. Finally, this alternative would not meet BOEM's purpose and need "to determine whether to approve, approve with modifications, or disapprove Atlantic Shores' COP to construct and install, operate and maintain, and decommission two commercial-scale offshore wind energy projects within the Lease Area." In particular, the Atlantic Shores South Projects 1 and 2 combined could contribute approximately 2.5 GW to New Jersey's goal of 11 GW of offshore wind energy generation by 2040 as outlined in New Jersey Governor's EO No. 307, issued on September 22, 2022. In pursuit of this goal, BPU has outlined a series of solicitations for 1,200 MW of electricity and above through 2030, with existing awards made consistently above 1,100 MW per project. If only Project 1 was approved, Atlantic Shores would not be able to bid Project 2 into these upcoming solicitations which would undermine the achievement of New Jersey's goals by reducing competition and the supply of potential areas for offshore wind projects.
Offshore Export Cables	
Shared Cable Corridor routing that uses common corridors with adjacent projects such as the Atlantic Shores South and Ocean Wind 1 projects	Commenters recommended that BOEM consider ECC routing alternatives that would have adjacent projects (i.e., Atlantic Shores South and Ocean Wind 1) use a shared cable corridor. BOEM cannot dictate that a lessee use a shared cable corridor. 30 CFR 585.200(b) states that, "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 OCS as necessary for the full enjoyment of the lease." BOEM cannot limit a lessee's right to a project easement when a shared 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 Atlantic Shores to use a future shared cable corridor for this Project. Furthermore, the Atlantic Shores South Project's export cables would connect to the power grid via different onshore substations

Alternative Dismissed	Justification for Dismissal
	than Ocean Wind 1. Developing a shared ECC would not be technically or economically practicable because the Atlantic Shores South and Ocean Wind 1 projects have distinct interconnection points to the electric power grid. At this time this alternative is not technically or economically feasible as the POIs associated with the cable corridors would be unable to accept the total MW capacity produced by both Atlantic Shores South and Ocean Wind 1, and the delays and costs of switching or gaining approval to upgrade the necessary POIs for a shared cable corridor would not allow Atlantic Shores to meet deadlines in its agreement with BPU. See the following *Single Cable Corridor* rationale for additional justification. There are currently potential transmission proposals under review by BPU to support the plan for 11 GW of offshore wind by 2040, which may be able to help further address this comment in the future.
Single Cable Corridor routing that uses a single ECC for Project 1 and Project 2	Comments received from the Garden State Seafood Association expressed concern about the multiple export cable routes and recommended that BOEM consider the use of a single cable corridor for Project 1 and Project 2 with the shortest route to shore. Due to electrical capacity constraints at the target POIs, Atlantic Shores determined that two POIs are needed to accommodate the expected amount of electricity that could be generated by Project 1 and Project 2 (estimated to be at least 2.8 GW). Project 1's nameplate capacity is 1,510 MW and is associated with the existing Cardiff POI. The existing Cardiff POI ROW does not have the physical capacity to fit the cables for both projects, thus additional cable landing location(s) and ROWs would be necessary if both projects were combined into the Cardiff POI. This, in turn, would lead to added expense and delays for Project 2, the nameplate capacity of which is not yet determined, but for which Atlantic Shores has a goal of 1,327 MW. In addition, upgrading the existing Cardiff POI would require additional interconnection studies and modifications to the onshore engineering design, which would lead to an additional 5–10-year delay and would not enable Atlantic Shores to meet its Project 1 delivery schedule, as defined by BPU Order (Docket Nos. QO20080555 and QO21050824). Thus, it would be economically infeasible to adjust the current plans to accommodate the use of a single ECC. The delays would jeopardize the viability of the Atlantic Shores South Project, ultimately causing the Project to not meet the purpose and need.
Export Cable Corridors that Minimize Navigational Conflicts	A comment received from the New York State Department of State requested that the area occupied by the ECCs be minimized within the existing vessel traffic routes. BOEM was not able to identify an alternate technically feasible route due to multiple conflicts near the landfall site, inclusive of fiber optic cables, ocean disposal sites, federal and state sand resource areas, and sand borrow areas, and the lack of available data that would demonstrate feasibility for cable installation and burial. Thus, an alternate technically feasible route is speculative. The Project's proposed ECCs are sited to avoid significant marine constraints and protected resources, ensure cable constructability and reliability, and minimize impacts on marine users. In addition, reduction of the risk of the potential for a vessel to snag a cable with its anchor and incur liability and other navigational conflicts could be addressed by defining the cable easement(s) within the ECCs, which typically occurs with COP

Alternative Dismissed	Justification for Dismissal
	approval; as well as during the final review of the Cable Burial Risk Assessment that occurs during the Final Design Report and Fabrication and Installation Report review. As a result, an alternate technically feasible route, if it exists, is unlikely to confer a substantial environmental or socioeconomic advantage over the routes included as part of the Proposed Action. Proposing a new ECC on unsurveyed areas would require additional data to be collected and a detailed analysis to be undertaken to determine the economic and environmental feasibility of the proposed cable route. This would result in a delay of a year or more, rendering the Project economically infeasible. Therefore, this alternative was not carried forward for detailed analysis.
Onshore Infrastructure	
Onshore infrastructure that Minimizes Land Use Conflicts	BOEM was not able to identify alternate technically feasible landfall locations, POIs, or onshore interconnection cable routes due to multiple physical and capacity constraints (COP Volume I, Appendix I-G; Atlantic Shores 2024). The Project's proposed landfall sites were selected based on location (within the maximum distance for HDD to reach beyond the top-of-slope of the beach), size (the amount of space needed to transition between offshore and onshore cables), and existing infrastructure and land use (i.e., undeveloped or limited to surface development [such as parking lots]). The Project's proposed POIs were selected based on location and capacity. The Project's proposed onshore interconnection cable route options were sited to avoid submerged aquatic vegetation, unsuitable terrain, existing utility corridors, and high population densities. In addition, the route options were sited to limit disturbance to existing land uses, minimize the number of hard route angles, and minimize the overall route length. As a result, alternate technically feasible landfall locations, POIs, and onshore cable routes, if they exist, are unlikely to confer a substantial environmental or socioeconomic advantage over the onshore infrastructure sites included as part of the Proposed Action. Furthermore, as explained in the *Single Cable Corridor* rationale in this table, additional interconnection studies and modifications to the onshore engineering design would lead to an additional multi-year delay, rendering the Project economically infeasible. Therefore, this alternative was not carried forward for detailed analysis.

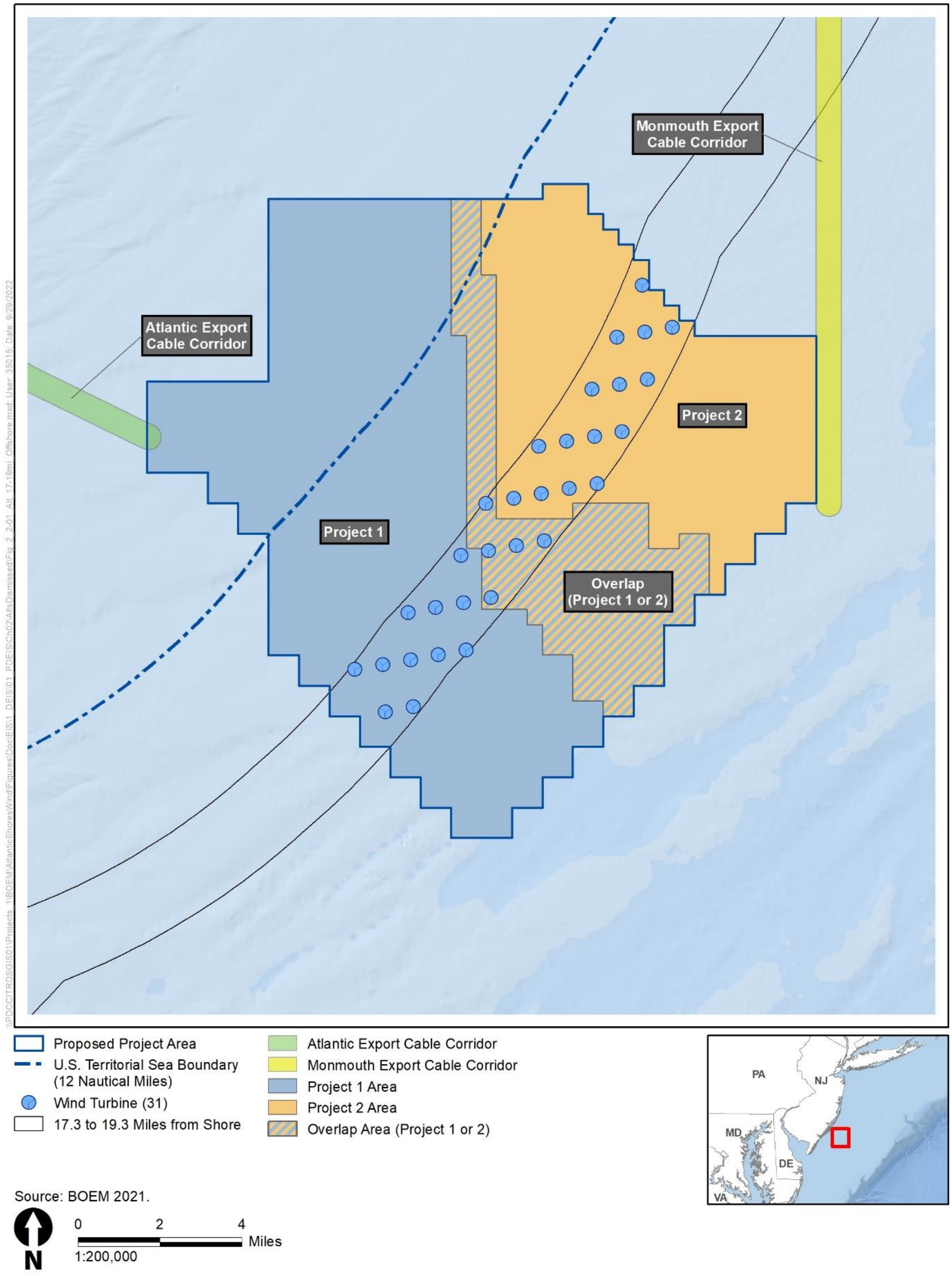


Figure 2.2-1. Restrict WTG locations within the southern portion of the Lease Area within the range of 17.3 to 19.3 miles (27.8 to 31.1 kilometers) from shore

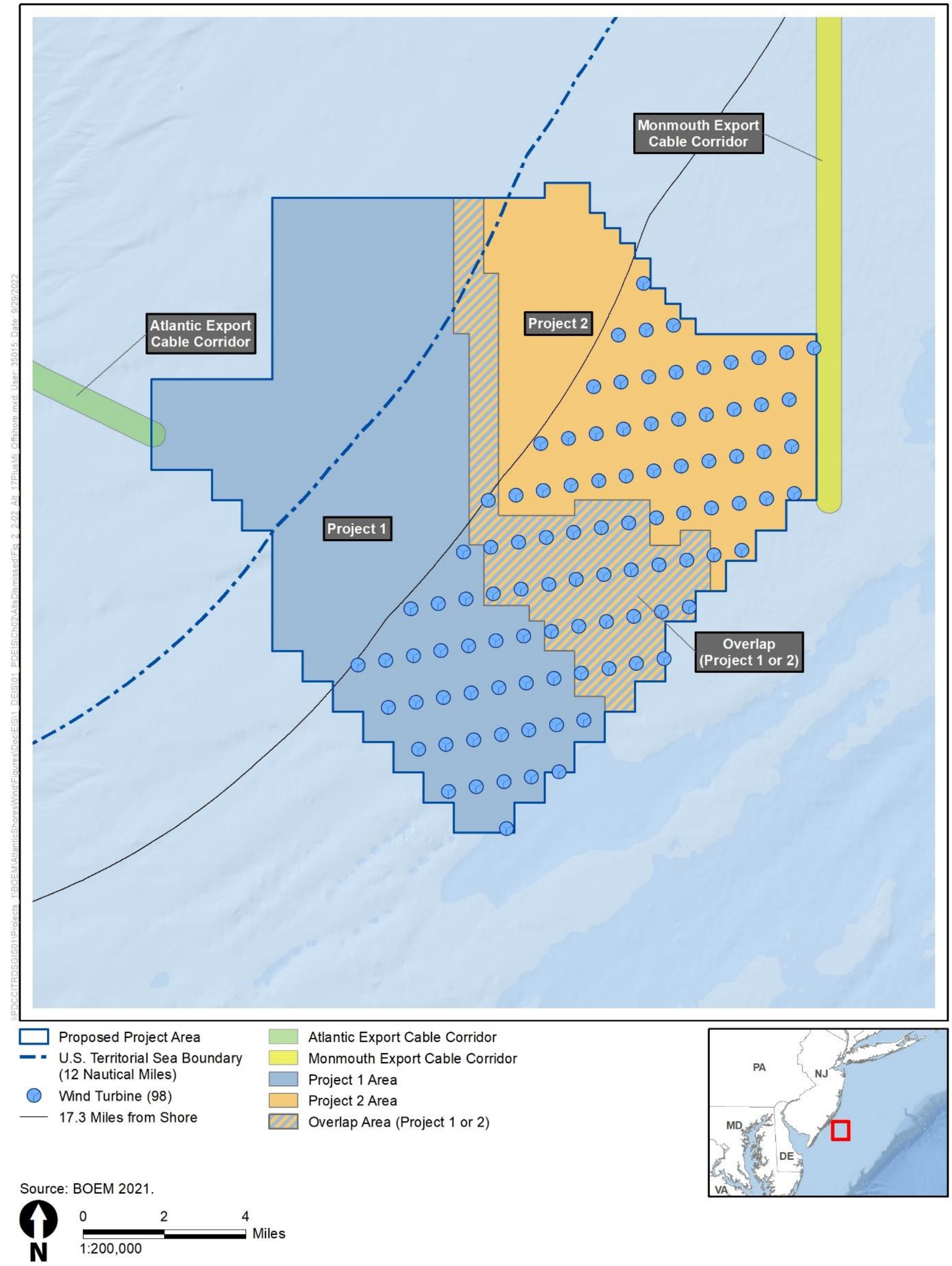


Figure 2.2-2. Restrict WTG locations within the southern portion of the Lease Area to beyond 17.3 miles (27.8 kilometers) from shore

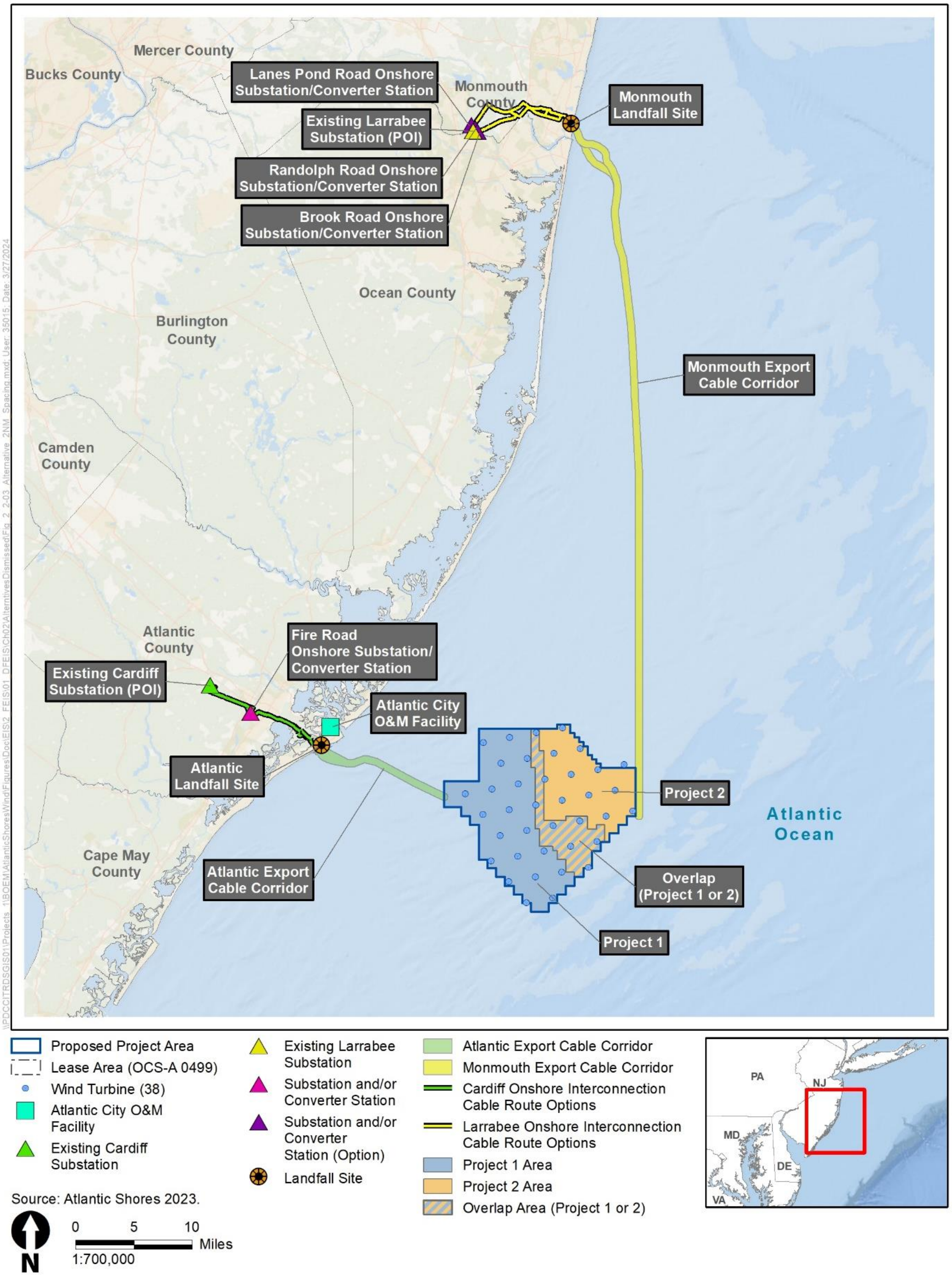


Figure 2.2-3. Minimum WTG spacing using a 2-nautical mile (3,704-meter) by 2-nautical mile (3,704-meter) wind turbine layout to provide safe access for fishing vessels

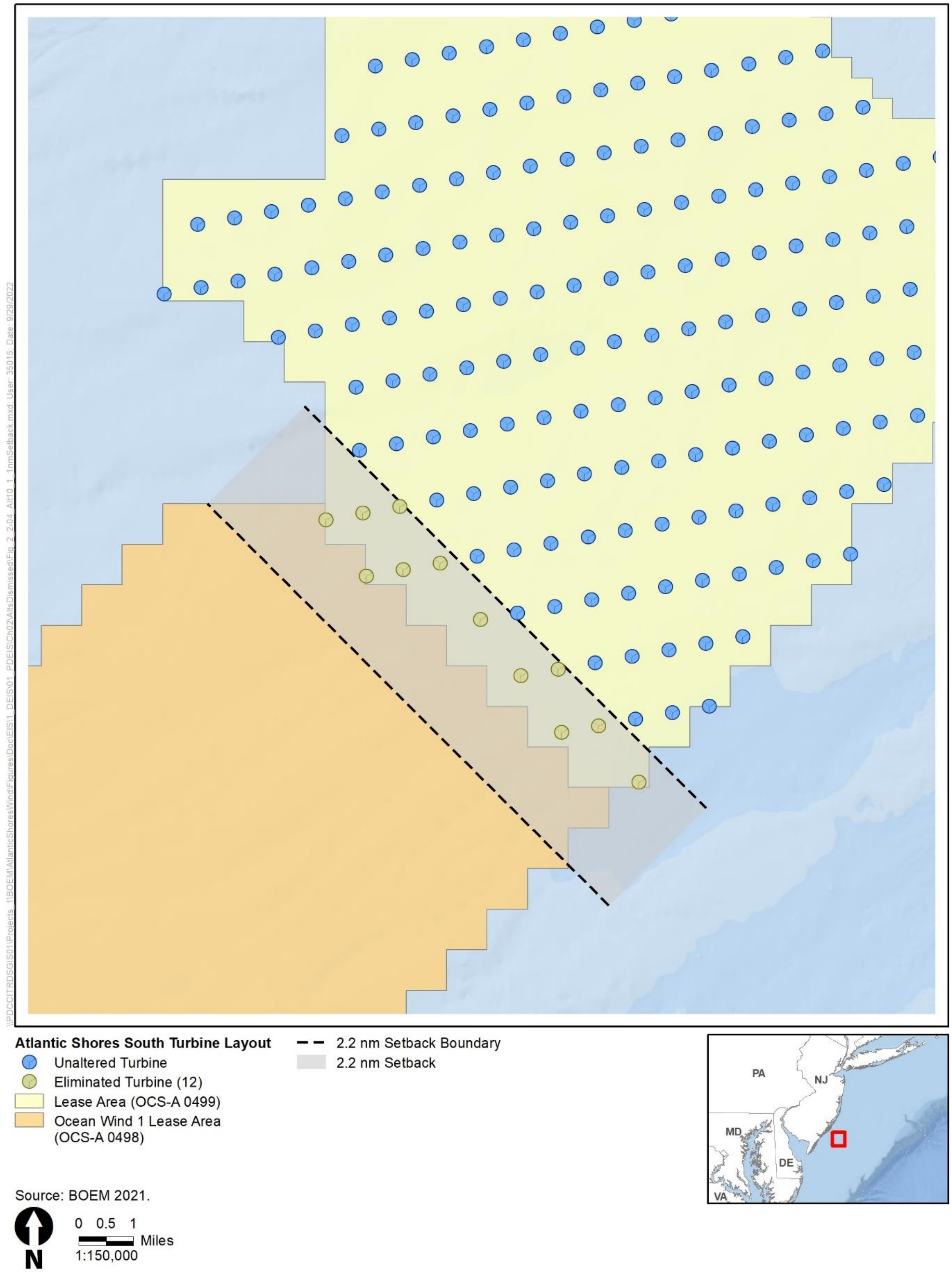


Figure 2.2-4. 2.2-nautical-mile (4,074-meter) separation between the Ocean Wind 1 and Atlantic Shores South projects

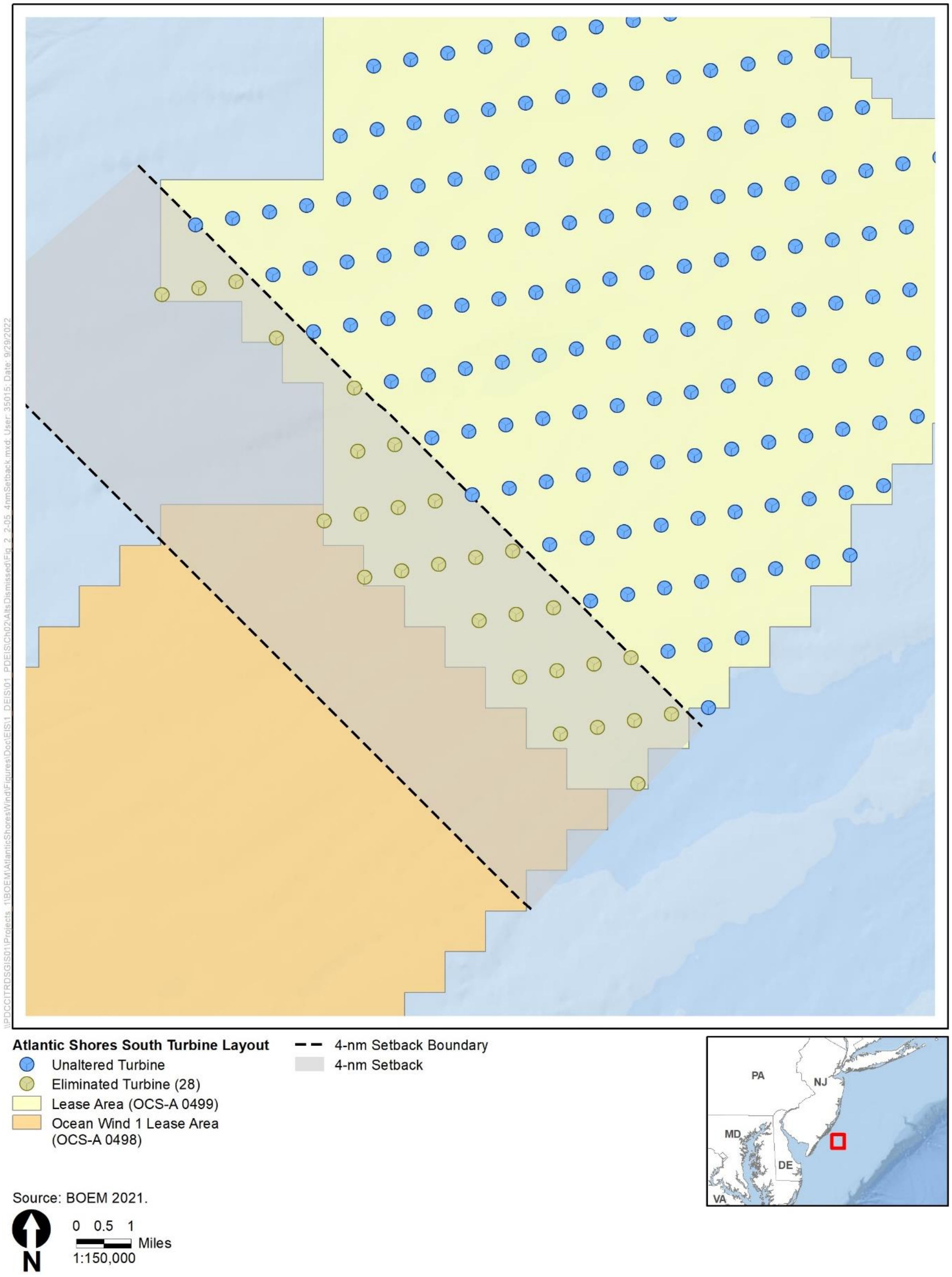
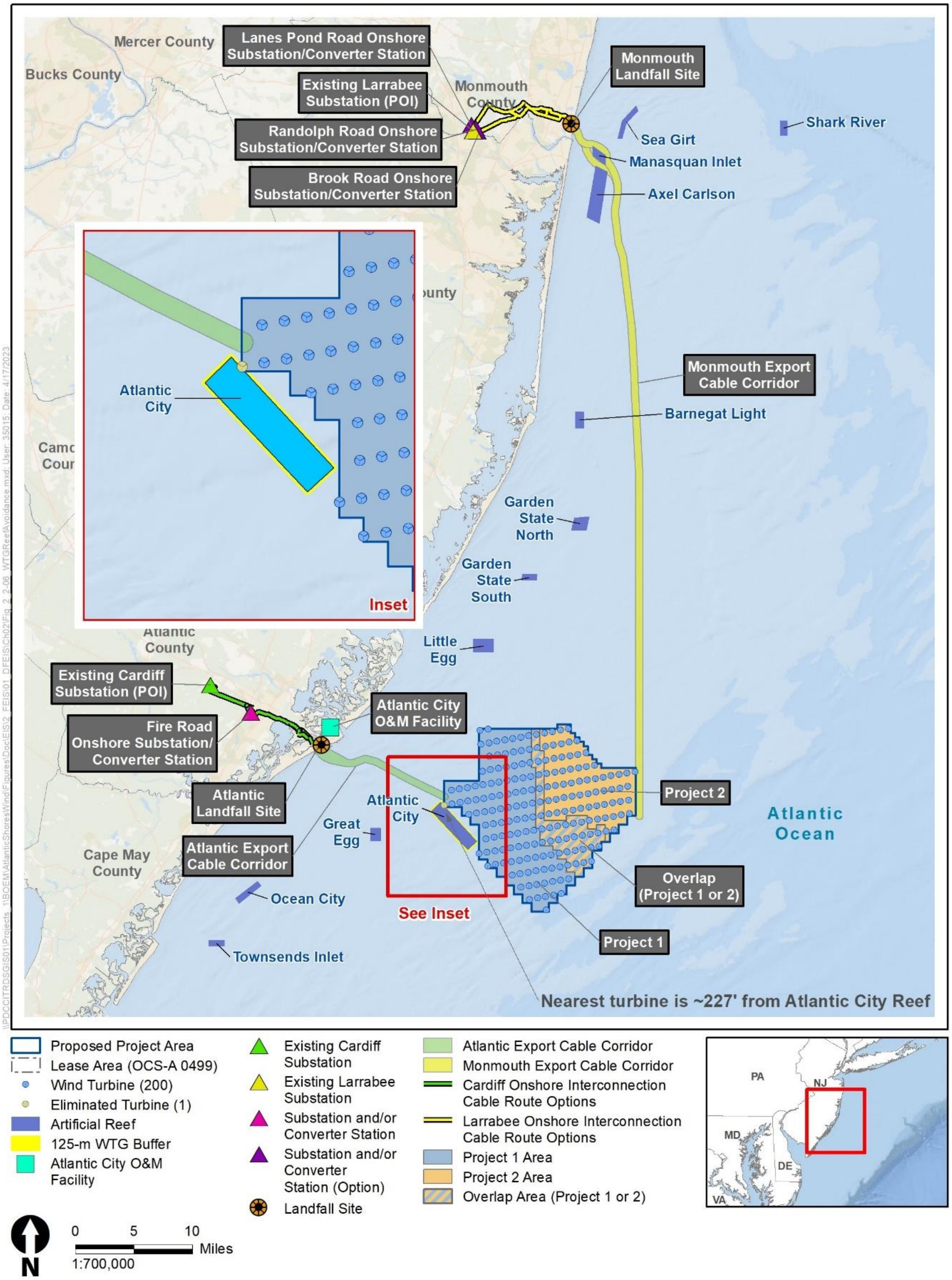
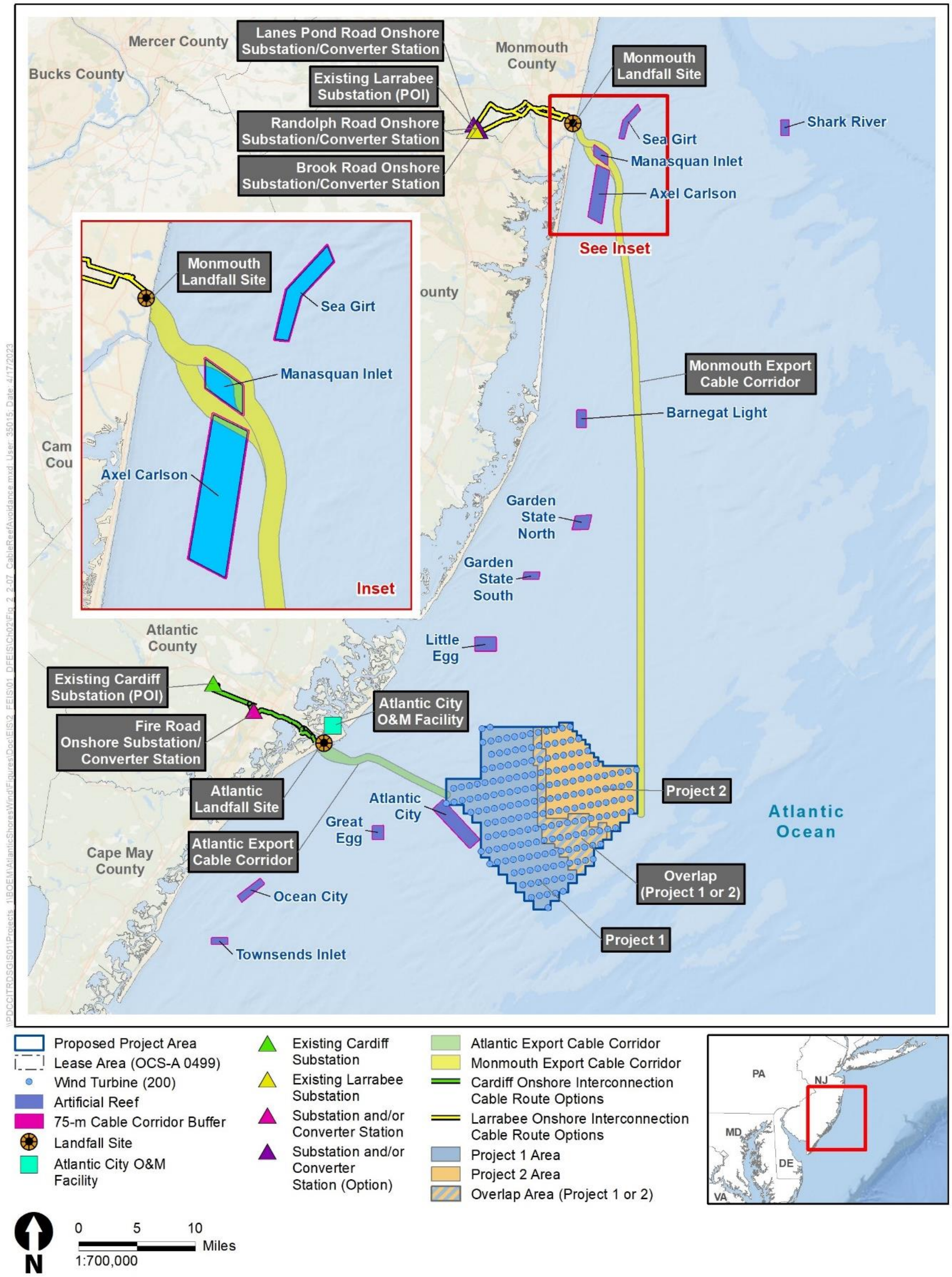


Figure 2.2-5. 4-nautical-mile (7,408-meter) separation between the Ocean Wind 1 and Atlantic Shores South projects



Source: Atlantic Shores 2023, NJGIN 2021.

Figure 2.2-6. Artificial reef avoidance buffers for WTG installation



Source: Atlantic Shores 2023, NJGIN 2021.

Figure 2.2-7. Artificial reef avoidance buffers for cable installation

2.3 Non-Routine Activities and Low-Probability Events

Non-routine activities and low-probability events associated with the proposed 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 or 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, seismic activities, and terrorist attacks. These activities or events are impossible 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 as a result of unanticipated equipment wear or malfunctions. Atlantic Shores anticipates housing spare parts for key Project components at an O&M facility to initiate repairs expeditiously.
- *Collisions and allisions:* These could result in spills (described below) or injuries or fatalities to wildlife (addressed in Chapter 3, *Affected Environment and Environmental Consequences*). Collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the proposed Project:
    - USCG requirements for lighting on vessels
    - NOAA vessel speed restrictions
    - The proposed spacing of WTGs and OSSs
    - The inclusion of proposed 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 Atlantic Shores such as the need for one or more cable splices to an export or interarray cable(s). However, such incidents are unlikely to occur because the proposed Project area would be indicated on navigational charts, and the cable would be buried to the target depth of 5 to 6.6 feet (1.5 to 2.0 meters) or protected with rock placement, concrete mattresses, rock bags, grout-filled bags, or half-shell pipes. Additionally, Atlantic Shores would employ a monitoring system on its export cables that would be able to provide advance warning of any potential cable failures due to insulation degradation, physical damage, or other causes. In the event that a fault is detected, the fault would be isolated, and diagnostics would be performed to precisely locate the position of the fault. The damaged section of the export cable would then be recovered to a vessel, the damaged section of cable would be removed, and a new section of cable would be spliced in to replace the damaged section. Finally, the cable would be returned to the seabed and buried.
- *Chemical spills or releases:* For offshore activities, these include inadvertent releases from refueling vessels, spills from routine maintenance activities, and any more significant spills as a result of

a catastrophic event. All vessels would be certified by the Project to conform to vessel O&M protocols designed to minimize risk of fuel spills and leaks. Atlantic Shores has prepared an Oil Spill Response Plan (OSRP) and would be expected to comply with USCG and BSEE regulations relating to prevention and control of oil spills. Onshore, releases could potentially occur from construction equipment or HDD activities. All wastes generated onshore would 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:* The Atlantic Shores Offshore and Onshore Project areas are subject to extreme weather, such as storms and hurricanes, which may impose hydrodynamic load and sediment scouring (COP Volume II, Section 2.2.1.5, Atlantic Shores 2024). The return rate of hurricanes may become more frequent than the historical record, and the future probability of a major hurricane will likely be higher than the historical record of these events due to climate change (see Appendix B.1.4, *Hurricanes and Tropical Storms*).

  Wind turbines are engineered, designed, fabricated, installed, maintained, and inspected to ensure their structural integrity for the life of the structure. These structures are built with a safety factor providing a conservative design to mitigate against any stresses, loads, or fatigue. The WTGs come with safety functions and control systems in-built to enhance their structural reliability. Critical parameters such as wind speed and wind direction changes, WTG vibrations, etc. are continuously monitored to keep the WTG either in an idle or an operational mode and to maintain the blade pitch and/or the turbine yaw within the designed limits. Scheduled or unscheduled maintenance would likely occur and would most likely be dependent on the operator and/or manufacturer.

  Atlantic Shores has committed to adhering to IEC 61400, an international standard regarding WTGs. The engineering specifications of the WTGs and their ability to sufficiently withstand weather events is independently evaluated by a certified verification agent when reviewing the Facility Design Report and Fabrication and Installation Report 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 includes withstanding 3-second gusts of a 500-year return interval event, which would correspond to Category 5 hurricane windspeeds. 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 (i.e., loss of a blade or 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:* The Project area is located along the Western Atlantic continental margin, which is not an area considered tectonically active (USGS 2019). 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 for severe weather and natural events. An Emergency Response Plan would be prepared by Atlantic Shores, in coordination with USCG, to provide clear instructions regarding procedures to be followed during emergency incident scenarios, including terrorist attacks.

2.4 Summary and Comparison of Impacts between Alternatives

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 proposed Project would not occur; however, impacts could occur from other ongoing and planned activities. The impacts associated with Alternatives F1, F2, and F3 will be comparable to one another during O&M. During construction and installation and decommissioning, the timing and level of disturbance of the three sub-alternatives will differ depending on the foundation type(s) selected. Section 3.1, *Impact-Producing Factors,* provides definitions for **negligible**, **minor**, **moderate**, and **major** impacts.

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Table 2-7. Summary and comparison of impacts by action alternative with no mitigation measures[15]

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.4.1 Air Quality	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor to moderate** impacts on air quality. *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 adverse** impacts due to emissions of criteria pollutants, volatile organic compounds, hazardous air pollutants (HAPs), and greenhouse gases (GHG), mostly released during construction and installation and decommissioning, and **minor to moderate beneficial** impacts on regional air quality after offshore wind projects are operational.	*Proposed Action:* The Proposed Action would have **minor to moderate adverse** impacts attributable to air pollutant, GHG emissions and accidental releases. The Project may lead to reduced emissions from fossil-fueled power-generating facilities and consequently **minor to moderate beneficial** impacts on air quality and climate. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would result in **minor to moderate adverse** impacts and **minor to moderate beneficial** impacts.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* Emissions from construction and installation of different foundation types would not differ substantially among the sub-alternatives and would be similar to the Proposed Action. The impact magnitude would remain **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.4.2 Water Quality	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on water quality. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on water quality primarily due to sediment resuspension, discharges, and accidental releases. The impacts are likely to be temporary or small in proportion to the geographic analysis area. *Cumulative Impacts of the Proposed Action:* Impacts of	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities,	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities,	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other	*Alternative F:* Water quality impacts from construction and installation of different foundation types would not differ substantially among the sub-alternatives and would be similar to the Proposed Action. The impact magnitude would remain **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing

[15] All sub-alternatives were deemed to have similar impacts unless otherwise stated within the applicable column. Alternative impacts are inclusive of baseline conditions and impacts from ongoing activities for each resource as described in their respective sections in Chapter 3, *Affected Environment and Environmental Consequences*. Cumulative impacts represent alternative impacts (with the baseline) plus other foreseeable impacts.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	in **moderate adverse** impacts primarily driven by the unlikely event of a large-volume, catastrophic release.	the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** primarily due to short-term, localized effects from increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operations due to the presence of structures.	including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	offshore wind activities, would be the same as for the Proposed Action.	combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.1 Bats	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts on bats. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **negligible** impacts on bats 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 on bats. The most significant sources of potential impact would be collision mortality from operation of the offshore WTGs (although BOEM anticipates this to be rare because offshore occurrence of bats is low) and potential onshore removal of habitat. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **negligible**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would not change the number of structures within the OCS, and thereby would not have the potential to significantly reduce or increase impacts on bats. The overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.2 Benthic Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on benthic resources.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts from habitat disturbance; permanent habitat conversion; and behavioral changes, injury, and mortality	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. The removal, or micrositing of up to 29 WTGs and 1 OSS under Alternative C would result in a	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. The removal of up to 31 WTGs under Alternative D would result in a proportional decrease in the amount of	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. The removal of up to 5 WTGs under Alternative E would result in a proportional decrease in the amount of EMF and noise impacts and benthic habitat	*Alternative F:* Alternative F1 would result in similar impacts as the Proposed Action from installing only piled foundations: **moderate adverse** impacts, with some	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	Cumulative Impacts of the No Action Alternative: The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts from habitat degradation and conversion and **moderate beneficial** impacts from emplacement of structures (habitat conversion to hard substrate).	of benthic fauna. **Moderate beneficial** impacts would result from new hard surfaces that could provide new benthic habitat. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** and **moderate beneficial**.	proportional decrease in the amount of electromagnetic field (EMF) and noise impacts and benthic habitat disturbance and conversion related to the installation of foundations, interarray cables, and scour protection. With Alternatives C1 and C2, the Project could avoid impacts on one or both (if Alternatives C1 and C2 were combined) NMFS AOCs, both of which have pronounced bottom features and produce habitat value. Although impacts on benthic resources would be reduced under Alternative C, overall impacts on benthic resources would be similar to those under the Proposed Action: **moderate adverse** impacts, with some **moderate beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	EMF and noise impacts and benthic habitat disturbance and conversion related to the installation of foundations, interarray cables, and scour protection. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** impacts, with some **moderate beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	disturbance and conversion related to the installation of foundations, interarray cables, and scour protection. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** impacts, with some **moderate beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	**moderate beneficial** impacts. Under Alternatives F2 and F3, there would be no underwater noise impacts on benthic resources due to impact pile driving. The avoidance of impact pile-driving noise impacts would reduce overall construction and installation impacts on benthic resources under Alternatives F2 and F3 compared to the Proposed Action. Alternatives F2 and F3 would avoid pile-driving noise impacts from installing suction bucket and gravity-based foundations but would result in increased habitat conversion from larger foundations. The overall impact level for Alternatives F2 and F3 would be **minor adverse** impacts. Due to the reduction in scour protection and the beneficial hard-bottom habitat it provides, Alternatives F2 and F3 could include only **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** and **moderate beneficial**.	impacts with some **moderate beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.3 Birds	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** impacts on birds	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on birds. The most significant sources of potential impact would be collision mortality	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action:	*Alternative F:* This alternative would not change the number of structures within the OCS, and thereby would not have the potential to significantly reduce or	*Preferred Alternative*: This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	primarily through construction of ongoing activities and climate change. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts on birds due to habitat loss from increased onshore construction and interactions with offshore developments, and **minor beneficial** impacts because of the presence of offshore structures.	from operation of the offshore WTGs and long-term but minimal habitat loss and conversion from onshore construction. The Proposed Action would also result in potential **minor beneficial** impacts associated with foraging opportunities for marine birds. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse**, as well as **minor beneficial**, primarily through the permanent impacts from the presence of structures.	same as for the Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	**moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	increase impacts on birds. The overall impact level would be the same as for the Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	same as for the Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.4 Coastal Habitat and Fauna	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on coastal habitat and fauna, primarily through onshore construction and climate change. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts on coastal habitat and fauna through onshore construction and climate change.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on coastal habitats and fauna due to the developed and urbanized landscape that dominates the geographic analysis area and measures taken to avoid sensitive habitat, but with consideration of climate change. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** due to impacts on wildlife habitat in the geographic	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
		analysis area, but with consideration of climate change.					
3.5.5 Finfish, Invertebrates, and Essential Fish Habitat	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on finfish, invertebrates, and essential fish habitat. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** and **minor beneficial** impacts on finfish, invertebrates, and essential fish habitat.	*Proposed Action:* The Proposed Action would result in **moderate adverse** and **minor beneficial** impacts on finfish, invertebrates, and essential fish habitat, primarily due to the disturbance of seafloor during cable emplacement and the presence of structures. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** and **minor beneficial**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would not change the number of structures within the OCS, and thereby would significantly reduce or increase most impacts on finfish, invertebrates, and essential fish habitat. Impacts due to pile-driving noise would be eliminated under Alternative F; therefore, impacts due to noise would be reduced to negligible under Alternative F compared to the moderate levels determined under the Proposed Action. The overall impact levels would still be **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	*Preferred Alternative*: The reduction in number of WTGs and micrositing under this alternative would reduce impacts due to fewer disturbances of bottom habitats. The reduction in disturbances to complex habitats in the NMFS-identified AOCs would also benefit finfish and invertebrates that are known to be productive in these areas. These reductions of impacts are not sufficient to change the impact determinations made under Alternative B; however, avoidance and/or reduction of impacts to these resources within the AOCs is ecologically valuable. The impacts due to the Preferred Alternative would be **moderate adverse** with some **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative*: The cumulative impacts of the Preferred Alternative with ongoing and planned activities including the connected action and other offshore wind activities, would be the same as the Proposed Action.
3.5.6 Marine Mammals	*Incremental Impacts*[16]: None *No Action Alternative Impacts:* Continuation of	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other mysticetes, odontocetes, and pinnipeds	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other

[16] Incremental impacts (i.e., alternative impacts without the baseline) were included at NMFS' request in order to support determinations under the MMPA.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on pinnipeds, odontocetes, and mysticetes (except for NARW) and **major adverse** impacts on NARW and could include **minor beneficial** impacts on odontocetes and pinnipeds. The No Action Alternative would have no additional incremental effect on marine mammals. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts on pinnipeds, odontocetes, and mysticetes (except for NARW) and **major adverse** impacts on NARW and could include **minor beneficial** impacts due to increased foraging opportunities for odontocetes and pinnipeds. However, these effects may be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.	mysticetes, odontocetes, and pinnipeds *Proposed Action:* Including the baseline, the Proposed Action would result in **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and **major adverse** impacts on NARW. **Minor beneficial** impacts on odontocetes and pinnipeds could result from the presence of structures. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of the Proposed Action when compared to the No Action Alternative would be **minor to moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds, and **minor** for NARW. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds, and **major** for NARW, and would also include **minor beneficial** impacts on odontocetes and	mysticetes, odontocetes, and pinnipeds *Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level, including the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of Alternative C would be the same as the Proposed Action. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	mysticetes, odontocetes, and pinnipeds *Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level, including the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of Alternative D would be the same as the Proposed Action. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level, including the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of Alternative E would be the same as the Proposed Action. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	mysticetes, odontocetes, and pinnipeds *Alternative F:* Alternative F1 would not result in measurably different impacts, inclusive of the baseline, from the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. Alternatives F2 and F3 would result in measurably different impacts from the Proposed Action due to the avoidance of impact pile-driving noise. However, given the baseline, Alternatives F2 and F3 would still result in **moderate** adverse impacts on pinnipeds, odontocetes, and mysticetes (except for NARW) and **major adverse** impacts on NARW and could include **minor beneficial** impacts on odontocetes and pinnipeds. The incremental impact of Alternative F would be the same as the Proposed Action. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when	mysticetes, odontocetes, and pinnipeds *Preferred Alternative*: This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level, inclusive of the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW and could include **minor beneficial** impacts on odontocetes and pinnipeds. The incremental impact of the Preferred Alternative would be the same as the Proposed Action. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
		pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.				combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	
3.5.7 Sea Turtles	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** impacts on sea turtles. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts on sea turtles and could include **minor beneficial** impacts. Adverse impacts would result mainly from pile-driving noise, presence of structures, and vessel traffic. Beneficial impacts could result from the presence of structures allowing for increased foraging opportunities.	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts on sea turtles, primarily due to pile-driving noise, vessel noise, and presence of structures. **Minor beneficial** impacts could result from the presence of structures allowing for increased foraging opportunities. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **minor adverse** and would also include **minor beneficial** impacts.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* Alternative F1 would not result in measurably different impacts from the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. Alternatives F2 and F3 would result in measurably different impacts from the Proposed Action due to the avoidance of impacts associated with pile-driving noise. However, given that impacts are still expected due to vessel noise, displacement of sea turtles into higher-risk areas associated with the presence of structures, and vessel traffic, construction and installation, O&M, and decommissioning of Alternatives F2 and F3 would still result in **minor** adverse impacts on sea turtles and could include **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts with some **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.5.8 Wetlands	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on wetlands, primarily driven by land disturbance. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts, primarily driven by land disturbance.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on wetlands, primarily due to land disturbance. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate,** primarily due to cable emplacement and onshore construction activities.	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.1 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 **major adverse** impacts on commercial fisheries and for-hire recreational fishing. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **major adverse** impacts on commercial fisheries and for-hire recreational fishing. These impacts would primarily result from fisheries use and management and the increased presence of offshore structures. The impacts could also include **minor beneficial** impacts for some for-hire recreational fishing operations due to the	*Proposed Action:* The Proposed Action would result in **major adverse** impacts on commercial fisheries and for-hire recreational fisheries, primarily due to fisheries use and management and long-term impacts from the presence of structures, including navigational hazards, gear loss and damage, and space use conflicts. **Minor beneficial** impacts could result from the presence of structures and the artificial reef effect. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **major adverse** and would also include **minor**	*Alternative C:* This alternative would have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* Alternative F2 (suction bucket foundations) would result in the greatest area of habitat conversion from scour protection and was evaluated under the Proposed Action. Alternative F1 (piled foundations) and Alternative F3 (gravity-based foundations) would result in a reduction in scour protection compared to the Proposed Action. However, the overall impact levels under Alternatives F1, F2, and F3 would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action and would modify the layout of offshore structures. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	presence of structures and the artificial reef effect.	**beneficial** impacts on for-hire recreational fisheries.				combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	
3.6.2 Cultural Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on cultural resources, primarily through the presence of structures. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **major adverse** impacts on cultural resources.	*Proposed Action:* The Proposed Action would result in **major adverse** impacts on cultural resources because a notable and measurable impact requiring mitigation is anticipated. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **major adverse**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the reduction in impact severity on cultural resources would not avoid visual adverse effects as compared to the Proposed Action, resulting in the same overall impact level as the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* The severity of impacts on cultural resources increases with the size of the foundation type and anticipated seabed disturbance. However, the nature of physical activities proposed under this alternative would result in the same level of impacts as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative*: This alternative would include at least 5 fewer WTGs, in addition to a WTG height restriction in Project 1, compared to the Proposed Action and would modify the layout of offshore structures. This would lessen the overall severity of physical and visual impacts on a limited proportion of identified cultural resources; however, the impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Preferred Alternative*: Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.3 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 on demographics, employment, and economics, primarily driven by land disturbance and additional employment opportunities.	*Proposed Action:* The Proposed Action would result in **minor adverse** and **minor beneficial** impacts on demographics, employment, and economics, primarily due to job and revenue creation. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Preferred Alternative:* This alternative would include at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	Cumulative Impacts of the No Action Alternative: The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** and **moderate beneficial** impacts, the latter of which would be on ocean-based employment and economics.	activities, including the connected action and other offshore wind activities, would be **minor adverse** and **moderate beneficial**. The beneficial impacts would primarily be associated with the investment in offshore wind, job creation and workforce development, income and tax revenue, and infrastructure improvements, while the adverse impacts would result from aviation hazard lighting on WTGs, new cable emplacement and maintenance, the presence of structures, vessel traffic and collisions/allisions during construction, and land disturbance.	*Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.4 Environmental Justice	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** impacts on environmental justice populations, primarily driven by ongoing population growth and new development. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts, primarily due to short-term impacts from cable emplacement, construction-phase noise, and vessel traffic, as well as the long-term presence of structures. **Minor beneficial** impacts could result through	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on environmental justice populations, primarily due to land disturbance, and noise. The Proposed Action would result in **minor beneficial** impacts on environmental justice populations, primarily due to port utilization and presence of structures. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** impacts and **moderate beneficial** impacts. The adverse effects are primarily driven by land disturbance, and noise and the beneficial	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	economic activity, job opportunities, and reductions in air emissions.	impacts are primarily driven by port utilization, presence of structures, and air emissions.					
3.6.5 Land Use and Coastal Infrastructure	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** and **minor beneficial** impacts on land use and coastal infrastructure. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts, primarily driven by land disturbance, noise, and traffic. **Major beneficial** impacts would result from productive use of ports and related infrastructure for offshore wind activity.	*Proposed Action:* The Proposed Action would result in **minor adverse** and **moderate beneficial** impacts on land use and coastal infrastructure. Adverse impacts are primarily due to land disturbance, noise, and traffic during onshore construction. Beneficial impacts are primarily due to supporting designated uses and infrastructure improvements at ports. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **minor adverse** and **major beneficial**. The adverse impacts would primarily be driven by land disturbance, noise, and traffic. The beneficial impacts would primarily be associated with port utilization.	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.6 Navigation and Vessel Traffic	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on navigation and vessel traffic. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities	*Proposed Action:* The Proposed Action would result in **major adverse** impacts on navigation and vessel traffic, primarily due to changes in navigation routes, delays in ports, degraded communication and radar signals, and increased difficulty of offshore search and rescue or surveillance missions.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing	*Alternative E:* This alternative would involve a 0.81-nautical mile (1,500-meter) to 1.08-nautical mile (2,000-meter) setback between WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) and the Atlantic Shores South Lease Area (OCS-A 0499). This alternative would result in the exclusion or micrositing of up to 5 WTGs. The setback would be an improvement to vessel navigation and search	*Alternative F:* This alternative would involve installing a range of foundation types, which has little to no impact on navigation and traffic. Furthermore, the number of structures within the OCS would not change under this alternative. Thus, the overall impact level would be the same as for the Proposed Action: **major adverse**.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action and would modify the layout of offshore structures. This modification would lessen potential impacts to vessel navigation. Thus, the overall impact level would be reduced when compared to the Proposed Action: **moderate adverse**.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	(including other offshore wind activities) would result in **moderate adverse** impacts primarily due to the presence of offshore wind structures, which would increase the risk of collisions, allisions, and accidental releases, as well as due to port utilization and vessel traffic.	*Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **major adverse**, primarily due to the increased possibility for marine accidents.	and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	and rescue considerations, but due to the presence of off-grid structures, the impact level would remain the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be reduced from the Proposed Action: **moderate**.
3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, and 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 military and national security uses except USCG SAR operations, aviation and air traffic, cables and pipelines, and radar systems; **minor adverse** impacts for marine mineral extraction and USCG SAR operations, and **moderate adverse** impacts for scientific research and surveys. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts for marine mineral extraction, military and national security uses except for USCG SAR operations, aviation and air traffic, cables and pipelines and radar systems; and **moderate adverse** impacts for USCG SAR operations and	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts for marine mineral extraction, military and national security uses except for USCG SAR operations, aviation and air traffic, and cables and pipelines; **moderate adverse** impacts for radar systems; and **major adverse** impacts for USCG SAR operations and scientific research and surveys. The presence of structures associated with the Proposed Action and increased risk of allisions are the primary drivers for impacts on USCG SAR operations. Impacts on 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-	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level for the individual IPFs would be the same as for the Proposed Action and range from: **minor to major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level for the individual IPFs would be the same as for the Proposed Action and range from **minor to major adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would involve a 0.81-nautical mile (1,500-meter) to 1.08-nautical mile (2,000-meter) setback between WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) and the Atlantic Shores South Lease Area (OCS-A 0499). This alternative would result in the exclusion or micrositing of up to 5 WTGs. The overall impacts would be the same as for the Proposed Action except for USCG SAR operations. The setback would be an improvement to vessel navigation and SAR considerations and would lead to reduced impacts for USCG SAR operations when compared to the Proposed Action: **moderate adverse**. The overall impact range would remain **minor to major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would	*Alternative F:* This alternative would involve installing a range of foundation types, which has little to no impact on navigation and traffic. Furthermore, the number of structures within the OCS would not change under this alternative. Thus, the overall impact level would be the same as for the Proposed Action and range from: **minor to major adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action and would modify the layout of offshore structures. The overall impacts would be the same as for the Proposed Action except for USCG SAR operations. The modified layout would be an improvement to vessel navigation and SAR considerations and would lead to reduced impacts for USCG SAR operations when compared to the Proposed Action: **moderate adverse**. The overall impact range would remain **minor to major adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	major adverse scientific research and surveys.	species research as a whole, as well as on the commercial fisheries community. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **minor adverse** for marine mineral extraction, military and national security uses except for USCG SAR operations, aviation and air traffic, and cables and pipelines; **moderate adverse** for radar systems; and **major adverse** for USCG SAR operations and scientific research and surveys.			the same as for the Proposed Action except for USCG SAR operations, which would be **moderate adverse**. The overall impact range would remain **minor to major**.		Action except for USCG SAR operations, which would be **moderate adverse**. The overall impact range would be **minor to major adverse.**
3.6.8 Recreation and Tourism	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** impacts on recreation and tourism. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts, primarily driven by land disturbance, cable emplacement and maintenance, noise, traffic, anchoring, lighting, and the presence of structures. **Minor beneficial** impacts would result from the anticipated artificial reef effect resulting	*Proposed Action:* The Proposed Action would result in **minor adverse** and **minor beneficial** impacts on recreation and tourism. Adverse impacts are primarily due to anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, traffic, and the presence of structures. Beneficial impacts are primarily due to the presence of structures and the potential for the artificial reef effect. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities,	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* Alternative D1 would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs. Alternative D2 would exclude placement of WTGs up to 12.75 miles (20.5 kilometers) from shore, resulting in the removal of up to 31 WTGs. Alternative D3 would exclude placement of WTGs up to 10.8 miles (17.4 kilometers) from shore, resulting in the removal of up to six WTGs. Alternatives D1 and D2 may substantially reduce the visual impacts on historic aboveground resources. Alternative D3 is not anticipated to result in a substantial reduction. Though the visual impact may be reduced for Alternatives D1 and D2, the overall impact	*Alternative E: Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would involve installing a range of foundation types, which would not have measurable impacts on recreation and tourism that are materially different from the impacts of the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	from installation of offshore structures.	would be **minor adverse** and **minor beneficial**.		level for Alternative D would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.			
3.6.9 Scenic and Visual Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **major adverse** impacts on scenic and visual resources. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **major adverse** impacts due to the addition of new structures, nighttime lighting, onshore construction, and increased vessel traffic.	*Proposed Action:* Effects of Offshore Project elements on high- and moderate-sensitivity seascape character units, open ocean character units, and landscape character units would be **major adverse**. Onshore facilities would result in **major adverse** impacts on scenic and visual resources. *Cumulative Impacts of the Proposed Action:* Overall, impacts from ongoing and planned activities, including other offshore wind activities, would be **major adverse**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* Alternative D1 would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs. Alternative D2 would exclude placement of WTGs up to 12.75 miles (20.5 kilometers) from shore, resulting in the removal of up to 31 WTGs. Alternative D3 would exclude placement of WTGs up to 10.8 miles (17.4 kilometers) from shore, resulting in the removal of up to 6 WTGs. Alternatives D1 and D2 may substantially reduce the visual impacts on historic aboveground resources. Alternative D3 is not anticipated to result in a substantial reduction. Though the visual impact may be reduced for Alternatives D1 and D2, the overall impact level for Alternative D would be the same as for the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative D:* Impacts of	*Alternative E: Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would involve installing a range of foundation types, which would not have measurable impacts on scenic and visual resources that are materially different from the impacts of the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative*: This alternative would include at least 5 fewer WTGs, in addition to a WTG height restriction in Project 1, compared to the Proposed Action and would modify the layout of offshore structures. This would lessen the overall severity of visual impacts; however, the impact level would remain the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Preferred Alternative*: Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
				Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.			

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Chapter 3

Affected Environment and Environmental Consequences

This chapter addresses the affected environment, also known as the existing condition, for each resource area and the potential environmental consequences to those resources from implementation of the alternatives described in Chapter 2, *Alternatives*. In addition, this section addresses the impact of the alternatives when combined with other past, present, or reasonably foreseeable planned activities using the methodology and assumptions outlined in Chapter 1, *Introduction*, and Appendix D, *Ongoing and Planned Activities Scenario*. Appendix D describes other ongoing and planned activities within the geographic analysis area for each resource. These actions may be occurring on the same time scale as the proposed Project or could occur later in time but are still reasonably foreseeable.

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

3.1 Impact-Producing Factors

BOEM completed a study on the North Atlantic OCS that identified the impact-producing factors (IPFs) to consider in an offshore wind development planned activities scenario (2019). This document incorporates that study by reference. The study provides the following information:

- Identifies cause-and-effect relationships between renewable energy projects and the human environment (includes but is not limited to physical and biological resources, socioeconomic conditions, scenic and visual resources, and cultural 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 for consideration in a cumulative impacts analysis.
- Identifies actions and activities that may affect the same resources as renewable energy projects and states that such actions and activities may produce the same IPFs.

The BOEM study identifies the relationships between IPFs associated with specific past, present, and reasonably foreseeable future actions in the North Atlantic OCS. As also discussed in the study, reasonably foreseeable actions other than offshore wind projects may also affect the same resources as the proposed offshore wind Project or other offshore wind projects, possibly via the same or additional IPFs (BOEM 2019). BOEM determined the relevance of each IPF to each resource analyzed in this Final EIS. If BOEM found an IPF not associated with the proposed Project, it did not include it in the analysis.

Table 3.1-1 provides brief descriptions of the primary IPFs involved in this analysis, including examples of sources or activities that result in each IPF. The IPFs cover all phases of the proposed Project, including construction and installation, O&M, and decommissioning.

Table 3.1-1. Primary 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, and interarray 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 are distinct from routine discharges, consisting of authorized operational effluents, and they are restricted via treatment and monitoring systems and permit limitations.
Air emissions	• Combustion related stationary or mobile emission sources (e.g., generators [both on- and offshore], or support vessels, vehicles, and aircraft) • Non-combustion related sources, such as leaks from tanks and switchgears	Refers to emission sources that emit regulated air pollutants (gaseous or particulate matter) into the atmosphere. Releases can occur on- and offshore.
Anchoring	• Anchoring of vessels • Attachment of a structure to the sea bottom by use of an anchor, mooring, or gravity-based weighted structure (i.e., bottom-founded structure)	Refers to seafloor disturbance (anything below Mean Higher High Water [MHHW]) related to any offshore construction or maintenance activities. Refers to an activity or action that disturbs or attaches objects to the seafloor.
Cable emplacement and maintenance	• Dredging or trenching • Cable placement • Seabed profile alterations • Sediment deposition and burial • Cable protection of concrete mattress and rock placement	Refers to seafloor disturbances (anything below MHHW) related to the installation and maintenance of new offshore submarine cables. Cable placement methods include trenchless installation (such as HDD, direct pipe, and auger bore), jetting, vertical injection, control flow excavation, trenching, and plowing.
Discharges/intakes	• Vessels • Structures • Onshore point and non-point sources • Dredged material • 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 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 and/or numeric pollutant concentration limitations as required through USEPA

IPF	Sources and Activities	Description
		National Pollutant Discharge Elimination System permits or 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 and/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.
Electric and magnetic fields and cable heat	• Substations • Power transmission cables • Interarray 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 the 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, dependent on cable design and burial depth.
Gear utilization	• Monitoring surveys	Refers to entanglements and bycatch during monitoring surveys.
Land disturbance	• Vegetation clearance • Excavation • Grading • Placement of fill material	Refers to land disturbances (anything above MHHW) during onshore construction activities.
Lighting	• Vessels or offshore structures above or under water • 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.
Noise	• Aircraft • Vessels • Turbines • Geophysical and geotechnical surveys • Operations and maintenance • Onshore and offshore construction and installation • Vibratory and impact pile driving • Dredging and trenching • Unexploded ordnances (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., pile driving) or broad spectrum and continuous (e.g., from Project-associated marine transportation vessels). May also be noise generated from turbines themselves or interactions of the turbines with wind and waves.

IPF	Sources and Activities	Description
Port utilization	• Expansion and construction • Maintenance • Use • Revitalization	Refers to an activity or action associated with port activity, upgrades, or maintenance that occur only as a result of the Project from increased economic activity. 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, submarine cables, and scour/cable protection	Refers to the post-construction, long-term presence of on- or offshore structures.
Traffic	• Aircraft • Vessels (construction, operation and maintenance, 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.

3.2 Mitigation Identified for Analysis in the Environmental Impact Statement

During the development of the EIS and in coordination with cooperating agencies, BOEM considered potential additional mitigation measures that could further avoid, minimize, or mitigate impacts on the physical and biological resources, socioeconomic conditions, scenic and visual resources, and cultural resources assessed in this document. These potential additional mitigation measures are described in Appendix G, *Mitigation and Monitoring*, and are analyzed in the relevant resource sections in Chapter 3. BOEM has identified two additional measures as incorporated in the Preferred Alternative:

- BOEM-Proposed Mitigation Measure #6 (Appendix G, Table G-3): No permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical miles (1.1 kilometers)[1] by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, meteorological tower, and WTGs would be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.

- NOAA/NMFS-Proposed Mitigation Measure #1 (Appendix G, Table G-3): Removal of a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).

Furthermore, 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 MSA. Mitigation measures identified through consultations, authorizations, and permits are presented in Appendix G of the Final EIS. Those additional mitigation measures presented in Appendix G, Tables G-2 through G-4, may not all be within BOEM's statutory and regulatory authority to require; however, other jurisdictional governmental agencies may potentially require them. BOEM may choose to incorporate one or more additional measures in the ROD and adopt those measures as conditions of COP approval. As previously discussed, all Atlantic Shores-committed measures, listed in Table G-1, are part of the Proposed Action (see Section 2.1.2 for details).

[1] USCG has determined that 0.6 nautical mile (1.1 kilometers) is the minimum spacing between WTGs for vessels to safely maneuver within a wind farm (USCG 2020).

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3.3 Definition of Impact Levels

Based on previous environmental reviews, subject-matter expert input, consultation efforts, and public involvement to date, BOEM has identified the resources addressed in Section 3.4, *Physical Resources*, 3.5, *Biological Resources,* and 3.6, *Socioeconomic Conditions and Cultural Resources,* as those potentially affected by the Project. Each resource section includes impact-level definitions and geographic analysis area descriptions and maps.

In this section, BOEM identifies and defines terminology used in the Final EIS impact analysis.

3.3.1 Activities Terminology

When assessing impacts on the resources, BOEM considers all ongoing and planned activities within the geographic analysis area. For the purposes of analysis, these activities are grouped into two categories: non-offshore wind and offshore wind. The following definitions are used in this Final EIS:

- **Non-offshore wind**: Activities include the following: (1) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (2) tidal energy projects; (3) marine minerals use and ocean-dredged material disposal; (4) military use; (5) marine transportation (commercial, recreational, and research-related) and port development; (6) fisheries use, management, and monitoring surveys; (7) global climate change; (8) oil and gas activities; (9) onshore development activities; and (10) research, monitoring, and survey activities. For more detailed definitions of these activities, refer to Appendix D.
- **Offshore wind**:
  - *Proposed offshore wind*: Offshore wind energy activities associated with the Proposed Action or any of the alternatives presented in this Final EIS.
  - *Ongoing offshore wind*: Other offshore wind energy development activities that meet the following criteria: (1) the activity is not a part of the Proposed Action or any of the alternatives presented in this Final EIS; and (2) the activity is currently under construction, operation, or has an approved COP in place.
  - *Planned offshore wind*: other reasonably foreseeable future offshore wind energy development activities that meet the following criteria: (1) the activity is not a part of the Proposed Action or any of the alternatives presented in this Final EIS; and (2) a renewable energy lease has been executed for a project, but there is not an approved COP at the time of publication of this Final EIS.

3.3.2 Impact Terminology

In accordance with the most recent CEQ NEPA regulations (40 CFR 1501.3), federal agencies are required to evaluate the potentially affected environment and degree of the effects of the action when considering if effects are significant.

This Final EIS uses a four-level classification scheme to characterize the potential adverse and beneficial impacts of the Proposed Action and alternatives. Impact levels described in BOEM's *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (MMS 2007) were used as the initial basis for establishing adverse impacts specific to each resource. These resource-specific adverse impact-level definitions were then further refined based on prior NEPA analyses, scientific literature, and best professional judgement and are presented in each resource section.

When evaluating beneficial impacts and assigning an impact level to each resource, BOEM used a more general impact definition. Table 3.3-1 provides the definition of potential beneficial impact levels across all resources in the Final EIS.

Overall determinations consider the context, intensity, directionality (adverse or beneficial), and duration of the effects and provide the basis for the impact-level determination by resource. When considering the magnitude of impacts, the analysis should identify if the impacts are geographically local, regional, or widespread. With regard to temporal extent, the Final EIS assumes that potential construction effects generally diminish once construction ends; however, ongoing O&M activities could result in additional impacts during the 30-year life of the Project. Additionally, Atlantic Shores would have up to an additional 2 years to complete conceptual decommissioning activities. Therefore, the Final EIS considers the time frame beginning with construction and installation and ending when the Project's conceptual decommissioning is complete, unless otherwise noted.

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

- **Short-term effects**: Effects lasting less than 3 years. An example would be clearing of onshore shrubland vegetation for a construction staging area; the area would be revegetated when the construction is complete, and, after revegetation is successful, this effect would end.
- **Long-term effects**: Effects lasting longer than 3 years, but less than the life of the Project (34 years). An example would be the loss of habitat where a foundation has been installed and would be removed during decommissioning.
- **Permanent effects**: Effects lasting the life of the Project and beyond. An example would be the conversion of land to support new onshore facilities.

The main body of this Final EIS identifies or describes in detail the impacts for resources of most concern, while Appendix F, *Assessment of Resources with Minor (or Lower) Impacts*, provides the analysis of other resources consisting of only negligible to minor Proposed Action impacts. Some impacts of the Proposed Action may not be measurable at the project level, such as the beneficial impacts on benthic resources due to artificial habitat or climate change due to a reduction in greenhouse gas emissions. Where relevant, the impacts are discussed under each resource, while a more comprehensive analysis can be found in Appendix D.

The following definitions are used to describe the incremental impact of the Proposed Action and each alternative in relation to ongoing and planned non-offshore and other offshore wind activities:

- **Undetectable**: The incremental impact contributed by the Proposed Action or the alternative to ongoing and planned non-offshore and other offshore wind activities is so small that it is extremely difficult or impossible to discern or measure.
- **Noticeable**: The incremental impact contributed by the Proposed Action or the alternative, while evident and measurable, is still relatively small in proportion to the impacts from the Proposed Action or the alternative when combined with ongoing and planned non-offshore and other offshore wind activities.
- **Appreciable**: The incremental impact contributed by the Proposed Action or the alternative is measurable and constitutes a relatively large portion of the impacts from the Proposed Action or the alternative when combined with ongoing and planned non-offshore and other offshore wind activities.

Table 3.3-1. Definitions of potential beneficial impact levels

Impact Level	Physical, Biological, and Cultural Resources	Socioeconomic Resources
Negligible	Either no effect or impacts would be so small that it is extremely difficult or impossible to discern or measure.	Either no effect or impacts would be so small that it is extremely difficult or impossible to discern or measure them.
Minor	Small and measurable effects comprising at least one of the following: • Improvement in ecosystem health; • Increase in the extent and quality of habitat for both special-status species and species common to the proposed Project area; • Increase in populations of species common to the proposed Project area; • Improvement in air or water quality; or • Limited spatial extent or short-term duration of improved protection of physical cultural resources.	Small and measurable effects comprising at least one of the following: • Improvement in human health; • Increase in employment (job creation and workforce development); • Improvement to infrastructure/facilities and community services; • Economic improvement (increase in local business expenditure, gross domestic product, labor income, housing demand, supply chain needs, and tax revenue); • Increase in tourism; or • Improvement for individuals and/or communities that result from enhanced protection of cultural resources.
Moderate	Notable and measurable effects comprising at least one of the following: • Improvement in ecosystem health; • Increase in the extent and quality of habitat for both special-status species and species common to the proposed Project area; • Increase in populations of species common to the proposed Project area; • Improvement in air or water quality; or • Extensive/complete spatial extent, or long-term duration of, improved protection of physical cultural resources.	Notable and measurable effects comprising at least one of the following: • Improvement in human health; • Increase in employment (job creation and workforce development); • Improvement to infrastructure/facilities and community services; • Economic improvement (increase in local business expenditures, gross domestic product, labor income, housing demand, supply chain needs, and tax revenue); • Increase in tourism; or • Improvement for individuals and/or communities that result from enhanced protection of cultural resources.

Impact Level	Physical, Biological, and Cultural Resources	Socioeconomic Resources
Major	Regional or population-level effects comprising at least one of the following: • Improvement in ecosystem health; • Increase in the extent and quality of habitat for both special-status species and species common to the proposed Project Area; • Increase of populations of species common to the proposed Project Area; • Improvement in air or water quality; or • Permanent protection of physical cultural resources.	Large local, or notable regional effects comprising at least one of the following: • Improvement in human health; • Increase in employment (job creation and workforce development); • Improvement to infrastructure/facilities and community services; • Economic improvement (increase in local business expenditures, gross domestic product, labor income, housing demand, supply chain needs, and tax revenue); • Increase in tourism; or • Improvement for individuals and/or communities that result from enhanced protection of cultural resources.

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3.4.1 Air Quality

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

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3.4.2 Water Quality

The reader is referred to Appendix F, *Assessment of Resources with Moderate (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.

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3.5 Biological Resources

3.5.1 Bats

The reader is referred to Appendix F, *Assessment of Resources with Moderate (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.

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3.5.2 Benthic Resources

The reader is referred to Appendix F, *Assessment of Resources with Moderate (or Lower) Impacts,* for a discussion of current conditions and potential impacts on benthic resources from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.5.3 Birds

The reader is referred to Appendix F, *Assessment of Resources with Moderate (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.

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3.5.4 Coastal Habitat and Fauna

The reader is referred to Appendix F, *Assessment of Resources with Moderate (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.

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3.5.5 Finfish, Invertebrates, and Essential Fish Habitat

The reader is referred to Appendix F, *Assessment of Resources with Moderate (or Lower) Impacts,* for a discussion of current conditions and potential impacts on finfish, invertebrates, and essential fish habitat from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.5.6 Marine Mammals

This section discusses potential impacts on marine mammal resources from the proposed Project, alternatives, and ongoing and planned activities in the marine mammal geographic analysis area. The marine mammal geographic analysis area, as shown in Figure 3.5.6-1, includes the Canadian Scotian Shelf, Northeast Shelf, Southeast Shelf, and Gulf of Mexico LMEs. This broad geographic area includes the proposed Project area (defined as the area encompassing the Lease Area and ECCs) and is likely to capture the majority of the movement range for the marine mammal species that could be affected by the proposed Project. The geographic analysis area is also inclusive of the Gulf of Mexico LME because vessel transits may occur between the Lease Area and Corpus Christi, Texas.

Table D.A1-12 in Appendix D, *Ongoing and Planned Activities Scenario,* summarizes baseline conditions (i.e., existing conditions) and impacts, based on IPFs assessed, of ongoing non-offshore wind activities, planned non-offshore wind activities, and offshore wind activities.

3.5.6.1 Description of the Affected Environment and Future Baseline Conditions

Marine mammals are highly mobile animals that typically use the waters of the geographic analysis area for a range of life-sustaining activities, including migration, foraging, mating, and giving birth (Madsen et al. 2006; Weilgart 2007). Some individuals occur in all seasons, while others are seasonally present in the proposed Project area. The spatial distributions of marine mammal species in the geographic analysis area are not uniform; some species are pelagic and occur farther offshore, some are coastal and found nearshore, and others occur in both nearshore and offshore areas. Additionally, some species prefer waters of the OCS and shelf edge (defined as a region that straddles the continental shelf break [656-foot or 200-meter depth contour]), either seasonally or while feeding due to changes in the abundance and locations of their prey species; however, at other times of the year, these same species can occur in shallower depths closer to shore. Regarding terminology used to describe types of marine mammals herein, “pinnipeds” refers to seals; “odontocetes” refers to toothed whales, dolphins, and porpoises; “mysticetes” refers to baleen whales; and “cetaceans” is inclusive of odontocetes and mysticetes.

Forty species of marine mammals are known to occur or could occur in U.S. waters of the northwest Atlantic Ocean, which includes the Northeast Shelf LME and is where almost all Project activities would occur: 6 mysticete species, 29 odontocete species, 4 pinniped species, and 1 sirenian species (i.e., manatees and dugongs) (BOEM 2014; CSA Ocean Sciences 2021). All 40 marine mammal species that occur in the northwest Atlantic OCS are protected under the MMPA, and six are listed under the ESA. The blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), North Atlantic right whale (NARW) (*Eubalaena glacialis*), sei whale (*B. borealis*), and sperm whale (*Physeter macrocephalus*) are listed as endangered. The West Indian manatee (*Trichechus manatus*) is listed as threatened. No additional species are expected to occur in the Southeast Shelf LME, which Project vessels would transit through on their way to and from ports in the Gulf of Mexico. Three additional species occur in the Gulf of Mexico that are not expected to occur in the Canadian Scotian Shelf, Northeast Shelf, or Southeast Shelf

LMEs.[1] Current species abundance estimates for the 38 marine mammal species in the Atlantic under the jurisdiction of NMFS can be found in NMFS' marine mammal stock assessment reports for the U.S. Atlantic (Hayes et al. 2019, 2020, 2021, 2022, 2023; NMFS 2024d) and on NMFS' website (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments); beluga whale (*Delphinapterus leucas*) information can be found in the Committee on the Status of Endangered Wildlife in Canada status reports for Canadian designatable units of beluga whale (COSEWIC 2014, 2020); and manatee information can be found in the USFWS stock assessment report for West Indian manatee (USFWS 2023). For these reports, data collection, analysis, and interpretation are conducted through marine mammal research programs at NMFS Fisheries Science Centers and by other researchers. For the endangered NARW stock assessment report, the right whale catalog and sightings database, which use data from a photo-identification recapture database for individual NARWs, is used with available records through November 2020 (Hayes et al. 2023).

As noted above, marine mammals use the coastal waters off the geographic analysis area to rest, forage, mate, give birth, and migrate. Seasonal migrations between foraging and nursery areas are generally determined by prey abundance and availability. Some marine mammal species are highly migratory, traveling long distances between foraging and nursery areas, whereas other species migrate on a regional scale. Migratory patterns vary among species. Prey distribution can influence the distribution of marine mammals and is highly dependent on oceanographic properties and processes.

The best available information on marine mammal occurrence and distribution in the Offshore Project area is provided by a combination of visual sighting data from aerial and vessel surveys, which are routinely conducted near the Offshore Project area, as well as other available data, including passive acoustic monitoring data, habitat-based modeling efforts that utilize multiple years of visual survey data, technical reports, and academic publications, including the following:

- Marine mammal stock assessment reports (Hayes et al. 2017, 2018, 2019, 2020, 2021, 2022, 2023; NMFS 2024d): NMFS prepares marine mammal stock assessment reports each year presenting the most current description of the geographic range, minimum population estimate, population trend, net productivity rates, potential biological removals, status, estimate of human-caused mortality and serious injury by source, and descriptions of other factors contributing to population decline or inhibiting population recovery for each assessed stock. Though stock assessments are conducted each year, individual marine mammal stocks that are not designated as "strategic" are reviewed at

[1] Additional species that may occur in the Gulf of Mexico include the ESA-listed Rice's whale (*B. ricei*), melon-headed whale (*Peponocephala electra*), and Fraser's dolphin (*Lagenodelphis hosei*). As some Project vessels are expected to transit to and from the Gulf of Mexico area (i.e., Corpus Christi, Texas) during construction and installation, there is the potential for vessel-related impacts on these species. However, only 20 round trips from the Gulf of Mexico are expected for the Project. Accidental releases from Project vessels are unlikely (Section 3.5.6.5, *Impacts of Alternative B – Proposed Action on Marine Mammals*). Vessel noise would be temporary and localized, and noise effects of 20 round trips would be insignificant. The increased risk of a vessel strike associated with 20 round trips would be discountable. Therefore, Project impacts in the Gulf of Mexico are unlikely and species unique to the Gulf of Mexico are not considered further in this Final EIS.

least every 3 years (i.e., may not be reviewed in each annual assessment). These stock assessments are peer reviewed and subject to a public comment period.

- Ecological baseline studies conducted for NJDEP (Geo-Marine 2010): NJDEP funded the New Jersey Ecological Baseline Studies from January 2008 through December 2009 and used visual line-transect (shipboard and aerial) methods and passive acoustic monitoring to estimate the abundance and density of marine mammals from the shoreline to around 20 nautical miles (37 kilometers) off the coast of New Jersey between Stone Harbor and Seaside Park. Shipboard surveys were conducted once per month between January 2008 and December 2009. Aerial surveys were conducted once per month following the shipboard surveys between February and May 2008, and twice monthly (when possible) between January and June 2009.

- Sighting and density data from the Ocean Biodiversity Information System, which includes data from a habitat-based cetacean density model for the U.S. Exclusive Economic Zone of the East Coast and Gulf of Mexico developed by the Duke University Marine Geospatial Ecology Laboratory in 2016 and updated to include more recently available data in 2017, 2018, 2019, 2020, and 2022 (Roberts et al. 2015, 2016a, 2016b, 2017, 2018, 2020, 2022, 2023): The habitat-based cetacean density model was recently updated in June 2022 (Roberts et al. 2022) and serves as a complete replacement for the Roberts et al. (2016a) model and subsequent updates and is based primarily on a collection of Roberts et al. (2016b, 2017, 2018, 2020, 2021a, 2021b) density estimates. Collectively, these estimates are considered the best information currently available for marine mammal densities in the U.S. Atlantic. Marine mammal density estimates used in this analysis are derived from the habitat-based cetacean density model and are provided in the species descriptions below.

- Data from NMFS' Atlantic Marine Assessment Program for Protected Species surveys (NEFSC and SEFSC 2015, 2016, 2018, 2019, 2020, 2022; Palka et al. 2017), which coordinates data collection and analysis to assess the abundance, distribution, ecology, and behavior of marine mammals in the U.S. Atlantic: These surveys include both ship and aerial surveys conducted between 2011 and 2019. Although the majority of survey effort has been focused on offshore areas outside the Offshore Project area, a portion were relevant to the assessment of the Proposed Action.

Of the 40 species that are known to occur or could occur in the northwest Atlantic OCS, 35 have documented ranges that include the Offshore Project area. Marine mammal occurrence in the Project area by species is summarized in Table 3.5.6-1. Descriptions of marine mammals that could occur in the Project area are summarized in the COP for the proposed Project (Volume II, Section 4.7; Atlantic Shores 2024), which incorporates existing published literature, gray literature, and public reports. Abundance and density data maps are accessible from Duke University's Marine Geospatial Ecology Lab (MGEL 2024; Roberts et al. 2016b, 2023). These data also document a generally patchy and seasonally variable marine mammal species presence and population density in the Project area and the larger geographic analysis area.

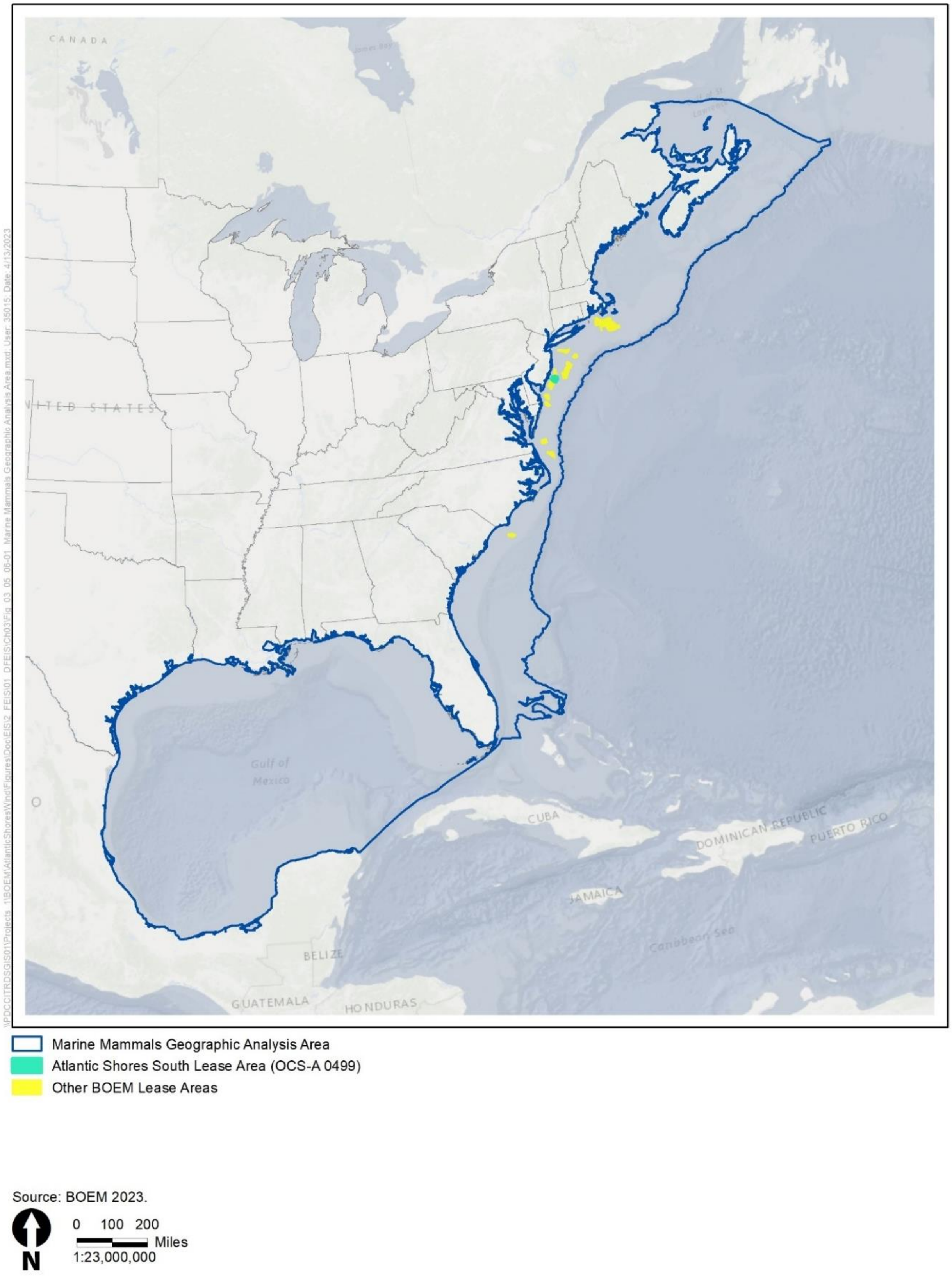

Figure 3.5.6-1. Marine mammals geographic analysis area

Table 3.5.6-1. Marine mammals that could potentially occur in the Project area

Common Name	Scientific Name	ESA/ MMPA Status[1]	Relative Occurrence in the Project Area[2, 3]	Seasonal Occurrence in the Project Area
Mysticetes				
Blue whale	*Balaenoptera musculus*	E/D	Rare	Rare
Fin whale	*Balaenoptera physalus*	E/D	Regular	Year-round, peak in winter and summer
Humpback whale	*Megaptera novaeangliae*	None/N	Common	Year-round, peak in spring and fall
Minke whale	*Balaenoptera acutorostrata*	None/N	Regular	Year-round, peak spring-early summer
North Atlantic right whale	*Eubalaena glacialis*	E/D	Regular	Year-round, peak in winter
Sei whale	*Balaenoptera borealis*	E/D	Uncommon	Spring
Odontocetes				
Atlantic spotted dolphin	*Stenella frontalis*	None/N	Rare	Rare
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	None/N	Uncommon	Fall-spring
Blainville's beaked whale	*Mesoplodon densirostris*	None/N	Rare	Rare
Bottlenose dolphin	*Tursiops truncatus*	None/D, N	Common	Year-round
Common dolphin	*Delphinus delphis*	None/N	Common	Year-round
Cuvier's beaked whale	*Ziphius cavirostris*	None/N	Rare	Rare
Dwarf sperm whale	*Kogia sima*	None/N	Rare	Rare
False killer whale	*Pseudorca crassidens*	None/N	Rare	Rare
Fraser's dolphin	*Lagenodelphis hosei*	None/N	Rare	Rare
Gervais' beaked whale	*Mesoplodon europaeus*	None/N	Rare	Rare
Harbor porpoise	*Phocoena phocoena*	None/N	Common	Year-round, peak in winter
Killer whale	*Orcinus orca*	None/N	Rare	Rare
Long-finned pilot whale	*Globicephala melas*	None/N	Uncommon	Year-round
Pantropical spotted dolphin	*Stenella attenuata*	None/N	Rare	Rare
Pygmy sperm whale	*Kogia breviceps*	None/N	Rare	Rare
Risso's dolphin	*Grampus griseus*	None/N	Uncommon	Year-round
Rough-toothed dolphin	*Steno bredanensis*	None/N	Rare	Rare
Short-finned pilot whale	*Globicephala macrorhynchus*	None/D	Rare	Rare
Sowerby's beaked whale	*Mesoplodon bidens*	None/N	Rare	Rare
Sperm whale	*Physeter macrocephalus*	E/D	Uncommon	Year-round, peak in summer
Spinner dolphin	*Stenella longirostris*	None/N	Rare	Rare
Striped dolphin	*Stenella coeruleoalba*	None/N	Rare	Rare
True's beaked whale	*Mesoplodon mirus*	None/N	Rare	Rare
White-beaked dolphin	*Lagenorhynchus albirostris*	None/N	Rare	Rare
Pinnipeds				
Gray seal	*Halichoerus grypus*	None/N	Regular	Year-round

Common Name	Scientific Name	ESA/ MMPA Status[1]	Relative Occurrence in the Project Area[2, 3]	Seasonal Occurrence in the Project Area
Harbor seal	*Phoca vitulina*	None/N	Regular	Year-round, peak fall-spring
Harp seal	*Cystophora cristata*	None/N	Rare	Rare
Hooded seal	*Phoca groenlandica*	None/N	Rare	Rare
Sirenians				
West Indian manatee	*Trichechus manatus*	T/D	Rare	Rare

[1] E = endangered; T = threatened; D = depleted; N = non-strategic.
[2] Rare – limited sightings for some years; uncommon – occurring in low numbers or on an irregular basis; regular – occurring in low to moderate numbers on a regular basis or seasonally; common – occurring consistently in moderate to large numbers.
[3] Source: COP Volume II Section 4.7.1.1, Table 4.7-1; Atlantic Shores 2024.

For the purposes of the description of the affected environment in this Final EIS, the focus is on 16 species of marine mammals (comprising 17 stocks) that would be likely to occur in the Offshore Project area or experience acoustic effects of the Proposed Action. This includes four ESA-listed whale species (i.e., NARW, sperm whale, sei whale, fin whale), two non-ESA listed whale species (i.e., minke whale [*Balaenoptera acutorostrata*], humpback whale [*Megaptera novaeangliae*]), several types of delphinids and small whales (i.e., Atlantic spotted dolphin [*Stenella frontalis*], Atlantic white-sided dolphin [*Lagenorhynchus acutus*], bottlenose dolphin [*Tursiops truncatus*, comprising two stocks, the Western North Atlantic Offshore and the Northern Migratory Coastal], common dolphin [*Delphinus delphis*], long-finned and short-finned pilot whales [*Globicephala* spp.], Risso's dolphin [*Grampus griseus*], and harbor porpoise [*Phocoena phocoena*]), and two pinniped species (i.e., harbor seal [*Halichoerus grypus*], gray seal [*Phoca vitulina*]). These species are analyzed herein. Marine mammal species likely to occur in the Project area or experience acoustic effects of the Proposed Action are described in the following paragraphs. The most recent Duke University Marine Geospatial Ecology Lab density models (Roberts et al. 2016b, 2023) were used to create activity-specific densities for each activity under the Proposed Action. Population information for marine mammals likely to occur in the Project area or experience acoustic effects of the Proposed Action is provided in Table 3.5.6-2. Other marine mammal species are not described further in this subsection but are included in the impact assessments below.

Threatened and Endangered Marine Mammals

The ESA (16 USC 1531 et seq.) classifies certain species as threatened or endangered based on their overall population status and health. Four marine mammals that are likely to occur in the Project area or are expected to experience acoustic effects are classified as endangered: fin whale, NARW, sei whale, and sperm whale. Of the marine mammal species listed under the ESA, critical habitat has only been designated for the NARW (NMFS 2016b), as described below. The BA for Atlantic Shores South (BOEM 2023a) provides a detailed discussion of ESA-listed species and critical habitat and potential impacts on these species and habitats as a result of the Project. The BA submitted to NMFS found that the Proposed Action *may affect, is likely to adversely affect* some ESA-listed marine mammal species (i.e., fin whale, NARW, sei whale, and sperm whale) but is expected to have no effect on critical habitat designated for NARW (BOEM 2023a). Consultation with NMFS pursuant to Section 7 of the ESA was completed December 18, 2023, per the completed Biological Opinion available online at https://www.fisheries.noaa.gov/s3/2024-02/GARFO-2023-01804.pdf. NMFS concluded that the Proposed Action is likely to adversely affect but is not likely to jeopardize the continued existence of fin whales, NARWs, sei whales, or sperm whales. Additionally, per the completed Biological Opinion, the Proposed Action is not likely to adversely affect blue whales or Rice's whale and is expected to have no effect on critical habitat designated for NARW (NMFS 2023a).

Table 3.5.6-2. Population information for marine mammals likely to occur in the Project area or experience acoustic effects of the Project

Common name	Stock	Population Estimate	Annual Human-Caused M/SI[1]	Reference
Fin whale	Western North Atlantic	6,802	2.05	NMFS 2024d
Humpback whale	Gulf of Maine	1,396	12.15	Hayes et al. 2020
Minke whale	Canadian East Coast	21,968	9.4	NMFS 2024d
North Atlantic right whale	Western North Atlantic	340	27.2	NMFS 2024d
Sei whale	Nova Scotia	3,292	0.6	NMFS 2024d
Atlantic spotted dolphin	Western North Atlantic	31,506	0	NMFS 2024d
Atlantic white-sided dolphin	Western North Atlantic	93,233	28	NMFS 2024d
Bottlenose dolphin	Western North Atlantic – Offshore	64,587	28	NMFS 2024d
	Western North Atlantic – Northern Coastal Migratory	6,639	12.2–21.5	Hayes et al. 2021
Common dolphin	Western North Atlantic	93,100	414	NMFS 2024d
Harbor porpoise	Gulf of Maine/Bay of Fundy	85,765	145	NMFS 2024d
Long-finned pilot whale	Western North Atlantic	39,215	5.7	NMFS 2024d
Risso's dolphin	Western North Atlantic	44,067	18	NMFS 2024d
Short-finned pilot whale	Western North Atlantic	18,726	218	NMFS 2024d
Sperm whale	North Atlantic	5,895	0	NMFS 2024d
Gray seal	Western North Atlantic	27,911 (U.S. waters)	4,570	NMFS 2024d
Harbor seal	Western North Atlantic	61,336 (U.S. waters)	339	Hayes et al. 2022

[1] Annual human-caused M/SI (mortality and/or serious injury) is mean annual figure for the period 2017–2021, with the exception of humpback whale, the Western North Atlantic – Northern Coastal Migratory stock of bottlenose dolphin, and harbor seal.

Fin whale: Fin whales found in the Offshore Project area belong to the Western North Atlantic stock. This species inhabits deep offshore waters of every major ocean and is most common in temperate to polar latitudes (NMFS 2021c). In the U.S. Atlantic, fin whales are common in shelf waters north of Cape Hatteras, North Carolina, and are found in this region year-round (Edwards et al. 2015; Hayes et al. 2020). This species most commonly occupies waters along the 328-foot (100-meter) isobath but may be found in both shallower and deeper waters (Kenney and Winn 1986). Primary prey species for fin whales include sand lance, herring, squid, krill, and copepods (Kenney and Vigness-Raposa 2010), and distribution of these species likely influences fin whale movements. Fin whale migratory patterns are complex, although the species generally exhibits a southward movement pattern in the fall from the Labrador/Newfoundland region to the West Indies (NMFS 2021c).

Fin whales may occur in the Offshore Project area year-round; densities are expected to be highest in the winter and summer months. Monthly density of fin whales is provided on Figure 4.7-1 in COP Volume II, Section 4.7.1 (Atlantic Shores 2024) and available through the Duke University Marine Geospatial Ecology Lab (Roberts et al. 2016b, 2023). Mean monthly densities in the Lease Area for this species are shown in Table 3.5.6-3 and range from 0.028 animal per 39 square miles (100 square kilometers) in August to 0.178 animal per 39 square miles (100 square kilometers) in January. The best abundance estimate for the Western North Atlantic stock is 6,802 individuals (NMFS 2024d) (Table 3.5.6-2). There are currently insufficient data to determine a population trend for this species (NMFS 2024d).

North Atlantic right whale: NARWs found in the Offshore Project area belong to the Western North Atlantic stock. This species is found primarily in coastal waters although it is also found in deep waters offshore (NMFS 2021d). In the U.S. Atlantic, the NARW range extends from Florida to Maine. This species feeds primarily on copepods belonging to the *Calanus, Pseudocalanus*, and *Centropages* genera (McKinstry et al. 2013). NARWs exhibit strong migratory patterns between high-latitude summer feeding grounds and low-latitude winter calving and breeding grounds.

Species densities are expected to be highest in the winter, but NARW could be found in the Offshore Project area throughout the year. Monthly density of NARW is provided on Figure 4.7-5 in COP Volume II, Section 4.7.1 (Atlantic Shores 2024) and available through the Duke University Marine Geospatial Ecology Lab (Roberts et al. 2016b, 2023). Mean monthly densities in the Lease Area for this species are provided in Table 3.5.6-3 and range from 0.001 animal per 39 square miles (100 square kilometers) in July and August to 0.074 animal per 39 square miles (100 square kilometers) in February. The best abundance estimate for the Western North Atlantic stock is 340 individuals (NMFS 2024d) (Table 3.5.6-2). The species is considered critically endangered, and the Western North Atlantic stock experienced a decline in abundance between 2011 and 2021 with an overall decline of 29.3 percent (NMFS 2024d). NARW has been experiencing an unusual mortality event (UME) since 2017 attributed to vessel strikes and entanglement in fisheries gear (NMFS 2024b). In 2017, a total of 35 mortalities, serious injuries, and morbidities were documented. Between 2017 and April 2024, a total of 126 mortalities, serious injuries, and morbidities (sublethal injury and illness) of NARW were documented (NMFS 2024b). The whales affected by the UME represent more than 20 percent of the population.

Table 3.5.6-3. Marine mammal density estimates in the Lease Area[1] for marine mammals likely to occur in the Project area or experience acoustic effects from the Project

Species	Mean Monthly Density Estimates for Species Animals/39 Square Miles (100 Square Kilometers)[2] Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
ESA-Listed Species													
Fin whale	0.178	0.123	0.098	0.099	0.088	0.075	0.047	0.028	0.029	0.031	0.038	0.141	0.081
North Atlantic right whale	0.069	0.074	0.062	0.046	0.010	0.003	0.001	0.001	0.002	0.004	0.010	0.042	0.027
Sei whale	0.026	0.016	0.034	0.074	0.027	0.006	0.001	0.001	0.002	0.008	0.026	0.042	0.022
Sperm whale	0.004	0.002	0.001	0.007	0.010	0.005	0.003	0.000	0.000	0.000	0.003	0.004	0.003
Other Mysticetes													
Humpback whale	0.093	0.065	0.084	0.101	0.091	0.058	0.011	0.006	0.020	0.065	0.086	0.121	0.067
Minke whale	0.051	0.049	0.049	0.737	0.810	0.202	0.054	0.026	0.015	0.066	0.016	0.042	0.176
Odontocetes													
Atlantic spotted dolphin	0.001	0.000	0.001	0.003	0.006	0.012	0.028	0.133	0.109	0.147	0.113	0.008	0.047
Atlantic white-sided dolphin	0.355	0.225	0.221	0.673	0.755	0.605	0.018	0.004	0.059	0.556	0.591	0.601	0.389
Bottlenose dolphin (northern coastal stock)	2.917	1.024	2.053	8.290	20.869	27.429	29.272	31.415	32.096	29.744	30.414	16.667	19.349
Bottlenose dolphin (offshore stock)	1.409	0.489	0.732	2.460	6.311	8.449	9.350	9.485	8.613	8.335	9.468	5.944	5.920
Common dolphin	2.754	1.139	1.347	2.751	3.431	1.695	0.939	0.507	0.085	1.006	5.315	5.876	2.237
Harbor porpoise	3.968	3.756	3.091	4.161	1.025	0.033	0.023	0.016	0.003	0.007	0.029	2.891	1.584
Long-finned pilot whale	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Risso's dolphin	0.015	0.002	0.003	0.031	0.029	0.008	0.006	0.006	0.006	0.013	0.074	0.115	0.026
Short-finned pilot whale	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Pinnipeds													
Gray seal	4.881	3.521	2.352	2.866	4.508	0.492	0.080	0.054	0.120	0.639	1.731	4.588	2.153
Harbor seal	10.967	7.911	5.285	6.439	10.127	1.106	0.180	0.122	0.271	1.437	3.889	10.308	4.837

Source: Table 9 in NMFS 2023b.

[1] Based on Lease Area OCS-A 0499 with a 2.4-mile (3.9-kilometer) buffer. Buffer was selected based on the largest calculated exposure range for impact pile driving with 10 dB of attenuation (see the *Noise* IPF in Section 3.5.6.4).

[2] Density estimates are from habitat-based density modeling of the entire U.S. Atlantic EEZ from Roberts et al. (2016b, 2023).

Sei whale: Sei whales found in the Offshore Project area belong to the Nova Scotia stock. This species inhabits deep offshore waters in subtropical, temperature, and subpolar latitudes (NMFS 2022c). Sei whale distribution is unpredictable, but this species is commonly found in the Gulf of Maine and on Georges and Stellwagen Banks in the summer (NMFS 2022c). Primary prey species for sei whales include plankton, small schooling fish, and cephalopods (NMFS 2022c). Sei whales are uncommon in the Mid-Atlantic Bight. Monthly density of this species is provided on Figure 4.7-6 in COP Volume II, Section 4.7.1 (Atlantic Shores 2024) and available through the Duke University Marine Geospatial Ecology Lab (Roberts et al. 2016b, 2023). Mean monthly densities in the Lease Area for this species range from 0.001 animal per 39 square miles (100 square kilometers) in July and August to 0.074 animal per 39 square miles (100 square kilometers) in April (Table 3.5.6-3). The best abundance estimate for the Nova Scotia stock is 6,292 individuals (NMFS 2024d) (Table 3.5.6-2). A trend analysis has not been conducted for this species due to insufficient data (NMFS 2024d).

Sperm whale: Sperm whales found in the Offshore Project area belong to the North Atlantic stock. This species occurs in every ocean around the globe (NMFS 2022d). Compared to other large whales (i.e., mysticetes), sperm whale migrations are relatively unpredictable and poorly understood. In some populations, females remain in tropical waters with their young year-round while males undergo long migrations to higher latitudes (NMFS 2022d). Primary prey species for this species include squid, sharks, skates, and deep-water fish (NMFS 2022d). Sperm whales are expected to occur year-round in deeper waters near the shelf break (Tetra Tech and Smultea Sciences 2018; Tetra Tech and LGL 2019, 2020). Monthly density of this species is provided on Figure 4.7-6 in COP Volume II, Section 4.7.1 (Atlantic Shores 2024) and available through the Duke University Marine Geospatial Ecology Lab (Roberts et al. 2016b, 2023). Mean monthly densities in the Lease Area for this species range from 0.000 animal per 39 square miles (100 square kilometers) in August through October to 0.010 animal per 39 square miles (100 square kilometers) in May (Table 3.5.6-3). The best abundance estimate for the North Atlantic stock is 5,895 individuals (NMFS 2024d) (Table 3.5.6-2). A trend analysis has not been conducted for this species due to low statistical power (NMFS 2024d).

Non-ESA-Listed Marine Mammals

As noted above, all marine mammals are protected pursuant to the MMPA (16 USC 1361 et seq.), and their populations are monitored by NMFS and USFWS.[2] Mysticetes that are not endangered or threatened and commonly or regularly occur in the Project area include the humpback whale and minke whale. Odontocetes that are not listed under the ESA and commonly or regularly occur in the Project area include bottlenose dolphin, common dolphin, and harbor porpoise. Four additional odontocete taxa—Atlantic spotted dolphin, Atlantic white-sided dolphin, pilot whales, and Risso's dolphin—are expected to experience acoustic effects of the Proposed Action. Pinnipeds that are not endangered or threatened and commonly or regularly occur in the Project area include gray seal and harbor seal. BIAs for humpback whale feeding have been identified well north of the Project area near Georges Bank, Cape Cod Bay, and the Gulf of Maine between the months of March and December (Van Parjis et al.

[2] Marine mammals under USFWS jurisdiction are not expected to occur in the Offshore Project area.

2015). Additional discussion and description of non-ESA-listed marine mammals can be found in Appendix B.

Of the ESA-listed species with the potential to occur in the Project area, critical habitat has been designated for NARW (see https://www.fisheries.noaa.gov/national/endangered-species-conservation/critical-habitat) and West Indian manatee (see https://ecos.fws.gov/ecp/report/table/critical-habitat.html). However, critical habitat for these species is not within or in the vicinity of the Atlantic Shores South Offshore Project area. 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 (Unit 1), as well as the calving grounds that stretch from off Cape Canaveral, Florida, to Cape Fear, North Carolina (Unit 2) (Hayes et al. 2021). NARW critical foraging habitat (Unit 1 of the designated critical habitat) is located approximately 249 miles (400 kilometers) northeast of the Lease Area; NARW critical calving habitat (Unit 2 of the designated critical habitat) is located approximately 424 miles (683 kilometers) south of the Lease Area. Manatee critical habitat is located within inland tributaries and along nearshore habitats of the coast of Florida.

The Offshore Project area lies between the New York and Great South Channel Sound seasonal management areas (SMAs) for NARW (Figure 3.5.6-2). Though outside of the Offshore Project area, Project vessels may transit through the SMA, which is in effect from November through April; during this period, vessels 65 feet (19.8 meters) or longer cannot exceed 10 knots (18.5 kilometers per hour) during transit. Biologically Important Areas (BIAs)[3] for NARW, fin whale, and sei whale have been identified within or north of the Project area. 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 (Van Parjis et al. 2015). The migratory corridor BIA for NARW overlaps with the Project area and surrounding waters for the months of March–April and November–December (Van Parjis et al. 2015). BIAs for NARW feeding have also been identified near Georges Bank, Cape Cod Bay, and the Gulf of Maine between the months of April and July; a calving BIA for NARW has been identified in the Southeast Atlantic from mid-November through April (Van Parjis et al. 2015). 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 (Van Parjis et al. 2015).

[3] Biologically Important Areas identify areas and times within which cetacean species or populations are known to concentrate for specific behaviors, or be range-limited, and consist of reproductive areas, feeding areas, migratory corridors, and small and resident populations. NOAA's Biologically Important Areas Map is available at https://cetsound.noaa.gov/biologically-important-area-map.

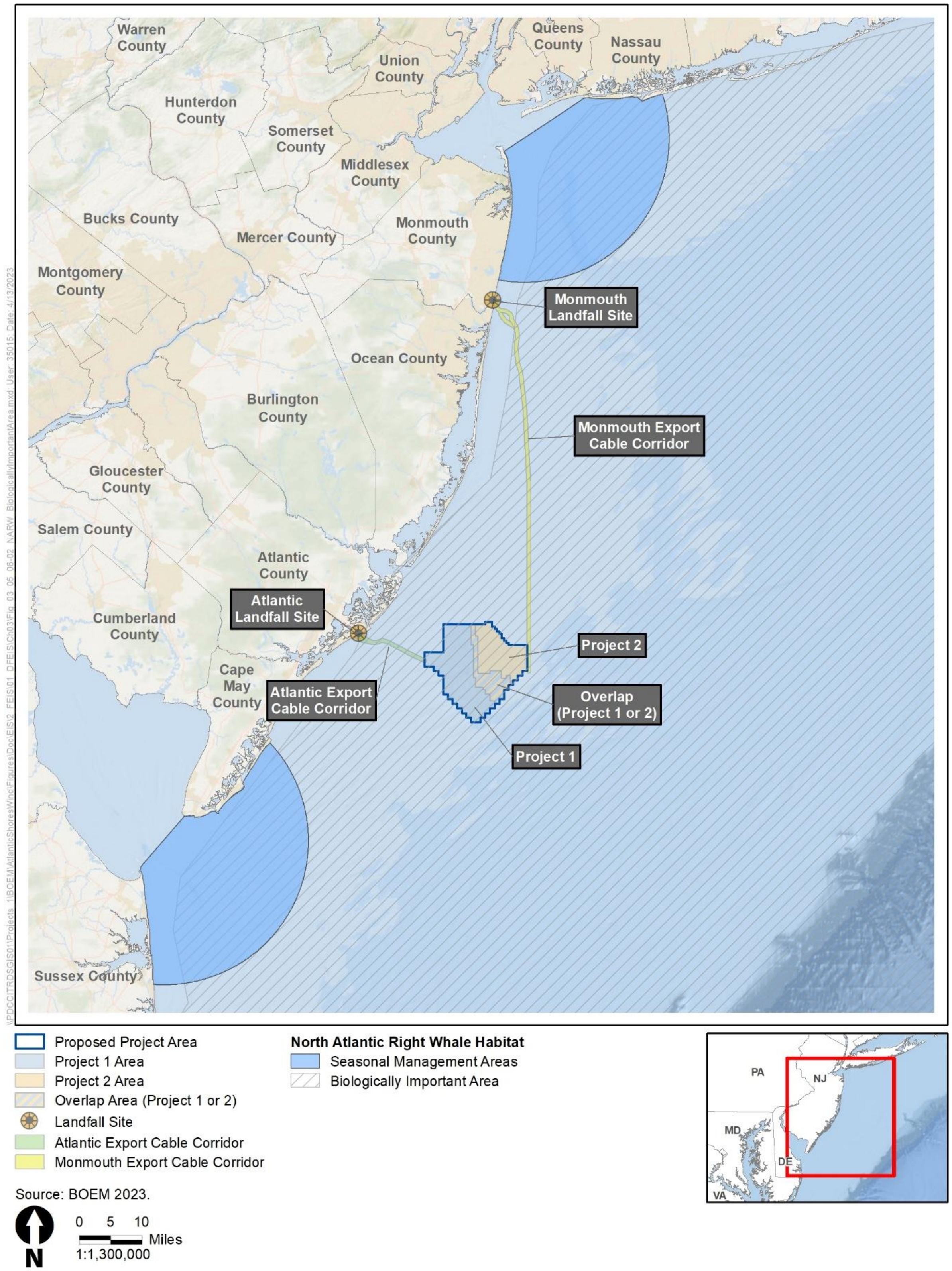

Figure 3.5.6-2. North Atlantic right whale Seasonal Management Areas and Biologically Important Area

Overview of Sound and Marine Mammal Hearing

Underwater noise can be described through a source-path-receiver model. An acoustic source emits sound energy that radiates outward and travels through the water and the seafloor as pressure waves; pressure is the most relevant component of sound to marine mammals. The sound level decreases with increasing distance from the acoustic source as the sound pressure waves spread out under the influence of the surrounding environment. The amount by which the sound levels decrease between a source and receiver (e.g., a whale) is called transmission loss (Richardson et al. 1995). The amount of transmission loss that occurs depends on the distance between the source and the receiver, the frequency of the sound, properties of the water column, and properties of the seafloor layers. Underwater sound levels are expressed in decibels, which is a logarithmic ratio relative to a fixed reference pressure of 1 micropascal (µPa). A brief overview of acoustic units and the propagation of underwater sound can be found in Section B.5 of Appendix B, *Supplemental Information and Additional Figures and Tables*.

Underwater sound can be produced by biological and physical oceanographic sources, as well as anthropogenic (i.e., human-introduced) sources. Biological sounds include sounds made by animals, including marine mammals. Physical oceanographic sounds include wind and wave activity, rain, sea ice, and undersea earthquakes. Anthropogenic sounds include, but are not limited to, shipping and other vessel traffic, military activities, marine construction, and oil and gas exploration. Some natural and anthropogenic sounds are present everywhere in the ocean all of the time; therefore, background sound in the ocean is commonly referred to as "ambient noise" (DOSITS 2019).

Anthropogenic underwater noise is a particular concern for 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 feet [1,500 meters] per second) than it does in air (approximately 1,148 feet [350 meters] per second), 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, toothed whales produce and listen to echolocation clicks to locate food and to navigate (Madsen and Surlykke 2013).

Anthropogenic underwater noise can often be detected by marine mammals many kilometers from the source. Potential acoustic effects of anthropogenic underwater noise on marine mammals include mortality, non-auditory injury, permanent or temporary hearing loss, behavioral changes, and acoustic masking, with the severity of the effect increasing with decreasing distance from the sound source. These potential effects are described in greater detail in the noise impact analysis in Section 3.5.6.3.

Marine mammals are acoustically diverse, with wide variations in ear anatomy, hearing frequency range, and amplitude sensitivity (Ketten 1991). An animal's sensitivity to sound likely depends on the presence and level of sound in certain frequency bands and the range of frequencies to which the animal is most sensitive (Richardson et al. 1995). In general, larger species, such as baleen whales, are believed to hear better at lower frequency ranges than smaller species, such as porpoises and dolphins. Hearing abilities are generally only well understood for smaller species for which audiograms (i.e., plots of hearing threshold at different sound frequencies) have been developed based on captive behavioral studies, which rely on captive animals to react to sounds, and electrophysiological experiments, which measure auditory evoked potentials on captive or stranded animals (Erbe et al. 2012). Audiograms have been obtained in some odontocetes and pinniped species (Finneran 2015; Southall et al. 2007), while direct measurements of mysticetes hearing are lacking (Ridgway and Carder 2001). Baleen whale hearing sensitivities have therefore been estimated based on anatomy, modeling, vocalizations, taxonomy, and behavioral response studies (Au and Hastings 2008; Cranford and Krysl 2015; Dahlheim and Ljungblad 1990; Houser et al. 2001; Reichmuth 2007; Richardson et al. 1995; Southall et al. 2019 citing Ketten and Mountain 2011, 2014; Wartzok and Ketten 1999). 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 2016; NMFS 2018a; 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 (LFC, MFC, and HFC, respectively), pinnipeds in water, and pinnipeds in air. These were further modified by NMFS in their underwater acoustic guidance document (NMFS 2018a), mainly to separate phocid pinnipeds (i.e., earless seals) from otariid pinnipeds (i.e., fur seals and sea lions), and updated again by Southall et al. (2019). Though the science (Southall et al. 2019) now supports the need for at least eight functional hearing groups (i.e., LFC, HFC, very high frequency cetaceans, sirenians, phocids in air, phocids in water, other marine carnivores in air, and other marine carnivores in water, described in Southall et al. 2019), current regulatory practice is still based on the NMFS 2018 guidance.

Generalized hearing ranges and taxonomic groups for each of the functional hearing groups are provided in Table 3.5.6-4.

Table 3.5.6-4. Marine mammal hearing ranges for functional hearing groups that may occur in the Project area

Functional Hearing Group	Taxonomic Group	Generalized Hearing Range[1]
Low-Frequency Cetaceans	Baleen whales (e.g., fin whale, humpback whale, minke whale, NARW, sei whale)	7 Hz to 35 kHz
Mid-Frequency Cetaceans	Most dolphin species (e.g., Atlantic spotted dolphin, Atlantic white-sided dolphin, bottlenose dolphin, common dolphin, Risso's dolphin) and toothed whales (e.g., long-finned pilot whale, short-finned pilot whale, sperm whale)	150 Hz to 160 kHz
High-Frequency Cetaceans	True porpoise (e.g., harbor porpoise), river dolphins, *Cephalorhynchus* dolphins	275 Hz to 160 kHz
Phocid Pinnipeds	Phocid or true seals (e.g., gray seal, harbor seal)	50 Hz to 86 kHz

Source: NMFS 2018a.

Hz = hertz; kHz = kilohertz

[1] Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing ranges chosen based on the approximate 65

dB re 1 µPa threshold from normalized composite audiogram, with the exception of lower limits for low-frequency cetaceans (Southall et al. 2007) and phocid pinnipeds (approximation).

3.5.6.2 Impact Level Definitions for Marine Mammals

As described in Section 3.3, *Definition of Impact Levels,* this Final EIS uses a four-level classification scheme (Table 3.5.6-5) to characterize potential impacts of alternatives, including the Proposed Action.

Table 3.5.6-5. 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.
	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.
	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.
	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.
	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.

3.5.6.3 Impacts of Alternative A – No Action on Marine Mammals

When analyzing the impacts of the No Action Alternative on marine mammals, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities (excluding the Proposed Action), on the baseline conditions for marine mammals. BOEM separately analyzes how resources will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix D.

Impacts of Alternative A – No Action

Under the No Action Alternative, BOEM would not approve the Atlantic Shores South COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on marine mammals associated with the Project would not occur. Baseline conditions of the existing environment, described in Section 3.5.6.1, would remain unchanged. Therefore, 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 for the Project, which would also result in no additional incremental impact on marine mammals and their habitat.

Under the No Action Alternative, the existing conditions for marine mammals would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. All marine mammal species in the geographic analysis area are also subject to ongoing anthropogenic threats. The main known contributors to mortality events include vessel strikes and gear utilization resulting in entanglement with fishing gear and fisheries bycatch. Other important IPFs considered include underwater noise from anthropogenic sources such as offshore construction, G&G surveys, military training and testing activities, vessels, aircraft, and dredging; accidental releases; cable emplacement and maintenance; EMF; lighting; port utilization; and presence of structures. IPFs may result in a range of impacts, from mortality to minor disturbance, and typically fall across a scale of risk depending on the activities and susceptibility of the species to impacts. These ongoing impacts on marine mammals are expected to continue regardless of the offshore wind industry. IPFs with the potential to affect marine mammals within the geographic analysis area are briefly discussed in the paragraphs that follow.

Global climate change is an ongoing risk for marine mammal species in the geographic analysis area. NMFS lists the long-term changes in climate as a threat for almost all marine mammal species (Hayes et al. 2020, 2021, 2022, 2023; NMFS 2024). Climate change is known to increase temperatures, raise sea levels, and alter ocean acidity. Warming and sea level rise could affect marine mammals through increased storm frequency and severity, altered precipitation patterns, altered habitat/ecology, altered migration patterns, increased disease incidence, and increased erosion and sediment deposition (i.e., reduced haul-out habitat availability for pinnipeds) (Love et al. 2013; NASA 2023; USEPA 2022). Increased storm severity or frequency may result in increased energetic costs, particularly for young life stages, reducing individual fitness (Kovacs et al. 2011; Wingfield 2013). Altered habitat/ecology associated with warming has resulted in northward distribution shifts for some prey species (Hayes et al. 2021; NMFS 2024d), and marine mammals are altering their behavior and distribution in response to these alterations (Davis et al. 2017, 2020; Hayes et al. 2020, 2021). Warming is expected to influence the frequency of marine mammal diseases, particularly for pinnipeds.

Increase of the ocean's acidity has numerous effects on ecosystems, including reducing available carbon that organisms use to build shells and causing a shift in food webs offshore (Love et al. 2013; NASA 2023; USEPA 2022). This has the potential to affect the distribution and abundance of marine mammal prey (PMEL 2020). For example, between 1982 and 2018, the average center of biomass for 140 marine fish and invertebrate species along U.S. coasts shifted approximately 20 miles (32 kilometers) north.

These species also migrated an average of 21 feet (6 meters) deeper (USEPA 2022). Shifts in abundance of their zooplankton prey will affect mysticetes who travel over large distances to feed (Hayes et al. 2020). The extent of these impacts is unknown; however, it is likely that marine mammal populations already stressed by other factors (e.g., NARWs) will likely be the most affected by the repercussions of climate change.

Warming and sea level rise, with their associated consequences, and ocean acidification could lead to long-term, high-consequence impacts on marine mammals. Impacts of climate change would likely be minor to moderate for mysticetes (except for NARW), odontocetes, and pinnipeds and are likely to result in long-term consequences to individuals or populations that are detectable and measurable. Effects to individual species, such as NARW, would depend on a number of complex factors, including the nature and extent of climate change impacts on the availability and distribution of forage and suitable habitat, the ability of the species to adapt to these impacts, and the status and resilience of the affected population. Impacts of climate change would likely be major for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species.

Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on marine mammals are generally associated with coastal and offshore development, marine transportation, and fisheries use, which would introduce the IPFs identified above. Specifically, coastal and offshore development, marine transport, and fisheries use and associated impacts are expected to continue at current trends and have the potential to affect marine mammals through accidental releases, which can have physiological effects on marine mammals; electric and magnetic fields and cable heat, which may result in behavioral changes in marine mammals; cable emplacement and maintenance and port utilization, which can disturb benthic habitats and affect water quality; 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. See Appendix D, Table D.A1-12 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for marine mammals.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on marine mammals (based on the scenario shown in Appendix D) include:

- Continued O&M of the BIWF Project (5 WTGs) installed in state waters;
- Continued O&M of the CVOW pilot Project (2 WTGs) installed in OCS-A 0497; and
- Ongoing construction of six offshore wind projects: the Vineyard Wind 1 Project (62 WTGs and 1 OSS) in OCS-A 0501, the SFWF Project (12 WTGs and 1 OSS) in OCS-A 0517, the Ocean Wind 1 Project (98 WTGs and 3 OSSs) in OCS-A 0498, the Revolution Wind Project (65 WTGs and 2 OSSs) in OCS-A 0486, the Empire Wind Project (147 WTGs and 2 OSSs) in OCS-A 0512, and the CVOW-C Project (202 WTGs and 3 OSSs) in OCS-A 0483.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing activities would affect marine mammals through the primary IPFs of noise, presence of structures, and vessel traffic. Ongoing offshore wind activities would have the same types of impacts from noise, presence of structures, and vessel traffic described in detail below, under *Cumulative Impacts of Alternative A – No Action*, for planned offshore wind activities but the impacts would be of lower intensity.

Potential impacts associated with ongoing activities by IPF for marine mammals are described below and summarized in Appendix D, Table D.A1-12. Impacts of ongoing activities on marine mammal prey items are assessed in Section 3.5.5, which summarizes the effects on finfish, invertebrates, and EFH.

Accidental releases: Marine mammals are particularly susceptible to the effects of contaminants from pollution and accidental releases as they accumulate through the food chain or are ingested with garbage. 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., Hall et al. 2018; Jepson et al. 2016; Murphy et al. 2018; Pierce et al. 2008); 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 (Muir et al. 1988; Taruski et al. 1975; 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 toothed whales 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).

There is a risk of accidental releases of fuels, fluids, and hazardous materials associated with ongoing vessel traffic and a low risk of fuel, fluid, and hazardous materials leaks from the 593 WTGs for ongoing activities. Marine mammal exposure to releases through aquatic contact or inhalation of fumes can result in death or sublethal effects, including but not limited to adrenal effects, hematological effects, hepatological effects, poor body condition, and dermal effects (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). In addition to direct effects on marine mammals, accidental releases of fuels, fluids, and hazardous materials can indirectly affect these species through impacts on prey species (see Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*).

Though exposure to accidental releases from ongoing non-offshore wind activities could result in more severe impacts, current regulations and requirements imposed on federally approved activities prohibit vessels from dumping potentially harmful debris, require measures to avoid and minimize spills of toxic materials, and provide mechanisms for spill reporting and response. These measures would reduce the likelihood, and the extent of potential impacts would be localized to the area around each activity.

Therefore, impacts from accidental releases from ongoing activities would likely be minor for mysticetes (including NARW), odontocetes, and pinnipeds and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable.

Impacts from accidental releases associated with the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to be negligible (BOEM 2021a, 2021b, 2023b, 2023e). Offshore wind projects will comply with their OSRP and USCG requirements for the prevention and control of oil and fuel spills.

Cable emplacement and maintenance: Emplacement and maintenance of submarine cables and pipelines associated with non-offshore wind activities, and cable emplacement and maintenance for ongoing offshore wind activities, would disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances would be local and generally limited to the emplacement corridor. Data are not available regarding marine mammal avoidance of localized turbidity plumes; however, Todd et al. (2015) suggest that because some marine mammals often live in turbid waters and some species of mysticetes and sirenians employ feeding methods that create sediment plumes, some species of marine mammals have a tolerance for increased turbidity. 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 impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on marine mammal prey species (see Section 3.5.5). Sediment resuspension during cable emplacement and maintenance will be short term and localized, and individual marine mammals, if present, would be expected to successfully forage in nearby areas not affected by increased turbidity.

Impacts from emplacement and maintenance of submarine cables and pipelines associated with ongoing non-offshore wind activities are anticipated to be negligible for mysticetes (including NARW), odontocetes, and pinnipeds, of the lowest level of detection, and barely measurable, with no perceptible consequences to individuals or the population.

Impacts from cable emplacement and maintenance from the ongoing construction and operation of offshore wind projects have been previously analyzed for other offshore wind projects in the area and were anticipated to be negligible or negligible to minor (BOEM 2021a, 2021b, 2023b, 2023e, 2023f).

Discharges/intakes: A potential impact related to vessels and vessel traffic is 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 Vessel General Permit standards, both of which regulate discharge of ballast or bilge water and effectively avoid the likelihood of non-native species invasions through discharges. Adherence to these regulations is the responsibility of the vessel operators.

Impacts from discharges/intakes associated with ongoing non-offshore wind activities are anticipated to be negligible for mysticetes (including NARW), odontocetes, and pinnipeds, of the lowest level of detection, and barely measurable, with no perceptible consequences to individuals or the population.

Electric and magnetic fields and cable heat: There are four in-service, and six out-of-service submarine telecommunication cables present in the offshore export cable corridor and in the vicinity of the Offshore Project area. The four in-service cables would presumably continue to operate and generate EMF effects under the No Action Alternative. While the type and capacity of those cables is not specified, the associated baseline EMF effects can be inferred from available literature. 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 meter) of the cable path (Gill et al. 2005). Fiber-optic communications cables with optical repeaters would not produce EMF effects.

Exponent Engineering, P.C. (2018) modeled EMF levels that could be generated by the SFWF export cable and interarray cable. The model estimated induced magnetic field levels ranging from 13.7 to 76.6 milligauss on the bed surface above the buried and exposed SFWF export cable and 9.1 to 65.3 milligauss above the buried and exposed interarray 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 Project (BOEM 2021b, Appendix F, Figure F-8). 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).

EMF effects on marine mammals from non-offshore wind activities 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 cable corridors. BOEM would require these future submarine 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 (Taormina et al. 2018). As a result, heat from submarine high-voltage cables is not expected to affect marine mammals.

Impacts from EMF and heat from ongoing non-offshore wind activities would likely be negligible for mysticetes (including the NARW), odontocetes, and pinnipeds, of the lowest level of detection, and barely measurable, with no perceptible consequences to individuals or the population.

Impacts from EMF and heat from the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to be negligible for mysticetes (including the NARW), odontocetes, and pinnipeds, due to estimated low EMF levels, the localized nature of EMF along the cables near the seafloor, and appropriate shielding and burial depth (BOEM 2021a, 2021b, 2023b, 2023e).

Gear utilization: Global demand for fish as a food source will likely increase; however, output of seafood from wild fish capture has plateaued (Costello et al. 2020). Although traditional fisheries' gear utilization may not increase, there is potential for more aquaculture gear utilization to meet the growing demand (Costello et al. 2020). Fisheries interactions can have adverse effects on marine mammal species, with estimated global mortality exceeding hundreds of thousands of individuals each year (Read et al. 2006). Marine mammals can ingest or become entangled in marine debris (e.g., ropes, plastic) that is lost from fishing vessels and other offshore activities. The majority of recorded marine megafauna entanglements are directly or indirectly attributable to ropes and lines associated with fishing gear (Benjamins et al. 2014; Harnois et al. 2015; McIntosh et al. 2015).

Entanglement is listed as a threat to large cetaceans (Hayes et al. 2020, 2021, 2022, 2023; NMFS 2024d). Entanglement may be a significant cause of death for several mysticete species (Read et al. 2006), including NARW. Of the available information on large whale entanglements, there are considerable data on the potential for entanglement of humpback whales and NARWs. A study of 134 individual humpback whales in the Gulf of Maine suggested that between 48 and 65 percent of the whales experienced entanglements (Robbins and Mattila 2001) and that 12 to 16 percent encounter gear annually (Robbins 2012). Along with vessel collisions, entanglement of humpback whales could be limiting the recovery of the population (Hayes et al. 2020). Entanglement in fishing gear has also been identified as one of the leading causes of mortality in NARWs and may be a limiting factor in the species' recovery (Knowlton et al. 2012; Moore et al. 2021). As noted in Section 3.5.6.1, *Description of the Affected Environment and Future Baseline Conditions*, NARW has been experiencing a UME since 2017, attributed to vessel strikes and entanglement in fisheries gear. More than 80 percent of NARWs show evidence of past entanglements, and it has been estimated that over 85 percent of NARWs have been entangled at least once (Johnson et al. 2005; Knowlton et al. 2012; NMFS 2021d). Almost 60 percent of NARWs show evidence of multiple entanglements (Johnson et al. 2005; 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 et al. 2021). Individual NARWs that survive entanglement may suffer energetic costs and declines in fecundity (Knowlton et al. 2022; Pirotta et al. 2024). A study of isotope and hormone levels in the baleen of a chronically entangled NARW indicated that entanglement leads to increased energy expenditure, presumably from drag, decreased ability to feed, and increased thermal stress, likely related to a decrease in blubber thickness (Lysiak et al. 2018). Such energetic costs may result in decreased body condition, which may have negative effects on reproduction and calf growth rates (Christiansen et al. 2020). In juveniles, entanglement in fishing gear, when not lethal, results in decreased post-entanglement survival (Robbins et al. 2015). There is limited information regarding entanglements of blue, fin, sei, and minke whales; however, evidence of fishery interactions causing injury or mortality has been noted for each of these species in the Greater Atlantic Regional Fisheries Office entanglement/stranding database (Hayes et al. 2021; NMFS 2024d). Fin whales are considered to be at lower risk of entanglement compared to other baleen whales due to their more offshore distribution (i.e., further from fishing activities that utilize vertical lines) and large size (Ramp et al. 2021 citing NMFS 2010). However, vessel-based and aerial photography indicate that entanglement rates in fin whales may be underestimated based on their surfacing behavior (Ramp et al. 2021). Limited information is available for sperm whale entanglement mortalities; however, from 1993 to 1998 there were three documented sperm whale entanglements, two of which were in the North Atlantic Ocean. Three additional sperm whale mortalities from entanglement were documented in 2009–2010 in a similar region (Waring et al. 2015). There are no documented reports of fishery-related mortality or serious injury to sperm whales in the U.S. EEZ from 2013 to 2021 (Hayes et al. 2020; NMFS 2024d).

Entanglement is also considered a threat to small cetaceans and seals (Hayes et al. 2020, 2021, 2022, 2023; NMFS 2024d). Dolphins common to the Project area include common dolphin and bottlenose dolphin and are also susceptible to fishery interactions. Although limited data were found on entanglement in the North Atlantic, case reports of lethal fishing hook and line entanglement have been documented. Blowholes are susceptible to unattached fishing hooks, and plastic lines can cause asphyxiation and, if ingested, can lead to septic complications (Byard et al. 2020). Pinnipeds, including harbor seals and gray seals, are also at risk for entanglements (Hayes et al. 2020, 2021; NMFS 2024d). Drowning or asphyxiation in gear, chronic secondary complications of injuries, and feeding impairment are all associated with entanglement mortalities in seals (Moore et al. 2013). A 2014 unoccupied aerial system survey of large populations of gray and harbor seals was used to assess the prevalence of entanglement within haul-out locations in the North Atlantic. The mean prevalence of entanglement within the haul-outs varied between 0.83 percent and 3.70 percent (Waring et al. 2015). However, observed serious injury rates are lower than would be expected from the anecdotally observed numbers of gray seals living with ongoing entanglements, as gray seals entangled in netting are common at haul-out sites in the Gulf of Maine and southeastern Massachusetts. This may be because the majority of observed animals are dead when they come aboard the vessel as bycatch (Josephson et al. 2021); therefore, rates do not reflect the number of live animals that may have broken free of the gear and are living with entanglements. Martins et al. (2019) estimated the mean prevalence of live entangled gray seals at haul-out sites in Massachusetts and Isle of Shoals to be between 1 and 4 percent.

Bycatch occurs in various commercial, recreational, and subsistence fisheries with hotspots driven by marine mammal density and fishing intensity (Lewiston et al. 2014). Small cetaceans and seals are at most risk of being caught as bycatch due to their small body size that allows them to be taken up in fishing gear. Of the species considered in this assessment, Risso's dolphins, long-finned pilot whales, short-finned pilot whales, harbor porpoises, white-sided dolphins, harbor seals, and gray seals have been documented in several fisheries' bycatch data. The ones that most commonly report bycatch are pelagic longlining, bottom trawling, and sink gillnetting (Hayes et al. 2020, 2021; NMFS 2024d). Purse seine fisheries, Atlantic blue crab trap/pot, North Carolina roe mullet stop net, and hook and line (rod and reel) have also noted instances of marine mammal bycatch.

Stranding data indicate that other marine mammal species may be affected by entanglements or bycatch; however, the contribution of fishery-related mortalities and serious injuries to these strandings is often difficult to determine. This is because not all of the marine mammals that die or are seriously injured wash ashore, and not all will show signs of entanglement or other fishery interaction (Hayes et al. 2020, 2021; NMFS 2024d). As a result, the contribution of fisheries interactions to the annual mortality and injury of marine mammal species in the geographic analysis area and beyond is likely underestimated (Hayes et al. 2020, 2021; NMFS 2024d). Although the duration of increased gear utilization is long term, the frequency of individual gear in any one location throughout the geographic analysis area is short term and localized.

The impacts of gear utilization on mysticetes (except for NARW), odontocetes, and pinnipeds from ongoing 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. Impacts on individual mysticetes (except for NARW), odontocetes, and pinnipeds could have population-level effects, but the population should sufficiently recover. Gear utilization from ongoing non-offshore wind activities would likely result in major impacts for NARW because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species.

BOEM does not anticipate that mysticete, odontocete, or pinniped entanglement in gear used for biological monitoring for ongoing offshore wind projects would occur. Biological monitoring using conventional fishing methods has the potential to result in the take of protected species. Fisheries monitoring plans for ongoing offshore wind activities would follow BOEM's guidance for fisheries surveys provided in *Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf* (BOEM 2023d), including recommendations to reduce the number of vertical lines, such as use of ropeless gear technologies, buoy line weak links, and other risk reduction measures consistent with NMFS recommendations (https://www.fisheries.noaa.gov/s3/2023-06/NOAAFisheriesGreaterAtlanticRegionProtectedSpeciesBestManagementPracticesandRiskReductionMeasuresforOffshoreWindFisherySurveys20Jun2023.pdf). While impacts from gear utilization associated with biological resource monitoring on individual marine mammals could occur, monitoring plans will have sufficient mitigation procedures in place to reduce potential impacts and not result in population-level effects. Accordingly, impacts are expected to be negligible, negligible to minor, or minor to moderate (BOEM 2021a, 2021b, 2023b, 2023e).

Lighting: The addition of 593 WTGs and 12 OSSs/ESPs and met towers to the geographic analysis area with aviation and marine navigation lighting, as well as lighting associated with construction vessels, would increase artificial lighting in the offshore environment. Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities on marine mammal distribution, behavior, and habitat use were uncertain but likely negligible if recommended design and operating practices are implemented. BOEM requires wind farm developers to comply with the current design guidance for avoiding and minimizing artificial lighting effects; however, artificial light could aggregate prey species at night. Impacts from lighting from ongoing offshore wind activities would likely be negligible for mysticetes (including the NARW), odontocetes, and pinnipeds and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or populations (BOEM 2021a, 2021b, 2023b, 2023e).

Noise: As described in Section 3.5.6.1, marine mammals rely heavily on sound for essential biological functions, including communication, mating, foraging, predator avoidance, and navigation (Madsen et al. 2006; Weilgart 2007). Anthropogenic underwater sound is a pervasive issue throughout the world's oceans and can adversely affect marine mammals. 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 (Götz et al. 2009). These potential effects are 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., lungs, gastrointestinal tract). 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 and animal mass, the ambient pressure, the animal's proximity to the blast, including depth, and the size of the blast (Finneran et al. 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. 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). TTS is a relatively short-term (e.g., lasting several hours or days), reversible loss of hearing following noise exposure (Finneran 2015; Southall et al. 2007, 2019), often resulting from hair cell fatigue (Saunders et al. 1985; Yost 2007). 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 2015; Southall et al. 2007, 2019).

Behavioral impacts: Farther away from a source and at lower received levels, 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, exhibit changes in vocal activity, stop foraging, or change their typical dive behavior, among other responses (NRC 2003). When exposed to the same sound repeatedly, it is possible that marine mammals may become either habituated (i.e., show a reduced response) or sensitized (i.e., show an increased response) (Bejder et al. 2009). A number of 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., novelty of 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). Due to these many factors, behavioral impacts 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 disturbance 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 (Clark et al. 2009; Richardson et al. 1995). Masking can reduce an individual's communication space (i.e., the range at which it can effectively transmit and receive acoustic cues from conspecifics), listening space (i.e., the range at which it can detect relevant acoustic cues from the environment), or echolocation effectiveness (for odontocetes). 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 (Kight and Swaddle 2011; Wright et al. 2007). Physiological stress 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 that serve as stress biomarkers (e.g., 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 baleen whales 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 underwater 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 the received sound (see Section B.5 in Appendix B for a discussion of sound source characteristics), 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 (e.g., marine mammal hearing groups). Criteria for assessing effects of underwater noise on marine mammals are described below. More information about the regulatory process associated with noise impacts, including the development of these criteria, can be found in Section B.5 of Appendix B.

Auditory Criteria for Injury and Disturbance

Assessment of the potential effects of underwater noise on marine mammals requires acoustic thresholds against which received sound levels can be compared. Acoustic thresholds for underwater noise are expressed using three common metrics: root-mean-square sound pressure level (SPL or L_{rms}), peak sound pressure level (L_{pk}), and sound exposure level (SEL or L_E). Sound pressure level is measured in decibels relative to 1 micropascal (dB re 1 µPa), and sound exposure level is measured in decibels relative to 1 micropascal squared second (dB re 1 $\mu Pa^2 s$). L_{pk} is an instantaneous value, whereas L_E is the total noise energy over a given time period or event. As such, SEL accumulated over 24 hours, (SEL_{24h} or $L_{E, 24h}$) is appropriate when assessing effects on marine mammals from cumulative exposure to multiple pulses or durations of exposure. L_{rms} is a root-mean-square average over a period of time and is equal to the sound exposure divided (linearly) by the time period of exposure. Therefore, if the time period is 1 second, L_E and L_{rms} have equal values because the sound level is divided by 1 second.

For marine mammals, NMFS has developed *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS 2018a). The technical guidance established acoustic criteria identifying the potential for onset of PTS and TTS. NMFS developed dual metric thresholds for impulsive sources that consider the peak SPL (L_{pk}) and 24-hour cumulative SEL, which utilizes marine mammal auditory weighting functions. Non-impulsive sources only rely upon weighted cumulative SEL thresholds (i.e., there is no L_{pk} threshold for non-impulsive sounds). The SEL thresholds are differentiated by hearing group (Table 3.5.6-4) to acknowledge that not all marine mammal species have identical hearing or susceptibility to noise-induced hearing loss. NMFS has also established SPL behavioral disturbance thresholds for all marine mammal species, that utilize an L_{rms} of 160 dB re 1 µPa for intermittent sounds and 120 dB re 1 µPa for continuous sounds for all marine mammal species (NOAA 2013). Unlike PTS and TTS thresholds, behavioral disturbance thresholds are not frequency weighted to account for different hearing abilities by the five marine mammal hearing groups.

Table 3.5.6-6 outlines the acoustic thresholds for onset of hearing impairment (i.e., PTS and TTS) for marine mammals expected to occur in the Project area for both impulsive and non-impulsive noise sources. For further detail about classification of underwater sounds, please see Section B.5 in Appendix B. Impulsive noise sources considered in this assessment include impact pile driving and some HRG equipment. Non-impulsive noise sources include vibratory pile driving, vessel traffic, some HRG equipment, turbine operations, and dredging.

Table 3.5.6-6. PTS and TTS thresholds for marine mammals expected to occur in the Project area

Hearing Group[1]	Effect	Impulsive Source		Non-Impulsive Source
		L_{pk} (dB re 1 μPa)	SEL_{24h}[2] (dB re 1 μPa^2s)	SEL_{24h}[1] (dB re 1 μPa^2s)
LFC	PTS	219	183	199
	TTS	213	168	179
MFC	PTS	230	185	198
	TTS	224	170	178
HFC	PTS	202	155	173
	TTS	196	140	153
Phocid pinnipeds	PTS	218	185	201
	TTS	212	170	181

Source: NMFS 2018a.
[1] PTS and TTS thresholds have also been established for otariid pinnipeds, but this hearing group in not expected to occur in the Project area.
[2] SEL thresholds are frequency-weighted.

Noise Impacts under Alternative A – No Action

Vessel traffic, seismic surveys, and active naval sonars are the main anthropogenic contributors to low- and mid-frequency noises in oceanic waters (NMFS 2018b), with vessel traffic the dominant contributor to ambient sound levels in frequencies below 200 hertz (Hz) (Arveson and Vendittis 2000; Veirs et al. 2016). In the marine mammal geographic analysis area, underwater noise from anthropogenic sources includes offshore marine construction activities (including pile driving), vessel traffic, seismic surveys, and sonar and other military training activities. The long-term effects of multiple anthropogenic underwater noise stressors on marine mammals across their large geographical range are difficult to determine and relatively unknown. The potential for these stressors to have population-level consequences likely varies by species, among individuals, across situational contexts, and by geographic and temporal scales (Southall et al. 2021a).

Noise generated from ongoing non-offshore wind activities includes impulsive sources (e.g., seismic surveys, sonar) and non-impulsive sources (e.g., vessels, aircraft, dredging). Impact pile driving, seismic exploration, and sonar surveys can lead to injury-level effects (i.e., PTS) in marine mammals. In addition, high-intensity sonar activities have been linked to stranding events (Balcolmb and Claridge 2001; Cox et al. 2006; D'Amico et al. 2009; Dolman et al. 2010; Fernandez et al. 2005; Jepson et al. 2003; Parsons et al. 2008; Wang and Yang 2006). All noise sources have the potential to cause behavior-level effects, and some may also cause PTS and TTS in certain species. The frequency and number of noise-generating anthropogenic activities in the marine mammal geographic analysis area are relatively unknown. If marine mammal populations are subjected to multiple anthropogenic noise stressors throughout their lifetimes that disrupt critical life stages (e.g., feeding, breeding, calving) and throughout their ranges, then impacts from noise from ongoing non-offshore wind activities could be major, particularly for listed species such as NARW, and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species.

BOEM previously determined that noise impacts on marine mammals from pile driving for Vineyard Wind 1 would be negligible for odontocetes (i.e., MFC and HFC) and pinnipeds. Minor impacts on NARW were determined due to avoidance of peak seasons of occurrence and the incorporation of extensive mitigation specific to the species. Impacts from pile driving were determined to be moderate for all other mysticetes (i.e., LFC). Impacts of vessel noise during construction and installation were determined to be moderate for all mysticetes because the lower frequency of sound emitted from vessels overlaps in the most sensitive hearing range of mysticetes. Potential temporary behavioral impacts on all other marine mammals (i.e., odontocetes and pinnipeds) from vessel noise and temporary impacts on marine mammals from cable-laying noise were determined to be minor. Operation of WTGs was determined to result in negligible impacts on marine mammals (BOEM 2021a). No mortality or non-auditory injury of any marine mammal would occur.

For South Fork, BOEM's analysis determined construction noise exposures associated with impact pile driving would have moderate impacts on fin whales, minke whales, humpback whales, and harbor porpoises; minor impacts on NARWs, Atlantic spotted dolphins, Atlantic white-sided dolphins, bottlenose dolphins, and common dolphins; and negligible impacts on Risso's dolphin, sei whales, sperm whales, and pilot whales. Construction vessel noise impacts on marine mammals were assessed to be minor. Dredging noise impacts on marine mammals from O&M facility construction were expected to be negligible, while vibratory and impact pile-driving noise to install moorage improvements at the O&M facility would likely result in minor impacts on seals and porpoises (BOEM 2021b).

For Ocean Wind 1, BOEM's analysis determined construction noise would have moderate impacts on all marine mammal hearing groups. Operational noise was expected to have minor impacts on all marine mammals (BOEM 2023e).

For Revolution Wind, BOEM's analysis determined construction noise would have minor to moderate impacts on marine mammals, depending on the species. Operational noise was expected to have moderate impacts on LFC and negligible to minor impacts on all other marine mammal hearing groups (BOEM 2023f).

For the Empire Wind Project, BOEM's analysis determined construction noise would have moderate impacts on LFC except NARW and minor impacts on NARW, MFC, HFC, and pinnipeds. Operational noise was expected to have minor impacts for all marine mammals (BOEM 2023c).

For the CVOW-C Project, BOEM's analysis determined construction noise exposures associated with pile driving during foundation installation would have moderate impacts on LFC except NARW, HFC, and pinnipeds and minor impacts on NARW and MFC. Vessel and operational WTG noise impacts on marine mammals were assessed to be minor. Impacts of all other noise sources were expected to be negligible (BOEM 2023b).

BOEM reviewed underwater noise levels produced by the available types of HRG survey equipment as part of a programmatic BA for activities associated with regional offshore wind energy development. NMFS concurred with BOEM's determination that planned HRG survey activities using even the loudest available equipment types would be unlikely to injure or measurably affect the behavior of ESA-listed marine mammals. The rationale supporting this conclusion also applies to non-listed marine mammal species. Specifically, the noise levels produced by HRG survey equipment are relatively low, meaning that an individual marine mammal would have to remain close to the sound source for extended periods of time to experience injury. This type of exposure is unlikely as the sound sources are continuously mobile and directional (i.e., pointed at the bottom) (BOEM 2021a).

Noise: Summary of impacts. Anthropogenic underwater noise impacts on marine mammals from ongoing activities are anticipated to occur. Noise generated from ongoing non-offshore wind and offshore wind activities include impulsive (e.g., impact pile driving, seismic surveys, sonar, some HRG surveys) and non-impulsive sources (e.g., vibratory pile diving, some HRG surveys, vessels, aircraft, cable laying or trenching, drilling, dredging, other site preparation activities, turbine operations). Of those activities, only pile driving, seismic surveys, and sonar are anticipated to cause PTS/injury-level effects in marine mammals. All noise sources that are audible by a given species have the potential to cause behavioral responses. All ongoing offshore wind projects are expected to include applicant-proposed measures (e.g., shutdown zones, protected species observers), similar to the measures included in the Vineyard Wind 1, South Fork, Ocean Wind 1, Revolution Wind, Empire Wind, and CVOW-C projects (BOEM 2021a, 2021b, 2023b, 2023c, 2023e, 2023f), that would minimize underwater noise impacts on marine mammals. The effects of implementing underwater noise impact minimization measures would likely be similar to those described for the Proposed Action in Section 3.5.6.5.

Noise impacts from ongoing non-offshore wind and offshore wind activities would likely result in moderate short-term impacts for mysticetes (i.e., LFC), odontocetes (i.e., MFC and HFC), and pinnipeds. Impacts on individual marine mammals would be detectable and measurable; however, populations are expected to recover from the impacts.

Port utilization: Vineyard Wind 1 will use port facilities in Connecticut, Massachusetts, Rhode Island, and Canada during construction and installation and O&M, and BOEM found that no changes to port utilization would occur (BOEM 2021a). South Fork will use existing port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, Virginia, or Nova Scotia for offshore construction, staging, fabrication, crew transfer, and logistics support, and BOEM found that although dredging or in-water work could be required for the Port of Montauk, these actions would occur within heavily modified habitats (BOEM 2021b). Ocean Wind 1 will use port facilities in New Jersey and South Carolina during construction and installation and O&M, and no changes to these ports to support the project were identified (BOEM 2023e). Revolution Wind will use port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Virginia, and Maryland during construction and installation and O&M; no port expansion activities to support the project were identified (BOEM 2023f). Empire Wind will use port facilities in New York, South Carolina, and Texas during construction and installation and O&M. Improvements at South Brooklyn Marine Terminal in New York are necessary to support the project; impacts of these improvements were assessed to be negligible for marine mammals (BOEM 2023c). CVOW-C will use port facilities in Viriginia during construction and installation and O&M, and no changes to this port to support the project were identified (BOEM 2023b). Port expansion activities are localized to nearshore habitats and are expected to result in temporary, short-term impacts, if any, on marine mammals. The impacts on water quality from sediment suspension during port expansion activities are temporary and short term. Port utilization may also result in increased vessel noise, which is assessed under the noise IPF above. Impacts from port utilization from ongoing construction and operation of offshore wind projects have been previously analyzed, as described above, and would be negligible.

Presence of structures: There are more than 130 artificial reefs in the Mid-Atlantic region, 15 of which are offshore New Jersey. Artificial reefs are made of a variety of materials including cars, trucks, subway cars, bridge rubble, barges, boats, and large cables (MAFMC 2023). Ongoing offshore wind projects will add a total of 593 WTGs and 12 OSSs/ESPs and met towers to the offshore environment. The presence of structures associated with ongoing offshore wind and non-offshore wind activities may result in habitat conversion and prey aggregation (i.e., the artificial reef effect), entanglement in or ingestion of lost fishing gear that becomes tangled on structures, avoidance or displacement, and behavioral disruption.

Similar to artificial reefs, the addition of hard bottom from scour and cable protection and vertical structures such as WTG foundations in open water and soft-bottom habitats can induce the “reef” effect (i.e., the attraction or aggregation of prey species) (Causon and Gill 2018; Taormina et al. 2018). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans, providing a potential increase in available forage items and shelter for seals and small odontocetes compared to the surrounding soft bottom habitat. Studies of artificial reefs have demonstrated potential increased biomass of larger predator species, including pelagic fish, birds, and marine mammals (Pezy et al. 2018; Raoux et al. 2017; Wang et al. 2019), and attraction of predatory species, including sea birds, sea turtles, and marine mammals, to offshore wind structures (Degraer et al. 2020). Available data indicate that seals and harbor porpoises may be attracted to the structure provided by offshore wind facilities (Russell et al. 2014; Scheidat et al. 2011), indicating that pinnipeds and odontocetes are likely to use habitat created by offshore wind facility structures to forage. Increased prey abundance would be localized at foundation and cable protection locations, but a substantial increase in use of offshore wind project areas by foraging marine mammals is not anticipated (NMFS 2021b).

Artificial reefs and offshore wind structures (e.g., scour and cable protection, WTG, OSS/ESP, and met tower foundations) may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestion, entanglement, injury, or death of individuals (Moore and van der Hoop 2012), if present where artificial reefs or structures are located. However, abandoned or lost fishing gear may become tangled with foundations, reducing the chance that abandoned gear would cause additional harm to marine mammals and other wildlife, although debris tangled with WTG foundations may still pose a hazard to marine mammals. These potential long-term, intermittent impacts would be low in intensity and persist until decommissioning is complete and structures are removed.

The presence of structures associated with ongoing activities could result in avoidance and displacement of marine mammals, which could potentially move them from preferred habitats into areas with lower habitat value or with higher risk of vessel collision or fisheries interactions. The evidence for long-term displacement is unclear and varies by species. For example, 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. The study cautioned that observational evidence was limited for certain species, and further research would be required in order to draw a definitive conclusion about operational effects. Some research has suggested long-term displacement of species like harbor porpoise, but the evidence is mixed, and observed changes in abundance may be more indicative of general population trends than an actual wind farm effect (Nabe-Nielsen et al. 2011; Teilmann and Carstensen 2012; Vallejo et al. 2017). Displacement effects remain a focus of ongoing study (Kraus et al. 2019).

The presence of structures could also displace commercial or recreational fishing vessels to areas outside of wind energy facilities or potentially lead to a shift in gear types due to displacement. If displacement leads to an overall shift from mobile to fixed gear types, there could be an increased number of vertical lines in the water, increasing the risk of interactions with fishing gear. As described under the Gear Utilization IPF, fisheries interactions are likely to have demographic effects on some marine mammal species. Commercial and recreational fishing efforts and their impacts on protected species (e.g., marine mammals) are managed through state and federal regulations. The likelihood of an increased risk of entanglement directly resulting from the presence of offshore wind structures beyond existing commercial and recreational fishing conditions is considered low.

Disruption of normal behaviors could occur due to the presence of offshore structures. Although spacing between the WTGs, OSS/ESP, and met tower structures would be sufficient to allow marine mammals to utilize habitat between and around structures, information about large whale responses to offshore wind structures is lacking. Given the uncertainty regarding marine mammal responses to the presence of offshore wind structures, BOEM cannot discount the possibility that the presence of structures could have long-term, intermittent impacts on foraging, migration, and other normal behaviors.

The widespread development of offshore renewable energy facilities may facilitate climate change adaptation for certain marine mammal prey and forage species. Hayes et al. (2021) 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 offshore wind 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 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.

Impacts from presence of structures associated with the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to be negligible to minor because of the potential for increased interaction with derelict fishing gear. Minor beneficial impacts on pinniped and odontocete foraging and sheltering may occur as a result of the monopiles and scour protection creating an artificial reef effect (BOEM 2021a, 2021b, 2023b, 2023c, 2023e, 2023f; Russell et al. 2016).

These beneficial effects have the potential to be offset by risk of entanglement in derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.

Traffic: Studies indicate that maritime activities can have adverse effects on marine mammals due to vessel strikes, which are a major source of mortality and injury for many marine mammal species (Hayes et al. 2021; Laist et al. 2001; Moore and Clarke 2002; NMFS 2024d). 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). In general, large baleen whales are more susceptible to a vessel strike than smaller cetaceans and pinnipeds. While there are rare reports of toothed whales 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). However, the behavioral choice by small delphinds to bowride does expose them to the potential for vessel strike and has occurred seasonally in Florida (Wells and Scott 1997) as vessel traffic increases with recreational vessels. 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/United States) 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).

Research into vessel strikes and marine mammals has focused largely on baleen whales 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 vessel strikes on toothed whales 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 strikes have been preliminarily determined as a leading cause of death for humpback whales during the current UME (NMFS 2023c) and a primary contributor to the NARW UME (NMFS 2023b).

North Atlantic cetaceans and pinnipeds, including, but not limited to, fin whale, humpback whale, NARW, sei whale, minke whale, sperm whale, long-finned pilot whale, Risso's dolphin, Atlantic white-sided dolphin, common bottlenose dolphin, harbor porpoise, harbor seal, and gray seal, are all common or regular visitors within the geographic analysis area and could be susceptible to vessel collisions. Most odontocetes (e.g., harbor porpoise) 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. Although data are limited, events of vessel collisions[4] were recorded in recent stock assessments (Hayes et al. 2021; NMFS 2024d) or as part of ongoing UMEs for the following species:

- From 2017 to 2023, there have been 21 confirmed vessel strikes on NARWs; 17 of those resulted in mortality or serious injury (NMFS 2024b). From 2017–2021, 35 percent of the observed mortality and serious injury cases were attributed to vessel strike (NMFS 2024d). Applying this percentage to the estimated mortality/serious injury cases, it is estimated that 48 cases of mortality have occurred within the same time period (NMFS 2024d). From 2017–2021, the 5-year average of annual vessel collisions was 2.5. Four cases of morbidity (a lesser impact than mortality/serious injury) are documented in the NARW UME. Although vessel strikes with NARW may not seriously injure or kill the animal, sustained injuries can be internal and affect reproductive success (Corkeron et al. 2018; van der Hoop et al. 2012).

- For data collected between 2017 and 2021, the fin whale had an annual average rate of 0.6 collision per year with U.S. vessels (NMFS 2024d). Between 2017 and 2021, there were two confirmed fin whale mortalities linked with vessel collisions: one each in 2017 and 2018.

- The annual average rate of vessel collisions was 0.2 per year for the sei whale between 2017 and 2021 (NMFS 2024d).

- The minke whale had between one and two confirmed cases of whale mortalities linked with vessel traffic in North Atlantic waters each year between 2014 and 2018, with the exception of the year 2016, which had no confirmed deaths (Hayes et al. 2021). The average rate of vessel collisions is 1.2 per year in U.S. waters.

- Of the 221 whales involved in the 2016–2024 humpback whale UME, 40 percent showed evidence of human interaction (either entanglement or vessel strike) (NMFS 2024a). The exact percentage attributable to vessel strike alone is not available; however, recent strandings in the New York/New Jersey area demonstrate that vessel strikes of humpback whales remain a serious threat.

- From 2014 to 2018, 692 bottlenose dolphins of the Northern Migratory Coastal Stock stranded between North Carolina and New York; 11 percent (n = 80) had evidence of human interaction, and of those 5 percent (n = 4) exhibited evidence of vessel strikes; 19 percent (n = 134) showed no evidence of human interaction (Hayes et al. 2021). For 69 percent (n = 478) of strandings a cause of death could not be determined.

Vessel speed and size are particularly important factors for determining the probability and severity of vessel strikes as the size and bulk of large vessels inhibit the ability for crew to detect and react to marine mammals along the vessel's transit route. 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 feet (80 meters) or longer traveling at speeds greater than 13 knots (24 kilometers per hour). A more recent

[4] None of these vessel collisions occurred with vessels working on offshore wind projects.

analysis conducted by Conn and Silber (2013) built upon collision data collected by Vanderlaan and Taggart (2007) and Pace and Silber (2005) and 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 kilometers per hour]). 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 (17 kilometers per hour). 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 (15.9 and 27.8 kilometers per hour), and that the probability of death declined by 50 percent at speeds less than 11.8 knots (21.9 kilometers per hour).

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 SMAs require operators of vessels 65 feet (19.8 meters) or longer to maintain speeds of 10 knots (18.5 kilometers per hour) or less and to avoid SMAs when possible. Vessel strikes were thought to be a leading cause of a UME for NARW that began in 2017 (NMFS 2023b). 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 SMA 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 (NMFS 2020a). NARW vessel strike mortalities decreased from 10 prior to the implementation of SMAs to 3 after implementation, 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 SMAs 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 SMAs. Prior to implementation of SMAs, they found that 87 percent of NARW and 46 percent of humpback whale ship-strike deaths were found either inside SMAs or within 52 miles (83 kilometers), and that no ship-struck carcasses were found within the same proximity during the first 5 years of SMAs.

NMFS also recognized that NARW foraging aggregations take place outside of established SMAs; therefore, temporal voluntary Dynamic Management Areas (DMAs) are established when a group of three or more NARWs are sighted within close proximity. Mariners are encouraged to avoid the DMA or reduce speed to less than 10 knots (18.5 kilometers per hour) when transiting through the area. NMFS establishes a DMA boundary around the whales for 15 days and alerts mariners through radio and local notices. Adhering to reduced speed limits within DMAs is voluntary; though vessel traffic data indicates that vessels generally reduce their speed during active DMA periods, cooperation with the voluntary 10 knot (18.5 kilometers per hour) speed restriction has been modest and not at the same levels as achieved with SMAs (NMFS 2020a).

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. The proposed rule,[5] if issued, would

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(1) modify the spatial and temporal boundaries of current SMAs, (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 SMAs, and (4) update the speed rule's safety deviation provision (NMFS 2022a).

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 the Offshore Project area from 2017 to 2019 was composed of recreational vessels (34 percent), dry cargo vessels (27 percent), fishing vessels (11 percent), unspecified vessels (9 percent), tankers (6 percent), tug-barge vessels (6 percent), passenger vessels (3 percent), and other vessels (4 percent) (COP Volume II, Appendix II-S; Atlantic Shores 2024). Vessels more than 262 feet (80 meters) in length are more likely to cause lethal or severe injury to large whales (Laist et al. 2001).

As previously noted, 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 whale, blue whale, fin whale, sei whale, sperm whale, and, to a lesser extent, minke whale due to its smaller size (Hayes et al. 2020, 2021; NMFS 2024d). Although the duration of increased vessel traffic for ongoing 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 (i.e., vessel strikes) on mysticetes (except for NARW) from ongoing non-OSW activities (i.e., from any vessel) would be moderate because traffic is likely to result in long-term consequences to individuals or populations that are detectable and measurable. Impacts of traffic on individual mysticetes (except for NARW) could have population-level effects, but the population should sufficiently recover. BOEM notes that not all populations (e.g., minke whales, fin whales) are experiencing population-level consequences from vessel strikes; however, vessel strikes are a threat for all whales. The impacts of traffic on NARW from ongoing activities would be major and long term because vessel strikes have had and continue to have population-level effects that compromise the viability of the species. The impacts of traffic on odontocetes and pinnipeds from ongoing non-OSW activities would be minor because population-level effects are unlikely although consequences to individuals would be detectable and measurable.

The likelihood of an offshore wind vessel striking a marine mammal is considered very low. BOEM concluded that vessel strikes associated with ongoing offshore wind projects were unlikely to occur because of the relatively low number of vessel trips and the monitoring and mitigation activities to avoid vessel strikes (BOEM 2021a, 2021b, 2023b, 2023c, 2023e, 2023f). Therefore, ongoing offshore wind activities are anticipated to have no effect on marine mammals via the vessel traffic IPF, as vessel strikes from this industry are not likely to occur.

Cumulative Impacts of Alternative A – No Action

The cumulative impact analysis for the No Action Alternative considered the impacts of the No Action Alternative (i.e., not approving the COP), inclusive of ongoing activities, in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities within the geographic analysis area that may contribute to impacts on marine mammals include undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; marine minerals use and ocean-dredged material disposal; dredging and port improvement; military use (e.g., sonar, munitions training); marine transportation; research initiatives; fisheries use and management; oil and gas activities, including development of the oil and gas leases sold in the two sales in 2023 and up to three new lease sales between 2024 and 2029 in the Gulf of Mexico; installation of new structures (e.g., artificial reefs); and onshore development activities (see Section D.2 in Appendix D for a description of planned activities). These activities could result in displacement and injury to or mortality of individual marine mammals. BOEM expects planned activities other than offshore wind to affect marine mammals through several primary IPFs, including accidental releases, electric and magnetic fields and cable heat, cable emplacement and maintenance, port utilization, noise, and the presence of structures that are described in detail in Section 3.5.6.3. for ongoing non-offshore wind activities.

The sections below summarize the potential impacts of other planned offshore wind activities (i.e., exclusive of the Proposed Action) on marine mammals during construction and installation, O&M, and decommissioning of the projects. This section provides a general description of these mechanisms, recognizing that the extent and significance of potential effects of planned offshore wind projects on conditions cannot be fully quantified for projects that are in the conceptual or proposal stage and have not been fully designed. Where appropriate, potential effects resulting from planned activities are generally characterized by comparison to effects resulting from approved projects that have been evaluated and are likely to be similar in nature. Planned activities with federal funding or approval would be subject to independent NEPA analyses and regulatory approvals. The environmental effects of other offshore wind energy development activities would be fully considered before BOEM makes a decision on the respective COP for each project. Other planned offshore wind activities in the geographic analysis area for marine mammals include the construction and installation, O&M, and decommissioning of 27 planned offshore wind projects on the Atlantic OCS, which would result in an additional 2,345 WTGs in the geographic analysis area, and development of the Lake Charles Lease Area in the Gulf of Mexico (Appendix D, Table D.A2-1).

BOEM expects planned offshore wind activities to affect marine mammals through the following primary IPFs.

Accidental releases: Offshore wind activities may increase accidental releases of fuels, fluids, and hazardous materials and trash and debris due to increased vessel traffic and installation of WTGs, OSSs/ESPs, and other offshore structures. The risk of accidental releases is expected to be highest during construction and installation, but accidental releases could also occur during O&M and decommissioning. Refueling of primary construction vessels at sea is anticipated for ongoing and planned offshore wind projects.

Ongoing and planned offshore wind activities are expected to gradually increase vessel traffic over the next 35 years, increasing the risk of accidental releases of fuels, fluids, and hazardous materials. There would also be a low risk of fuel, fluid, and hazardous materials leaks from any of the 2,940 WTGs (593 for ongoing activities and 2,347 for planned activities) (Appendix D, Table D.A2-1) anticipated in the geographic analysis area. The total volume of WTG fuels, fluids, and hazardous materials in the geographic analysis area is estimated at 21.3 million gallons (80.6 million liters) (Appendix D, Table D.A2-3). OSSs and ESPs are expected to hold an additional 10.1 million gallons (38.1 million liters) of fuels, fluids, and hazardous materials (Appendix D, Table D.A2-3). BOEM has modeled the risk of spills associated with WTGs and determined that a release of 128,000 gallons (484,533 liters) is likely to occur no more frequently than once every 1,000 years and a release of 2,000 gallons (7,571 liters) or less is likely to occur every 5 to 20 years (Bejarano et al. 2013). As described for ongoing activities, marine mammal exposure to releases can result in mortality, adrenal effects, hematological effects, hepatological effects, poor body condition, and dermal effects (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Accidental releases may also indirectly affect these species through impacts on prey species (see Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). Given the volumes of fuels, fluids, and hazardous materials potentially involved and the likelihood of release occurrence, the long-term increase in accidental releases associated with ongoing and planned offshore wind activities is expected to fall within the range of releases that occur on an ongoing basis from non-offshore wind activities.

Increased vessel traffic would also increase the risk of accidental releases of trash and debris during construction and installation, O&M, and decommissioning of offshore wind facilities. About half of all marine mammal species worldwide have been documented to ingest trash and debris (Werner et al. 2016), which can result in death. Based on stranding data, mortality rates associated with debris ingestion range from 0 to 22 percent. Ingestion may also result in sublethal effects, including digestive track blockage, disease, injury, and malnutrition (Baulch and Perry 2014). Linkages between impacts on individual marine mammals associated with debris ingestion and population-level effects are difficult to establish (Browne et al. 2015). BOEM assumes that all vessels will comply with laws and regulations to minimize trash releases and expects that such releases would be small and infrequent. The amount of trash and debris accidentally released long term during ongoing and planned offshore wind activities would likely be negligible compared to other ongoing trash releases.

Though exposure to accidental releases from ongoing and planned offshore wind activities could result in more severe impacts, current regulations and requirements imposed on federally approved activities prohibit vessels from dumping potentially harmful debris, require measures to avoid and minimize spills of toxic materials, and provide mechanisms for spill reporting and response. These measures would reduce the likelihood, and the extent of potential impacts would be localized to the area around each activity. Therefore, impacts from accidental releases from ongoing activities would likely be minor for mysticetes (including NARW), odontocetes, and pinnipeds and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable.

Cable emplacement and maintenance: Ongoing and planned offshore wind activities will involve the placement and maintenance of export and interarray cables. Cable emplacement and maintenance activities disturb bottom sediment, resulting in temporary increases in suspended sediment concentrations. Cable emplacement associated with offshore wind activities is expected to disturb more than 63,933 acres (25,873 hectares) of seabed (Appendix D, Table D.A2-2) between 2023 and 2030. This acreage could be reduced if open access offshore transmission systems are built, as have been proposed. However, such projects are not considered reasonably foreseeable at this time.

Effects of cable emplacement and maintenance would be similar in nature to those observed during construction of the BIWF Project (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. Areas subject to increased suspended sediment from simultaneous activities would be limited.

There are no data on physiological effects of suspended sediment on marine mammals or marine mammal avoidance of sediment plumes. As noted above, evidence suggests some marine mammal species may tolerate increased suspended sediment concentrations (Todd et al. 2015). There is also evidence that some pinniped species may not rely exclusively on visual cues to forage (McConnell et al. 1999). Elevated suspended sediment concentrations may cause marine mammals to alter their normal movements and behaviors to avoid the area of elevated suspended sediment. Such alterations are expected to be temporary and would be too small to be meaningfully measured or detected (NMFS 2020b). Suspended sediment is most likely to affect these species if the area of elevated concentrations acts as a barrier to normal behaviors. However, no adverse effects are anticipated due to marine mammals swimming through the area of elevated suspended sediment or avoiding the area (NMFS 2020b).

In addition to direct effects on marine mammal behavior, suspended sediment can indirectly affect these species through short-term impacts on prey species. Elevated suspended sediment concentrations are shown to have adverse effects on benthic communities when they exceed 390 mg/L (USEPA 1986). See Section 3.5.5 for a discussion of impacts on prey species. No individual fitness or population-level impacts would be expected to occur.

Impacts from cable emplacement and maintenance from ongoing and planned offshore wind activities would likely be minor for mysticetes (including NARW), 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.

Discharges/intakes: Ongoing and planned offshore wind activities would result in increased vessel traffic, potentially resulting in increases in discharges of ballast water and bilge water. Increases would be greatest during construction and decommissioning of offshore wind projects. Discharge rates would be staggered according to project schedules and localized. As described under *Impacts of Alternative A – No Action*, vessel operators are required to comply with USCG and USEPA regulations governing discharge of ballast or bilge water that effectively avoid the likelihood of non-native species invasions through vessel discharges.

Discharges related to cooling offshore wind conversion stations are possible for other offshore wind projects. Potential effects resulting from discharge use include altered micro-climates of warm water surrounding outfalls and altered hydrodynamics around discharges. The number of OSSs per project is likely small; therefore, these impacts, though long term, would be low in intensity and localized.

Entrainment and impingement of marine mammal prey organisms are expected to occur at cooling water intakes for HVDC converters and cable-laying equipment. As discussed in Section 3.5.5, impacts on prey species are expected to be negligible. Therefore, no individual fitness or population-level impacts would be expected to occur.

Impacts of discharges/intakes from ongoing and planned offshore wind activities would likely be negligible for mysticetes (including NARW), 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.

Electric and magnetic fields and cable heat: Ongoing and planned offshore wind activities would install up to 12,881 miles (20,730 kilometers) of export and interarray cables (Appendix D, Table D.A2-1), increasing the production of EMF in the geographic analysis area. Transmission cables using HVAC emit 10 times less magnetic field than HVDC (Taormina et al. 2018); therefore, HVAC cables are likely to have less EMF impacts on marine mammals. This Final EIS anticipates that the proposed offshore energy projects would use HVAC transmission, but HVDC designs are possible and could occur. EMF effects associated with ongoing and planned offshore wind activities would be reduced by cable burial to an appropriate depth and the use of shielding, if necessary. Cables are also expected to be separated by a minimum distance of 330 feet (100 meters), avoiding additive EMF effects from adjacent cables.

Marine mammals are capable of detecting magnetic field gradients of 0.1 percent of the Earth's magnetic field (i.e., approximately 0.05 microtesla [μT]) (Kirschvink 1990). This magnetic sensitivity has been documented in fin whale, humpback whale, sperm whale, bottlenose dolphin, common dolphin, long-finned 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 or physiologically for bottlenose dolphin; the remaining species were concluded based on theory or anatomical details. Assuming a sensitivity threshold of 50 milligauss (mG) (5 μT), it is theoretically possible that marine mammals could detect EMF from export and interarray cables (NMFS 2021f). However, to be exposed to EMF above this 50 mG detection threshold, an individual would have to be within 3 feet (0.9 meter) of a cable that is lying on the surface of the sediment. Marine mammal species that are more likely to forage near benthic habitats, such as certain delphinids, have more potential to experience EMF above baseline levels (Tricas and Gill 2011). 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.

Impacts from EMF from both ongoing and planned offshore wind and non-offshore wind activities would likely be negligible for mysticetes (including NARW), 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.

Heat from offshore wind cables is not expected to affect marine mammals. Above-sediment cables are cooled by the water, while the extent of heat from buried cables is limited to sediments (Taormina et al. 2018).

Gear utilization: Ongoing and planned offshore wind activities are likely to include monitoring surveys in the offshore wind lease areas. 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. 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. See *Impacts of Alternative A – No Action* for a detailed summary of gear utilization effects on marine mammals.

Though monitoring surveys have the potential to entrap or entangle marine mammals, developers have included marine mammal mitigation and monitoring procedures in COPs submitted to date designed to avoid entanglement or entrapment in any biological survey plans. Additionally, the monitoring projects for all projects would comply the requirements set forth in *Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf* (BOEM 2023d). Therefore, it is expected that monitoring plans will have sufficient mitigation procedures in place to reduce potential impacts and not result in population-level effects. Due to project-specific monitoring and mitigation measures for ongoing and planned offshore wind activities, these surveys are not expected to contribute appreciably to the above-described entanglement or entrapment risk for marine mammals. Additionally, based on the methods employed for these surveys, the likelihood of interactions with listed species of marine mammals is much lower than commercial and recreational fishing activities. The potential for impacts from gear utilization from planned offshore wind activities on mysticetes (including NARW), odontocetes, and pinnipeds is anticipated to be negligible. However, the potential extent and number of animals potentially exposed cannot be determined without project-specific information.

Lighting: The construction of up to 2,940 WTGs and 43 OSSs/ESPs and met towers in the geographic analysis area with long-term hazard and aviation lighting, as well as lighting associated with construction vessels, would increase artificial lighting. Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities on marine mammal distribution, behavior, and habitat use were uncertain but likely negligible if recommended design and operating practices are implemented. BOEM would require wind farm developers to comply with the current design guidance for avoiding and minimizing artificial lighting effects. Impacts from lighting from ongoing and planned offshore wind activities would likely be negligible and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or the population.

Noise: As described in Section 3.5.6.1, marine mammals rely on sound for essential biological functions, including communication, mating, foraging, predator avoidance, and navigation (Madsen et al. 2006; Weilgart 2007). Anthropogenic underwater noise would be generated by aircraft, G&G surveys, offshore WTGs, pile driving, cable laying, dredging, UXO/MEC detonation, and vessels associated with ongoing and planned offshore wind activities. Physical descriptions of sounds associated with these sources can be found in Section B.5 of Appendix B. Anthropogenic underwater noise may have adverse impacts on marine mammals if the sound frequencies produced by the noise sources overlap with marine mammals' hearing ranges (NSF and USGS 2011). If such overlap occurs, underwater noise can result in behavioral or physiological effects, as described under *Impacts of Alternative A – No Action*, potentially interfering with essential biological functions (Southall et al. 2007, 2019). This section focuses on potential impacts on marine mammals associated with ongoing and planned offshore wind activities, and each noise source is addressed separately.

Noise: Aircraft. Helicopters and fixed wing aircraft may be used to transport crew during construction and installation or O&M of offshore wind facilities. Further information about the physical qualities of aircraft noise can be found in Section B.5 of Appendix B. When aircraft travel at relatively low altitude, non-impulsive aircraft noise has the potential to elicit short-term behavioral responses by marine mammals, including altered dive patterns, percussive behaviors (i.e., breaching or tail slapping), and disturbance at haul-out sites (Efroymson et al. 2000; Patenaude et al. 2002; Richter et al. 2006; Smultea et al. 2008). 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). In general, marine mammal behavioral responses to aircraft most commonly occur at lateral distances of less than 1,000 feet (305 meters) and altitudes of less than 492 feet (150 meters) (Patenaude et al. 2002). Helicopters transiting to offshore wind facilities are expected to fly at sufficient altitudes to avoid behavioral effects on marine mammals, with the exception of WTG inspections, take-off, and landing. Approach regulations for NARWs (50 CFR 222.32) prohibit approaches within 1,500 feet (457 meters). BOEM would require all aircraft operations for ongoing and planned offshore wind activities to comply with current approach regulations for any NARW or unidentified large whale. Additionally, based on the physics of sound propagation across different media (e.g., air and water), an animal must be almost directly below an aircraft (within a 13° cone; see Section B.5 in Appendix B for details) to hear the sound from the aircraft.

Any behavioral responses elicited during low-altitude flight would be temporary, dissipating once the aircraft leaves the area, and are not expected to be biologically significant.

Noise: G&G Surveys. G&G surveys would be conducted for site assessment and characterization activities associated with offshore wind facilities to evaluate the feasibility of turbine installation and to identify potential hazards. Site assessment and characterization activities are expected to occur intermittently over a 2- to 10- year period at locations spread throughout lease areas within the geographic analysis area. Although schedules for many planned offshore wind activities are still being developed, it would be possible to avoid overlapping noise impacts on marine mammals by scheduling site assessment and characterization activities to avoid conducting simultaneous G&G surveys in proximity to each other.

Detailed information about the physical qualities of G&G surveys can be found in Section B.5 of Appendix B. Certain active acoustic sources used in these surveys (e.g., boomers, sparkers, and bubble guns) can generate impulsive noise that has the potential to disturb marine mammals if they are in proximity to some G&G survey activities. Recently, BOEM and USGS characterized underwater sounds produced by HRG 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, even without mitigation, are unlikely to result in substantial behavioral disturbances of marine mammals (Ruppel et al. 2022). This finding is supported by multiple empirical studies. 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 deep-water mapping surveys using a 12 kHz 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 kHz EK-60 echosounder, though Cholewiak et al. (2017) found a decrease in beaked whale echolocation click detections during use of an EK-60. 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. 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, intermittent use, and small ranges to acoustic thresholds.

No PTS (i.e., Level A harassment) is anticipated from HRG surveys, but, as described above, behavioral disturbance could occur. BOEM (2021c) and NMFS[6] have developed Project Design Criteria and Best Management Practices for offshore wind data collection activities (e.g., G&G surveys) to minimize impacts on protected species that lessees will be required to follow. BOEM also requires applicants to develop mitigation plans that include measures to protect marine mammals during HRG surveys, such as those outlined in Appendix G, *Mitigation and Monitoring* (e.g., protected species observers, clearance zones, shutdowns), which would further minimize exposure risk. Additionally, NMFS requires mitigation measures that minimize the risk of TTS and behavioral disturbance (i.e., Level B harassment). Any resulting impacts on individual marine mammals are not expected to result in stock- or population-level effects.

Noise: Operating WTGs. Sound is generated by operating WTGs due to pressure differentials across the airfoils of moving turbine blades and from mechanical noise of bearings and the generator converting kinetic energy to electricity. Sound generated by the airfoils, like aircraft, is produced in the air and enters the water through the air-water interface. Mechanical noise associated with the operating WTG is transmitted into the water as vibration through the foundation and subsea cable. The sound generated by operating WTGs is non-impulsive noise that is audible to marine mammals. 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 that vary over space and time and would affect an animal's ability to hear turbine operational noise over ambient conditions. Detailed information about the physical qualities of operational noise can be found in Section B.5 of Appendix B.

Offshore WTGs produce continuous, omnidirectional underwater noise during operation, mostly in lower-frequency bands (below 8 kHz). There are several recent studies that present sound properties of similar turbines in environments comparable to those ongoing and planned in the Atlantic OCS. Measured underwater sound levels in the literature are limited to geared smaller wind turbines. Broadband SPLs measured 164 feet (50 meters) from a BIWF turbine were 119 dB re 1 µPa with tonal peaks observed at 30, 60, 70, and 120 Hz (Elliott et al. 2019). The BIWF turbines are 6 MW, direct-drive, four-legged jacket-pile structures. At BIWF in winter, a 71 Hz constant tone was measured 328 feet (100 meters) from a turbine. Overall, results from this study indicate that there is a correlation between underwater sound levels and increasing wind speed, but this is not clearly influenced by turbine machinery; rather it may be the natural effects that wind and sea state have on underwater sound (Elliott et al. 2019; Urick 1983). At the CVOW pilot project, SPLs measured at approximately 1,148 feet (350 meters) from a turbine generally ranged from 120 to 130 dB re 1 µPa but reached up to 145 dB re 1 µPa during storm events (Ampela et al. 2023). The CVOW pilot project turbines are 6 MW geared turbines on monopile structures.

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[6] NMFS, "Offshore Wind Site Assessment and Site Characterization Activities Programmatic Consultation" https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic#offshore-wind-site-assessment-and-site-characterization-activities-programmatic-consultation.

A compilation of operational noise from several wind farms with turbines up to 6.15 MW in size showed that operational noise generally attenuates rapidly with distance from the turbines (falling below normal ocean ambient noise within 0.6 mile [1 kilometer] from the source) and that the combined noise levels from multiple turbines is lower or comparable to that generated by a small cargo ship (Tougaard et al. 2020). Larger turbines do produce higher levels of operational noise, and the least squares fit of that dataset would predict that an SPL measured 328 feet (100 meters) from a hypothetical 15 MW turbine in operation in 22 mile per hour (10 meter per second) wind would be 125 dB re 1 µPa (Tougaard et al. 2020). However, all of the turbines in the dataset, apart from those at BIWF, were operated with gear boxes of various designs that did not use newer direct-drive technology that is expected to lower noise levels significantly. Stöber and Thomsen (2021) noted that BIWF was expected to be approximately 10 dB quieter than other equivalent sized jacket-pile turbines because of the use of direct drive instead of a gearbox. Based on the Tougaard et al. 2020 dataset, operational noise from jacket piles could be louder than from monopiles due to there being more surface area for the foundation to interact with the water; however, the paper points out that received level differences among different pile types could be confounded by differences in water depth and turbine size. In any case, additional data are needed to fully understand the effects of size, foundation type, and drive type on the amount of sound produced during turbine operation.

For high ambient noise conditions, the distance at which the turbine can be heard above ambient noise was even less. Kraus et al. (2016) measured ambient noise conditions at three locations adjacent to SFWF over a 3-year period and identified baseline root mean square levels of 102 to 110 dB re 1 µPa.[7] Jansen and de Jong (2014) and Tougaard et al. (2009b) concluded that marine mammals would be able to detect operational noise within a few thousand feet of 2-MW WTGs, but the effects would have no significant impacts on individual survival, population viability, distribution, or behavior.

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 detections of marine mammals during the operational phase of wind farms (e.g., harbor seals: 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 preconstruction 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 unclear if the behavioral responses result from operational noise, or merely the presence 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.

Lucke et al. (2008) explored the potential for acoustic masking from operational noise by conducting hearing tests on trained harbor porpoises while they were exposed to simulated noise from operational wind turbines (i.e., < 1 kHz) at high and moderate masking levels (up to 128 dB re 1 µPa and 115 dB re 1 µPa, respectively), which were designed based on noise measurements from operational turbines of sizes less than 5 MW. Of the two masking levels, they saw masking effects at a received level of 128 dB

[7] These are 50th and 90th percentile values for monitoring locations RI-1, RI-2, and RI-3, as reported by Kraus et al. (2016).

re 1 μPa at frequencies of 0.7, 1, and 2 kHz, but found no masking at received levels of 115 dB re 1 μPa. At this higher broadband received level (128 dB re 1 μPa), the noise at 0.7, 1, and 2 kHz was 6.8, 7.3, and 4.8 dB over unmasked conditions, respectively. Based on these results, Lucke et al. (2008) concluded that masking may occur within approximately 66 feet (20 meters) of an operating turbine. This suggests the potential for a reduction in effective communication space within the wind farm environment for marine mammals that communicate primarily in frequency bands below 2,000 Hz. Any such effects would likely be dependent on hearing sensitivity and the ability to adapt to low-intensity changes in the noise environment.

Available data on large direct-drive turbines are sparse. Direct-drive turbine design eliminates the gears of a conventional wind turbine, which increases the speed at which the generator spins. Direct-drive generators are larger generators that produce the same amount of power at slower rotational speeds. Only one study of direct-drive turbines presented in Elliott et al. (2019) is available in the literature. The study recorded root mean square sound pressure levels of 114 to 121 dB re 1 μPa at 164 feet (50 meters) from a 6-MW direct-drive turbine.

Recent modeling conducted by Stöber and Thomsen (2021) and Tougaard et al. (2020) has suggested that operational noise from larger, current-generation WTGs would generate higher source levels (root mean square sound pressure levels of 170 to 177 dB re 1 μPa for a 10-MW WTG) than the range noted above from earlier research. However, the models were based on a small sample size, which adds uncertainty to the modeling results. In addition, modeling results were based on measured sound pressure levels from geared turbines. Even though current turbine engines are larger, WTGs with direct-drive technology could reduce sound pressure levels because they eliminate gears and rotate at a slower speed than the conventional geared generators.

Based on the currently available data for turbines smaller than 6.2 MW (Tougaard et al. 2020) and comparisons to acoustic impact thresholds (NMFS 2018a), underwater noise from turbine operations from ongoing and planned offshore wind activities (without the Proposed Action) is unlikely to cause PTS or TTS in marine mammals but may have the potential to cause behavioral and masking effects. It is expected that these effects would be at relatively short distances from the foundations and would reach ambient underwater noise levels within 0.6 mile (1 kilometer) of the foundations (Elliott et al. 2019; Holme 2023; Tougaard et al. 2009a). However, more acoustic research is warranted to characterize sound pressure levels originating from large direct-drive turbines, the potential for those turbines to cause TTS effects, and distances at which behavioral and masking effects are likely as a result of their operations.

Noise: Impact and vibratory pile driving. Ongoing and planned offshore wind activities would generate impulsive, intermittent pile-driving noise during impact pile driving for foundation installation. Detailed information about the physical qualities of impact pile-driving noise can be found in Section B.5 of Appendix B. Pile driving is expected to occur for up to 9 hours at a time as 2,940 WTGs and 43 OSSs/ESPs and met towers are constructed between 2023 and 2030 (Appendix D, Tables D-3, D.A2-1 and D.A2-2). Construction is expected to occur intermittently over this 7-year period. A limited amount of concurrent pile driving at adjacent projects is anticipated to occur (see the Vineyard Wind 1 Final EIS [BOEM 2021a] for a description of pile-driving scenarios for planned offshore wind activities). According to estimates provided in BOEM (2021a) and based on a maximum-case scenario of concurrent construction of multiple offshore wind projects, over the 7-year period, 343 or 172 concurrent pile-driving days could occur, depending on whether one or two piles are driven per day.[8] Concurrent pile driving involving two or more piles driven during a 24-hour period has the potential to extend the daily duration of exposure or result in a larger impact area. However, non-concurrent pile driving increases the number of days over which pile driving would occur, potentially increasing the number of exposures an individual may experience. Results from Southall et al. (2021a) showed that concurrent construction of multiple windfarms, if scheduled to avoid critical periods when NARWs are present in higher densities for example, minimizes the overall risk to the species. More broadly, this determination is likely applicable to multiple marine mammal species.

Due to ongoing and planned offshore wind activities, individual animals may be exposed to anywhere from a single pile-driving event (i.e., foundation installation over a 24-hour period) to intermittent events over a period of weeks if an individual travels through the larger geographic area where pile driving may be occurring. Based on 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. Given anticipated construction schedules, BOEM expects that marine mammals could be intermittently exposed to pile-driving noise for up to 7 consecutive years, from one or more projects.

The intense, impulsive noise associated with impact pile driving can cause behavioral and physiological effects. Behavioral effects may occur up to tens of kilometers from the center of pile-driving activity. Toothed whales and baleen whales show varying levels of sensitivity to mid-frequency impulsive noise sources (i.e., certain active sonar, impact pile driving), with observed responses ranging from displacement (Dähne et al. 2013; Maybaum 1993) to avoidance behavior (i.e., animals moving rapidly away from the source) (Hatakeyama et al. 1994; Russell et al. 2016; Watkins et al. 1993), decreased vocal activity (Brandt et al. 2011), and disruption in foraging patterns (Goldbogen et al. 2013) and behavior (Kastelein et al. 2019). Avoidance and displacement, both temporary and long term, are the most commonly reported behavioral responses to impact pile-driving noise (e.g., Dähne et al. 2013; Lindeboom et al. 2011; Russell et al. 2016; Scheidat et al. 2011). These effects have been well documented for harbor porpoises, a species of high abundance and concern in European waters, where most of the scientific literature on offshore wind is produced to date. A 2011 study of harbor porpoise acoustic activity in the North Sea at the Horns Rev II wind farm revealed that porpoise acoustic activity was reduced as far as an average distance of 11.1 miles (17.8 kilometers) from the construction site during pile driving; at a range of 13.7 miles (22.0 kilometers) this reduction was no longer present and instead porpoise acoustic activity temporarily increased detectibly (Brandt et al. 2011). At the closest measured distance of 1.5 miles (2.5 kilometers), acoustic activity completely ceased at the start of pile driving and did not recommence for up to 1 hour after pile driving ended and remained below average acoustic activity levels for 24–72 hours. Dahne et al. (2013) visually and acoustically monitored harbor

[8] The maximum-case scenario assumed installation of monopile foundations.

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 a displacement effect away from the pile-driving activity. During several construction phases of two Scottish windfarms (i.e., Beatrice Offshore Windfarm and the first construction phase of the Moray East Offshore Windfarm), an 8 to 17 percent decline in porpoise acoustic presence was seen in the 15.5- by 15.5-mile (25- by 25-kilometer) block containing impact pile-driving activity in comparison to a control block (Benhemma-Le Gall et al. 2021). Displacement within the pile-driving monitored area was seen up to 7.5 miles (12 kilometers) away.

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 passive acoustic monitoring data 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 sound exposure levels between 145 and 150 dB re 1 $\mu Pa^2 \cdot s$ and 90 percent at sound exposure levels above 170 dB re 1 $\mu Pa^2 \cdot s$. 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, a 33 percent decline 3.1 to 6.2 miles (5 to 10 kilometers) away, a 26 percent decline 6.2 to 9.3 miles (10 to 15 kilometers) away, and a decline of less than 20 percent[9] at greater distances, up to the 37-mile (60-kilometer) range modeled. 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) (Brandt et al. 2016). 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).

In addition to avoidance behavior, studies have observed other behavioral responses in marine mammals, such as impacts on foraging behaviors. A playback study on two harbor porpoises revealed that high-amplitude sounds, like impact pile driving, may adversely affect foraging behavior in this species by decreasing catch success rate (Kastelein et al. 2019).

In addition to harbor porpoise, the effects of impact 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

[9] Brandt et al. (2016) used a 20 percent decline as the threshold to indicate an adverse effect had occurred.

(*Sousa chinensis*) to impact pile driving in the seabed in water depths of approximately 20 to 26 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 by 19 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. Monitoring studies in the Dutch North Sea showed that harbor seals may avoid large areas (24.8 miles [39.9 kilometers]) during impact pile driving and other construction activities. However, seals returned to the area following construction activities, indicating that avoidance was temporary (Lindeboom et al. 2011).

As there are no studies that have directly examined the behavioral responses of baleen whales to impact pile driving, studies using other impulsive sound sources (e.g., seismic airguns) serve as the best available proxies. With seismic airguns, the distance at which responses occur depends on many factors, including the volume (and consequent source level) of the airgun, as well as the hearing sensitivity, behavioral state, and life stage of the animal (Southall et al. 2021b). In a 1986 study, researchers observed the responses of feeding gray whales (*Eschrichtius robustus*) 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 sound pressure levels reached 173 dB re 1 µPa (Malme et al. 1986). Other studies have documented baleen whales initiating avoidance behaviors to full-scale seismic surveys at distances as short as 1.9 miles (3 kilometers) away (Johnson 2002; McCauley et al. 1998; Richardson et al. 1986) and as far away as 12.4 miles (20 kilometers) (Richardson et al. 1999). Bowhead whales (*Balaena mysticetus*) have exhibited other behavioral changes, including reduced surface intervals and dive durations, at received sound pressure levels between 125 and 133 dB re 1 µPa (Malme et al. 1989). 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. However, 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 sound exposure levels over 135 dB re 1 $\mu Pa^2 \cdot s$ (Dunlop et al. 2017).

Potential physiological effects associated with impact pile driving noise include TTS or PTS. Depending on the hearing sensitivity of the species, exceedance of NMFS PTS and TTS thresholds may occur on the scale of several kilometers. PTS could permanently limit an individual's ability to locate prey, detect predators, navigate, or find mates and could therefore have long-term effects on individual fitness. However, based on the mobility of most marine mammals and an assumed avoidance behavior to aversive stimuli (Schakner and Blumstein 2013), like pile driving, certain marine mammal species are less likely to be exposed to underwater sound for sufficient duration to cause PTS and TTS. In addition, if mitigation measures are applied (e.g., bubble curtains, shutdown zones) all of these effects and exposure ranges can be reduced.

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 kHz, LFC and pinnipeds are more likely to experience acoustic masking from pile driving than MFC or HFC. 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 [*Delphinapterus leucas*]: Scheifele et al. 2005; 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.

BOEM anticipates that pile driving activities would be conducted in accordance with project-specific Incidental Take Regulations and associated LOAs that would include measures to minimize impacts on marine mammals, reducing the risk of TTS or PTS. Most individual marine mammals would be exposed to noise levels resulting in behavioral effects or TTS. PTS could occur in a relatively small number of marine mammals, but PTS is expected to be mild and limited to low-frequency bands. BOEM expects that marine mammals would be displaced for up to 18 hours per day during foundation installation, depending on the type of turbine foundation. Given that impact pile driving for ongoing and planned offshore wind activities will occur in the open ocean, BOEM anticipates that marine mammals will be able to avoid elevated underwater noise, to some extent. Therefore, any disruptions to foraging or other normal behaviors would be expected to be short term, and any increased energy expenditures associated with this temporary displacement are expected to be small. Furthermore, while it is possible that impact pile driving from ongoing and planned offshore wind activities could displace animals into areas with lower habitat quality or higher risk of vessel collision or fisheries interaction, those events are expected to be sparse as the availability of ample open ocean should provide animals with enough room to navigate into preferred habitats.

Multiple construction activities within the same calendar year for ongoing and planned offshore wind activities could potentially affect migration, foraging, calving, and individual fitness of animals; however, the magnitude of impacts would depend upon the locations, duration, and timing of concurrent construction for each project. Such impacts could be long term, of severe intensity, and of high exposure level. Generally, the more frequently an individual's normal behaviors are disrupted or the longer the duration of the disruption, the greater the potential for biologically significant consequences to individual fitness. The potential for biologically significant effects is expected to increase with the number of impact pile-driving events to which an individual is exposed.

Ongoing and planned offshore wind activities may also use vibratory pile driving as an alternative to impact pile driving. Vibratory pile driving is a non-impulsive sound source and sound levels are lower than with impact pile driving. This means that the distance at which masking could occur from vibratory pile driving is smaller than that of impact pile driving. Detailed information about the physical qualities of vibratory pile-driving noise can be found in Section B.5 of Appendix B. Similar to other activities that generate continuous noise, vibratory pile driving may elicit behavioral or physiological effects in marine mammals, though risk of physiological effects is expected to be lower for vibratory pile driving than impact pile driving. Vibratory pile-driving noise may exceed the behavioral disturbance threshold for continuous noise sources of 120 dB re 1 µPa, but these events are expected to be short term and limited to shallow water habitats, which limits the marine mammals potentially present during construction. Vibratory pile driving for the foundations in deeper waters may exceed the behavioral disturbance threshold thousands of meters from the source (NMFS 2024c); however, based on the information from CVOW-C (NMFS 2024c), vibratory pile driving would only occur over an approximate 90-minute period per foundation, and the proposed mitigation measures would similarly help reduce the severity of potential impacts.

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 higher-than-expected SPL source level for vibratory pile driving (192 dB re 1 µPa m) compared with the single strike SEL source level for impact pile driving (198 dB re 1 μPa^2 s m). 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 (i.e., 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 (Graham et al. 2017). 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 on marine mammals (Graham et al. 2017).

In a playback study, trained bottlenose 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.

BOEM assumes that project-specific Incidental Take Regulations and associated LOAs would include mitigation measures to reduce impacts of vibratory pile driving on marine mammals. Though individual marine mammals may experience behavioral or physiological effects, no stock- or population-level effects are anticipated.

Noise: Drilling. Drilling, which may occur during geotechnical surveys, foundation installation, and HDD at the export cable landfalls, produces low-frequency (20 to 1000 Hz), non-impulsive, continuous noise. Most measurements of offshore drilling noise have been taken during oil exploration and production drilling (e.g., Richardson et al. 1995; Todd et al. 2020), which is likely to produce higher sound levels than drilling associated with offshore wind activities. Geotechnical drilling SPL source levels have been measured at up to 145 dB re 1 µPa m (Erbe and McPherson 2017). HDD equipment is generally located on shore, and the sound that propagates into the water is negligible (Willis et al. 2010). Based on the low source levels, drilling is unlikely to result in auditory injury, but individual marine mammals may experience sound levels sufficient to cause behavioral effects. Though noise produced during drilling may exceed the behavioral response threshold, harbor porpoise in the North Sea have continued normal activities during oil and gas drilling activities (Todd et al. 2007) and ringed seal densities did not decrease near drilling noise (Moulton et al. 2003), indicating that drilling noise may not result in marine mammal avoidance.

Noise: Cable laying. Noise-producing activities associated with cable laying include route identification surveys, trenching, jet plowing, backfilling, vertical injection, controlled-flow excavation, and cable protection installation. Cable installation vessels are likely to use dynamic positioning systems while laying the cables. The sound associated with dynamic positioning generally dominates over 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 Section B.5 of Appendix B.

Modeling based on noise data collecting during cable-laying operations in Europe estimates that underwater noise levels would exceed 120 dB re 1 µPa in a 99,000-acre (40,000-hectare) area surrounding the source (Nedwell and Howell 2004; Taormina et al. 2018); the affected area associated with cable-laying activities is expected to be smaller than those modeled for other activities, including pile driving and G&G surveys. A majority of marine mammal species are predicted to exhibit behavioral avoidance responses within 98 to 722 feet (30 to 220 meters) of cable-laying operations and within about 2,100 feet (650 meters) of trenching activities, but may habituate to noise produced during cable laying except when closer (Nedwell et al. 2012).

As the cable-laying vessel and equipment would be continually moving, the ensonified area would also move. Given the mobile ensonified area, a given location would not be ensonified for more than a few hours. Foraging cetaceans are not expected to interrupt foraging activity when exposed to cable-laying noise but may forage less efficiently due to increased energy spent on vigilance behaviors (NMFS 2015). Decreased foraging efficiency could have short-term metabolic effects resulting in physiological stress, but these effects would dissipate once the prey distribution no longer overlaps the mobile ensonified area. Given the mobile nature of the ensonified area and associated temporary ensonification of a given habitat area, it is unlikely that cable-laying noise would result in adverse effects on marine mammals.

Noise: Dredging. Offshore wind activities include dredging for seabed preparation prior to foundation and export cable installation. Underwater noise levels generated by dredging depend on the type of equipment used. The two most common types of dredge equipment used for offshore wind projects are mechanical (e.g., clamshell or backhoe) and hydraulic (i.e., cutterhead). Detailed information about the physical qualities of dredging noise can be found in Section B.5 of Appendix B.

Dredging is unlikely to exceed marine mammal PTS thresholds, but if dredging occurs in one area for relatively long periods, TTS and behavioral thresholds could be exceeded and masking of marine mammal communications may occur (NMFS 2018b; Todd et al. 2015). 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,[10] according to measurements of trailing suction hopper dredge noise 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). Behavioral reactions and masking of low-frequency calls in baleen whales and seals are considered more likely to occur from dredging noise from either type of dredging due to the low-frequency spectrum over which the sounds occur.

Noise: Other site preparation activities (e.g., boulder clearance, pre-lay grapnel run). Prior to offshore wind project foundation and export cable installation, boulder clearance and pre-lay grapnel runs may be conducted to clear the area of obstructions. This may involve the use of a displacement plow, a subsea grab or, in shallower waters, a backhoe dredger (addressed above). Given the low source levels and transitory nature of these sources, exceedances of PTS and TTS levels are not likely.

Noise: UXO detonations. Ongoing and planned offshore wind activities may encounter UXO on the seabed in their offshore wind lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects (i.e., lift-and-shift), some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could cause disturbance and injury to marine mammals. The physical range at which injury or mortality could occur will vary based on the amount of explosive material in the UXO, the size of the animal, and the location of the animal relative to the explosive. Injuries may include hemorrhage 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. If in-situ disposal is required, only one detonation per day, during daylight only, is anticipated. Therefore, the potential for overlapping UXO detonations from nearby projects is unlikely. If overlapping detonations were to occur, they would be instantaneous and limited in the zone of impact. Additional description of effects of UXO/MEC detonations can be found in Section B.5.7.2 of Appendix B.

[10] Heinis et al. (2013) did not evaluate the potential for impacts on other marine mammal species.

Noise: Vessels. Vessels generate low-frequency (generally 10 to 500 Hz) (MMS 2007), non-impulsive, continuous noise that could affect marine mammals. Detailed information about the physical qualities of vessel noise can be found in Section B.5 of Appendix B. Vessel noise overlaps with the hearing range of marine mammals and may cause behavioral responses, stress responses, and masking (Erbe et al. 2018, 2019; Nowacek et al. 2007; Southall et al. 2007). Based on the low frequencies produced by vessel noise and the relatively large propagation distances associated with low-frequency sound, LFC are at the greatest risk of impacts associated with vessel noise.

A comprehensive review of the literature (Erbe et al. 2019; Richardson et al. 1995) 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 and within species, and indicated no direct evidence of hearing impairment, either PTS or TTS, occurring in marine mammals as a consequence of exposure to vessel-generated sound. Physical behavioral responses to vessel noise 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. 2001; 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 (i.e., LFC-weighted received SPL at 328 feet [100 meters] was 133 dB re 1 μPa) compared to control and low-noise conditions (i.e., 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 baleen whales. Rolland et al. (2012) showed that fecal cortisol levels in NARWs decreased following the 9-11 terrorist attacks, when vessel activity was significantly reduced. An increase in stress hormone levels in NARW associated with vessel noise could contribute to suppressed immunity and reduced reproductive rates and fecundity (Hatch et al. 2012). Interestingly, NARWs do not seem to avoid vessel noise or 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 see 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 2004; 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 acoustic activity (Finley et al. 1990; Tsujii et al. 2018). 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, which may interfere with detection of prey and predators and reduce communication distances. 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). Modeling results indicate that vessel noise has the potential to substantially reduce communication distances for both odontocetes and mysticetes (Hatch et al. 2012; Jensen et al. 2009), including NARW.

It Is assumed that construction and installation of each individual offshore wind project would generate approximately 20 to 65 simultaneous construction vessels operating in the geographic analysis area for marine mammals at any given time between 2023 and 2030. This increase in vessel activity could cause repeated, intermittent impacts on marine mammals resulting from short-term, localized behavioral responses, which would dissipate once the vessel or individual leaves the area. 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. BOEM expects behavioral responses to vessel noise to be infrequent given the patchy distribution of marine mammals in the geographic analysis area, and effects of such responses are not expected to be biologically significant (Navy 2018). Therefore, no stock- or population-level effects would be expected.

Noise: Summary of impacts. Underwater noise impacts on marine mammals from ongoing and planned offshore wind activities are anticipated to occur. Noise generated from ongoing and planned offshore wind activities include impulsive (e.g., impact pile driving, UXO detonations, some HRG surveys) and non-impulsive sources (e.g., vibratory pile diving, some HRG surveys, vessels, aircraft, cable laying or trenching, drilling, dredging, other site preparation activities, turbine operations). Of those activities, only pile driving and UXO detonations are anticipated to cause PTS/injury-level effects in marine mammals. Vibratory pile driving of WTG and OSS/ESP foundations could result in PTS if conducted continuously for long time periods. UXO detonation may also cause mortality, slight lung injury, and gastrointestinal tract injury at close range. All noise sources that are audible by a given species have the potential to cause behavioral responses ranging from very low to more severe. All projects are expected to include applicant-proposed measures, as applicable to each activity type (e.g., shutdown zones, clearance zones, protected species observers, PAM usage), similar to the measures included in Vineyard Wind 1 and South Fork, that would minimize underwater noise impacts on marine mammals. The effects of implementing underwater noise impact minimization measures would likely be similar to that described for the Proposed Action in Section 3.5.6.5.

Noise impacts from ongoing and planned offshore wind activities would likely result in moderate short-term impacts for mysticetes (i.e., LFC), odontocetes (i.e., MFC and HFC), and pinnipeds. Impacts on individual marine mammals would be detectable and measurable; however, populations are expected to recover from the impacts. Impacts from noise from ongoing and planned non-offshore wind activities could be moderate for some species, such as ESA-listed species (including NARW), because impacts on an individual could result in population-level effects; however, applicant-proposed measures and agency-required mitigation would be implemented to minimize impacts.

Port utilization: Port expansion or improvement is likely to accommodate the increased size of vessels and increased volume of vessel traffic associated with ongoing and planned offshore wind activities. At least two proposed offshore wind projects are considering port expansion, and other ports along the East Coast may be upgraded (see Appendix D, Section D.2.6 for further details on port improvement and expansion projects). The State of New Jersey is building an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek. 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 Marine Terminal, port expansion may be necessary to accommodate the increased activity, resulting in more significant increases to vessel traffic, dredging, and shoreline construction. USACE has proposed annual maintenance dredging of portions of the Newark Bay federal navigation channel (USACE 2022). Additionally, in 2017 USACE Charleston District awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot (16-meter) deep entrance channel to Charleston Harbor in South Carolina. However, port expansion associated with ongoing and planned offshore wind activities is expected to be only a minor component of port expansion activities associated with all planned activities.

Increased port utilization and expansion would result in increased vessel traffic (i.e., increased vessel noise and increased risk of vessel interactions), increased suspended sediment concentrations, and benthic disturbance during port expansion activities. Effects of vessel noise on marine mammals associated with port utilization are expected to be limited to short-term responses. See the *Noise* IPF discussion for potential marine mammal responses to vessel noise. The increased risk of vessel interactions is evaluated in the *Traffic* IPF discussion. Impacts on water quality associated with increased suspended sediment would be short term and localized, as previously described for the *Cable emplacement and maintenance* IPF in this section. Impacts on marine mammal prey species due to benthic disturbance would be short term and localized. Additionally, the area affected by benthic disturbance would be small compared to available foraging habitat.

Impacts from port utilization from ongoing and planned offshore wind activities on mysticetes (including NARW), odontocetes, and pinnipeds would likely be minor, with effects that would be detectable and measurable (e.g., increases in suspended sediment) 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: An estimated 2,940 WTGs and 43 OSSs/ESPs and met towers could be built in the geographic analysis area for ongoing and planned offshore wind activities. Approximately

4,727 acres (1,913 hectares) of hard scour protection would be installed around the WTG foundations, and an additional 8,158 acres (3,301 hectares) of hard protection would be installed on the seafloor to protect export and interarray cables that cannot be buried to the specified depth (Appendix D, Table D.A2-2). Installation of WTGs and OSSs/ESPs and hard protection could result in hydrodynamic changes, as described below. The presence of these additional structures could also result in entanglement in or ingestion of lost fishing gear that becomes tangled on structures, habitat conversion and prey aggregation (i.e., the artificial reef effect), avoidance or displacement, and behavioral disruption, as described for ongoing activities under *Impacts of Alternative A – No Action*. Potential impacts of planned offshore wind activities would be similar to those for ongoing activities, except the total number of structures expected for planned offshore wind projects would be substantially greater than those described for ongoing offshore wind projects. Although effects from individual structures are highly localized, the presence of an estimated 2,940 foundations could result in widespread but localized impacts. Studies or modeling of regional effects of the presence of offshore wind structures have been completed almost exclusively for regions outside the Atlantic OCS, and these modeling results are quite variable. Recently, the National Academy of Sciences, Engineering, and Medicine reviewed and summarized the oceanographic and atmospheric effects from the presence of offshore wind energy structures (NASEM 2023). The following summarizes Chapter 3, *Hydrodynamic Effects of Offshore Wind Developments*, from that report.

Oceanographic Effects

The physical presence of wind turbines acts as a barrier to hydrodynamic flow compared to baseline flow conditions (no turbines), as well as acting as a source of additional turbulent mixing of water around the foundations. Miles et al. (2021) summarizes existing laboratory and modeling studies that describe the influence of turbine-induced ocean wakes on downstream hydrodynamics. Laboratory studies (Miles et al. 2017) and numerical modeling (Carpenter et al. 2016; Cazenave et al. 2016; Schultze et al. 2020) focused on monopile structures. These studies concluded that the magnitude and extent of the turbine's impact varies depending on the magnitude of the existing ocean currents at a particular location, including subtidal and tidal flows around the structure, the strength of stratification, and the turbine structure geometry and farm layout. Miles et al. (2017) showed that at the individual turbine scale, the peak turbine-induced turbulence occurs within one monopile diameter of the structure, with weaker downstream effects extending up to 8 to 10 monopile diameters from the foundation. This scale of direct influence is confirmed with high-resolution numerical modeling, with modeled turbulence impacts extending up to 100 meters downstream of an individual turbine (Schultze et al. 2020). The types of environmental variables impacted up to 100-meter distance include temperature and suspended sediment (Schultze et al. 2020; Vanhellemont and Ruddick 2014).

Using an idealized one-dimensional mixing parameterization model, Carpenter et al. (2016) estimated that the impact of offshore wind turbines on the duration of typical North Sea seasonal stratification was uncertain. Variations in the turbine structure geometries and layouts alone could produce an expected difference in turbulence produced by a factor of 4.6. Combining this uncertainty with the different possible environmental scenarios of the stratification and turbine-enhanced mixing rates, thermal stratification during a typical summer could possibly be eroded (waters becoming mixed) by a wind farm as rapidly as 37 days or as long as 688 days. The modeled range of durations in which this could occur is shorter and significantly longer than the typical length of seasonal stratification in this [North Sea] region of ~80 days; thus, any modeled duration longer than 80 days would have no impact on the duration of thermal stratification. The modeled variability in turbulence-induced mixing by foundations is dependent on the magnitude of the water velocity moving past the turbine, the strength of stratification and its evolution under turbine-enhanced mixing, and turbine structure differences and wind farm layouts.

Whether or not models predict a cumulative impact from multiple turbine foundation on hydrodynamics is dependent on the relative size of developed areas and number of foundations. Using an unstructured grid model, Cazenave et al. (2016) expanded results for an idealized single turbine to an entire farm of turbines and found a localized weakening of stratification of about 5 to 15 percent of simulated seasonal stratification, consistent with previous results. Carpenter et al. (2016) extended these results to a larger geographic region and included natural ocean current estimates that restore seasonal stratification in the absence of turbines. This analysis showed that physical oceanographic forces can counteract the effect of wind farm-induced mixing when wind farm area coverage is small relative to size of the surrounding continental shelf region. These results for the North Sea are not directly applicable to other regions where ocean conditions vary from those conditions observed and modeled in the North Sea. The impact of turbine-induced ocean wakes on stratification must be evaluated within the context of the shelf-wide physical forces specific to the region that affect seasonal stratification. An important additional difference between results for the North Sea and the U.S. Atlantic OCS is the wider spacing of the turbine structures in the U.S. This is expected to result in a lower concentration of hydrodynamic impacts, other factors being equal (e.g., foundation structure geometry).

Atmospheric Effects

In addition to changes in mixing due to the physical presence of the turbine foundations (monopiles or jackets), wind-driven ocean circulation can potentially be affected via reductions in wind speeds in the lee of a turbine. Since each turbine acts as a momentum sink and source of turbulence, energy extraction from the ambient wind field results in reduced wind speeds downstream of a turbine. The theoretical maximum efficiency of a turbine has been found to be approximately 59 percent (known as the Betz Limit; Betz 1966), and modern offshore wind turbines extract approximately 50 percent of the energy from the wind that passes through the rotor area (DOE 2015), subject to a cutoff wind speed above which wind energy extraction reaches a saturation limit. The maximum reduction in wind speeds is at hub height (in the range of 387 feet [118 meters] to 499 feet [152 meters] above the sea surface; Beiter et al. 2020), with a decay in the wind speed reductions above and below hub height. Xie and Archer (2015) modeled the horizontal and vertical structure of wind turbine wakes and found that while the largest reductions in wind speed are at hub height, the vertical extent of the region of wind speed reductions begins to extend down to the sea surface within a horizontal distance of eight rotor diameters and may become more pronounced beyond this distance. At the scale of an offshore wind farm, wakes have been observed over several tens of kilometers downstream of the wind farm under stable atmospheric stratification conditions (Christiansen and Hasager 2005; Platis et al. 2018). Additionally, modeling studies of the atmosphere have generally reproduced these measured wake effects downstream of wind farms (Fischereit et al. 2021). In the North Sea, Duin (2019) examined wind stress reductions for a large offshore wind farm and reported that typical wind speeds at 33 feet (10 meters) above the sea surface are reduced by up to 3.3 feet per second (1 meter per second), and other effects were observed including increases and decreases in air temperature at various locations around the wind farm, decreases in relative humidity above the wind farm, and decreases in shortwave radiation near the wind farm.

Ocean circulation processes such as upwelling or downwelling are influenced by wind stress at the sea surface. Though the wake behind a single standalone turbine may be unlikely to affect wind-driven circulation, wind stress changes from a large offshore wind farm could occur over spatial scales large enough that wind-driven ocean circulation (e.g., upwelling/downwelling) can be influenced. Several studies have examined the effects of offshore turbines on wind-driven ocean circulation. Most of these studies have focused on the North Sea. Other studies focused on atmospheric circulation, larval transport, and upwelling circulation have been executed for coastal areas on the U.S. east and west coasts. The effect of wind stress reductions on ocean circulation (upwelling/downwelling) were examined using an analytical framework that showed the presence of a wind stress curl-driven upwelling/downwelling dipole in the lee of offshore turbines (Broström 2008). The relation between coastal upwelling and wind farm size was examined by Paskyabi and Fer (2012) and Paskyabi (2015), who found that wakes increase the magnitude of pycnocline (i.e., the boundary layer of water between warmer and colder stratified water) displacements, and in turn, upwelling/downwelling. A recent observational study conducted by Floeter et al. (2022) found the occasional presence of a curl-driven upwelling/downwelling dipole in the vicinity of a wind farm in the North Sea, similar to what was modeled for hypothetical wind farms in the California Current System by Raghukumar et al. (2023). A coupled physical-biological model implemented by Daewel et al. (2022) examined the effects of wind energy extraction by turbines in the southern North Sea and found changes in modeled primary production over a much larger area. While the appearance of an upwelling/downwelling dipole is justified by a clear, mechanistic understanding of the underlying physics, the appearance of changes (Daewel et al. 2022; Raghukumar et al. 2023) in other tracer fields, far from the wind farm areas requires further study, particularly from the point of view of understanding whether these changes are driven by numerical noise in instantaneous wind forcing or if there are indeed mechanistic processes that drive changes far from the wind farms.

Based on available information the potential impacts of ongoing and planned offshore wind projects would be similar to those described for ongoing activities under *Impacts of Alternative A – No Action*. Impacts other than potential prey impacts from hydrodynamic changes from the presence of structures from ongoing and planned activities would likely be minor for mysticetes (including NARW), odontocetes, and pinnipeds; although impacts on individuals would be detectable and measurable, they would not lead to population-level effects for most species. Impacts on odontocetes and pinnipeds may result in minor beneficial effects due to increases in aggregations of prey species. Given the uncertainty as described above, the hydrodynamic effects of offshore wind on prey in some areas, including key foraging grounds for NARWs, the impact on foraging in these areas is unknown but unlikely able to be distinguished from natural variability and the significant impacts of climate change. BOEM is committed to further studying the impacts of offshore wind operations on NARW prey (BOEM 2024).

Traffic: Ongoing and planned offshore wind activities would result in increased vessel traffic due to vessels transiting to and from individual lease areas during construction and installation, O&M, and decommissioning. Vessel strikes are a significant concern for marine mammals, particularly mysticetes, which are relatively slow swimmers, and calves, which spend considerably more time at or near the surface compared to older life stages. Vessel strikes are relatively common for cetaceans (Kraus et al. 2005) and are a known or suspected cause of two active UMEs in the geographic analysis area for cetaceans (humpback whale and NARW) (NMFS 2024a, 2024b). 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). Marine mammals are expected to be most vulnerable to vessel strikes when within the vessel's draft and when not detectable by visual observers (e.g., animal below the surface or poor visibility conditions such as bad weather or low light), and probability of vessel strike increases with increasing vessel speed (Pace and Silber 2005; Vanderlaan and Taggart 2007). Serious injury to cetaceans due to vessel collision rarely occurs when vessels travel below 10 knots (18.5 kilometers per hour) (Laist et al. 2001). Average vessel speeds in the geographic analysis area may exceed 10 knots (18.5 kilometers per hour), indicating that vessel traffic associated with ongoing and planned offshore wind activities may pose a collision risk for marine mammals.

It is assumed that construction and installation of each individual offshore wind project would generate approximately 20 to 65 simultaneous construction vessels operating in the geographic analysis area for marine mammals at any given time between 2023 and 2030. Vessels used during construction and installation range in size from larger heavy-lift vessels and heavy transport vessels to smaller CTVs. Once projects are operational, they would be serviced by CTVs and service operations vessels (SOVs) making routine trips between the wind farms and port-based O&M facilities. CTVs generally make one round-trip per week while service operations vessels would make trips on an as-needed basis. Based on information available in COPs for ongoing and planned offshore wind projects (e.g., Dominion Energy 2022; Empire 2022; Revolution Wind 2022; Sunrise Wind 2022), it is assumed that annual O&M vessel trips could range from 76 CTV and service operations vessel trips to up to 518 vessel trips. Unplanned maintenance activities would require the periodic use of larger vessels of the same class used for project construction and installation. Unplanned maintenance would occur infrequently, dictated by equipment failures, accidents, or other events. The number and size of CTVs 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.

Vessel activity associated with ongoing and planned offshore wind activities is expected to peak in 2026. Vessel collision risk is expected to be highest during construction and installation, when traffic volumes would be greatest; risk of collisions is expected to be highest when vessels are transiting to and from offshore wind lease areas. Within offshore wind lease areas, vessels are expected to be largely stationary and to travel at slow speeds when transiting between locations within the offshore wind lease area. The increase in traffic associated with ongoing and planned offshore wind activities would only be a small, incremental increase in overall traffic in the geographic analysis area. Therefore, the traffic impacts contributed by offshore wind activities would not increase the overall level of traffic impacts beyond those described for ongoing and planned non-offshore wind activities. Marine mammal vessel strikes are possible; however, the risk is low. Developers would be required to abide by several vessel strike avoidance measures during construction and installation and O&M. If a vessel strike from ongoing and planned offshore wind activities (without the Proposed Action) did occur, the outcome could range from no apparent injury to mortality. As discussed in Section 3.5.6.3, the speed and size of a vessel influences the outcome.

Impacts from traffic (i.e., vessel strikes) from ongoing and planned activities would likely be long-term and major for NARW, having the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species, and moderate for mysticetes (except for NARW). The impacts of traffic (i.e., vessel strikes) on odontocetes and pinnipeds from ongoing and planned activities would be minor because population-level effects are unlikely, although consequences to individuals would be detectable and measurable. Additionally, BOEM expects minimization measures for vessel impacts would be required for planned offshore wind activities, further reducing the risk of injury or mortality for marine mammals. If those measures are successful in avoiding vessel strikes, there would be no impact on marine mammal species from ongoing and planned offshore wind activities due to this IPF.

Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, BOEM would not approve Atlantic Shores' COP. As such, effects from construction and installation, and O&M of the Atlantic Shores South Project would not occur. Baseline conditions of the existing environment would remain unchanged. Therefore, not approving the COP would have no additional incremental effect on marine mammals. Similarly, NMFS' No Action Alternative (i.e., not issuing the requested incidental take authorization) would also have no additional incremental impact on marine mammals and their habitat.

Under the No Action Alternative, ongoing stressors and activities contributing to baseline conditions would result in a range of temporary to long-term impacts (e.g., disturbance, displacement, injury, mortality, and reduced foraging success) on marine mammals. Climate change would continue to affect marine mammal foraging and reproduction through changes to the distribution and abundance of marine mammal prey. Vessel activity (i.e., vessel collisions) and gear utilization associated with ongoing non-offshore wind activities would continue to cause long-term detectable and measurable injury and mortality of individual marine mammals. Underwater noise from pile driving during construction of offshore wind structures would also result in detectable impacts on marine mammals; however, these impacts would be short term. Accidental releases, discharges/intakes, EMF, the presence of structures, cable emplacement and maintenance, port utilization, and lighting would also result in long-term negligible or minor impacts on marine mammals. Although impacts on individual marine mammals and their habitat are anticipated from offshore wind activities, the level of impacts would be minimized due to the mitigation measures that are being implemented during construction and installation and O&M. The No Action Alternative, in consideration of baseline and ongoing activities (both non-offshore wind and offshore wind), would result in negligible to moderate impacts across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds. Considering all IPFs together, the No Action Alternative would result in **moderate** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds because impacts would be of medium intensity. The No Action Alternative may also result in **minor beneficial** impacts on odontocetes and pinnipeds from the artificial reef effect.

Because of the low population size for the NARW and continuing stressors, population-level effects on NARWs are occurring. Vessel activity (i.e., vessel collisions) and gear utilization associated with ongoing non-offshore wind activities would continue to result in long-term population-level impacts as serious injury or loss of a single individual from vessel strike or entanglement could threaten the viability of the species. The effects of climate change, which reduce the health and resilience of the population, would further exacerbate impacts on this species. For NARW, impacts of the No Action Alternative, considering baseline conditions, would range from negligible to major long-term impacts across individual IPFs. Considering all IPFs together, the No Action Alternative, including the baseline, would result in **major** impacts on NARW because the mortality and morbidity rates from existing and likely ongoing entanglement and vessel strikes are significantly exceeding birth rates, compromising the viability of the species (i.e., severe population-level effects). Ongoing offshore wind construction and installation and O&M activities would be conducted with applicant-proposed and agency-required mitigation measures developed to avoid and minimize impacts on NARW, so impacts from offshore wind activities are not anticipated to substantially contribute to the major impacts.

Cumulative Impacts of Alternative A – No Action.

Under the No Action Alternative, existing environmental trends and ongoing activities would continue in addition to cumulative impacts from planned offshore wind activities. Mysticetes, odontocetes, and pinnipeds would continue to be affected by natural and human-caused IPFs. Planned non-offshore wind activities would also contribute to impacts on marine mammals. Planned non-offshore wind activities include increased 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.

Cumulative impacts to NARW are in many cases more severe than otherwise similar impacts to other marine mammal species. Due to the declining status of the NARW population, impacts that lead to loss or reduced fitness of even one individual could compromise the viability of the species, which would constitute a major impact per the definitions provided in Section 3.5.6.2. Offshore wind construction and installation, operation, and maintenance activities would be conducted with applicant-proposed and agency-required mitigation measures developed to minimize impacts on NARW; therefore, impacts from offshore wind activities are not expected to substantially contribute to the existing major impacts from the baseline conditions described above.

On this basis, BOEM anticipates that the cumulative impacts of the No Action Alternative would range from negligible to moderate across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds. Considering all IPFs together, cumulative impacts of the No Action Alternative would be **moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds because impacts would be of medium intensity. Moderate impacts would be primarily driven by underwater noise impacts, vessel activity (i.e., vessel collisions), entanglement, and seabed disturbance and the lack of knowledge regarding any mitigation and monitoring requirements for planned non-offshore wind activities. Cumulative impacts on NARW would be **major** due to existing and likely ongoing entanglement and vessel strike that significantly exceed birth rates, leading to existing severe population-level effects.

3.5.6.4 Relevant Design Parameters and Potential Variances in Impacts

This Final EIS analyzes the maximum-case scenario; any potential variances in the proposed 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 marine mammals:

- Foundation types used for WTGs, OSSs, and met tower;
- Hammer energy;
- The number of foundations installed;
- The number of days of pile driving;
- The size of foundations installed;
- Vessels and ports; and
- Mitigation and monitoring measures.

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

- WTG, OSS, and met tower foundation types: the type(s) of foundation installed affect(s) the impacts associated with installation.
- WTG, OSS, and met tower foundation number: the number of foundations installed affects the duration of potential pile driving. The more foundations, the greater the number of pile-driving days.
- WTG, OSS, and met tower foundation size: the size of the pile (if a piled foundation is selected) affects the amount of noise produced during pile driving and thus the size of the ensonified area. Generally, a larger pile would result in a larger ensonified area.

- Hammer energy: the hammer energy affects the amount of noise produced during pile driving and thus the size of the ensonified area. The hammer energy also affects the duration of a single pile-driving event. Generally, a larger hammer would result in a larger ensonified area but a shorter event duration.
- Indicative duration of foundation installation: the duration of pile installation affects the number of pile-driving days. The longer the duration, the greater the number of pile-driving days.

Although variation is expected in the design parameters, the impact assessments in Sections 3.5.6.5 through 3.5.6.8 evaluate impacts associated with the maximum-case scenario for marine mammals identified in Appendix C.

3.5.6.5 Impacts of Alternative B – Proposed Action on Marine Mammals

Under the Proposed Action, baseline conditions for marine mammals (see Section 3.5.6.1) would continue to follow current regional trends within the geographic analysis area. Under Alternative B, BOEM would approve the COP for the Proposed Action. As described in Section 2.1.2, *Alternative B – Proposed Action,* the Proposed Action includes the construction of up to 200 WTGs, 10 OSSs, and 1 permanent met tower and the installation of up to 547 miles (880 kilometers) of interarray cables, 37 miles (60 kilometers) of interlink cables, and 441 miles (710 kilometers) of export cables between 2025 and 2028. The Proposed Action also includes 30 years of O&M over its commercial lifespan and decommissioning activities at the end of commercial life.

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.

Offshore Activities and Facilities

Accidental releases: The Proposed Action may increase the risk of accidental releases of fuels, fluids, and hazardous materials and trash and debris. The risk of any type of accidental release would be increased primarily during construction and installation when additional vessels are present and during the proposed refueling of primary construction vessels at sea, but also during O&M and decommissioning. However, accidental releases are considered unlikely. Lessees must conduct all authorized activities in a manner that prevents unauthorized discharge of pollutants including marine trash and debris into the offshore environment (30 CFR 285.105). USCG similarly prohibits the dumping of environmentally damaging trash or debris (International Convention for the Prevention of Pollution from Ships, Annex V, Public Law 100−220 (101 Stat. 1458). All Project vessels would also comply with USCG regulations for the prevention and control of oil spills (33 CFR Part 155) (WAT-05; Appendix G, Table G-1), further reducing the likelihood of an accidental release. Atlantic Shores has also developed an OSRP with measures to prevent accidental releases and a protocol to respond to such a release (WAT-03; Appendix G, Table G-1). However, the Proposed Action would not increase the risk of accidental releases beyond that described under the No Action Alternative. The combined regulatory requirements and applicant-proposed measures would effectively avoid accidental debris releases and avoid and minimize the impacts from accidental spills such that adverse effects on marine mammals would be unlikely to occur. Therefore, there is no anticipated effect on marine mammals, and impacts on mysticetes (including the NARW), odontocetes, and pinnipeds from accidental releases would be negligible, with no perceptible individual or population-level consequences.

Cable emplacement and maintenance: The Proposed Action would involve the placement of 1,025 miles (1,650 kilometers) of export, interlink, and interarray cables and the disturbance of approximately 4.1 square miles (10.6 square kilometers) of seabed for the emplacement of export cables (including anchoring disturbance) and 3.4 square miles (8.7 square kilometers) of seabed for the emplacement of interarray cables (Appendix D, Table D.A2-2). As described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals,* cable emplacement and maintenance activities disturb bottom sediment, temporarily increasing suspended sediment concentrations, which could result in behavioral effects on marine mammals or effects on marine mammal prey species. Cable emplacement is expected to affect only a small percentage of available benthic habitat, and any effects on marine mammals or their prey species would be localized and short term. Recolonization and recovery of benthic species is expected to occur within 2 to 4 years of emplacement (Van Dalfsen and Essink 2001) but could occur in as little as 100 days (Dernie et al. 2003).

BOEM anticipates short-term and localized seafloor disturbances and increases in turbidity from interarray cable installation would result in undetectable, negligible impacts on mysticetes (including the NARW), odontocetes, and pinnipeds, with no perceptible population-level consequences. Suspended sediment concentrations during the proposed cable-laying activities would be within the range of natural variability for this location, and above-ambient suspended sediment concentrations would be expected to settle relatively quickly (i.e., within a few hours). 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 mysticetes (including the NARW), odontocetes, and pinnipeds would be expected given the localized and temporary nature of the potential impacts.

Cable emplacement and maintenance for the Proposed Action may require sand bedform removal. Potential methods for removal include trailing suction hopper dredge, as well as cutterhead or backhoe dredging in limited areas. Dredging would result in increased suspended sediment concentrations, similar to cable emplacement equipment as described above, and would have the potential to result in physical interactions with the dredge (i.e., entrainment, impingement, or capture). Marine mammals are large relative to the dredging equipment (i.e., not vulnerable to entrainment) and would have to be on the seafloor or in the water column directly below the dredge for impingement to occur. Therefore, physical interactions between a hydraulic or mechanical dredge and marine mammals are unlikely to occur. The physical presence of dredging vessels and equipment could potentially displace marine mammals. However, given the limited spatial extent predicted for dredging, any impact on marine mammals would be so small that it could not be meaningfully evaluated. Given the limited spatial extent of the area where dredging would occur, the short duration of dredging, and those individual marine mammals, if present, would be expected to successfully forage in nearby areas not affected by increased sedimentation, the potential impacts of dredging on mysticetes (including the NARW), odontocetes, and pinnipeds, including entrainment, displacement, and impacts on prey species, would be negligible.

Discharges/intakes: The Proposed Action would result in increased vessel traffic, potentially resulting in increases in discharges of ballast water and bilge water. As described under *Impacts of Alternative A – No Action*, vessel operators are required to comply with USCG and USEPA regulations governing discharge of ballast or bilge water that effectively avoid the likelihood of non-native species invasions through Project vessel discharges. Therefore, there is no anticipated effect on marine mammals, and impacts on mysticetes (including the NARW), odontocetes, and pinnipeds from discharges would be negligible, with no perceptible individual or population-level consequences.

Atlantic Shores is exploring the use of closed-loop cooling technologies for offshore HVDC converter stations, which would eliminate entrainment and impingement at these stations. Entrainment and impingement of marine mammal prey organisms would occur at intakes for cable-laying equipment. Effects of entrainment on prey species are assessed in Section 3.5.5 and are expected to be negligible. Therefore, impacts on mysticetes (including the NARW), odontocetes, and pinnipeds from intakes would be negligible as no individual fitness or population-level impacts for marine mammals would be expected to occur.

Electric and magnetic fields and cable heat: During operation, the Proposed Action would result in the production of EMF, which may be detectable by marine mammals (NMFS 2021f), as described in Section 3.5.6.3. However, to be exposed to EMF above the 50 mG detection threshold for marine mammals, an individual would have to be within 3 feet (0.9 meters) of a cable that is lying on the surface of the seafloor. Atlantic Shores would bury cables to a minimum depth of 5 to 6.6 feet (1.5 to 2 meters) wherever possible (GEO-07; Appendix G, Table G-1). In areas where sufficient cable burial is not feasible, surface cable protection would be utilized. Cable burial and surface protection, where necessary, would minimize EMF exposure. Currently, no scientific evidence of marine mammal responses to EMF associated with underwater cables exists. The 50-milligauss detection threshold is theoretical and an order of magnitude lower than the lowest observed magnetic field strength resulting in observed behavioral responses (Normandeau et al. 2011). These factors indicate that the likelihood of marine mammals encountering detectable EMF effects is low, and any exposure would be below levels associated with measurable biological effects. Therefore, EMF effects on mysticetes (including the NARW), odontocetes, and pinnipeds would be at the lowest level of detection and negligible, with no perceptible population-level consequences.

Heat from Project cables would not impact marine mammals. Above-sediment cables would be cooled by the water, while heat from buried cables would be restricted to sediments (Taormina et al. 2018).

Gear utilization: Monitoring surveys for the Proposed Action include otter trawl surveys, trap surveys, hydraulic clam dredge surveys, grab sampling, and underwater imagery. As described in Section 3.5.6.3, survey gear could affect marine mammals through entanglement or entrapment. Monitoring surveys also have the potential to collect prey species for some marine mammals. See Section 3.5.5, *Finfish,* *Invertebrates, and Essential Fish Habitat*, for an assessment of the impacts of gear utilization on marine mammal prey species.

Trawl nets pose a discountable threat to mysticetes (NMFS 2016a), and the slow speed of mobile gear and the short tow times (less than 30 minutes) further reduce the potential for entanglements or other interactions. Fish traps and the anchoring lines and buoys used to secure them may pose an entanglement risk to marine mammals, although these risks would be mitigated because trap surveys would utilize groundlines, ropeless gear, and biodegradable components wherever possible, given any logistical or permitting constraints. Therefore, impacts on marine mammals from traps are expected to be negligible based upon the limited number of associated buoy lines, the short duration of sampling events, and the low probability for gear entanglement. Both surveys would comply with the Atlantic Large Whale Take Reduction Program, Harbor Porpoise Take Reduction Program, and Bottlenose Dolphin Take Reduction Program regulations. Given the short-term, low-intensity, and localized nature of the impacts of gear utilization for the Proposed Action, as well as the proposed mitigation and minimization measures, it is not likely that marine mammals would be entangled or entrapped in gear used for monitoring. The impact of gear utilization as a result of the Proposed Action, therefore, is expected to be negligible and with no perceptible population-level consequences for mysticetes (including NARW), odontocetes, and pinnipeds.

Lighting: The Proposed Action would introduce stationary artificial light sources in the form of navigation, safety, and work lighting. 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 (including the NARW), odontocetes, and pinnipeds would be non-measurable and negligible, with no perceptible individual or population-level consequences.

Noise: Underwater anthropogenic noise sources associated with construction and installation, O&M, and decommissioning of the Proposed Action would include G&G surveys, pile driving, cable laying, vessels, noise from operational WTGs, and potentially aircraft. A detailed description of the noise produced during these activities can be found in Section B.5 of Appendix B. As described in Section 3.5.6.3, these noise sources have the potential to affect marine mammals through behavioral or physiological effects. Underwater sound propagation modeling for impact pile driving was conducted in support of the COP (Volume II, Appendix II-L; Atlantic Shores 2024) and is summarized in Section 5 of Appendix B. Potential impacts associated with each Project-related noise source are discussed separately in the following paragraphs.

Noise: Aircraft. Aircraft may be used to support construction and installation of the Proposed Action. Helicopters may be used for crew transfer operations or visual inspection of equipment during installation. Atlantic Shores may utilize fixed-wing aircraft to support environmental monitoring and mitigation during construction and installation activities. As described in Section 3.5.6.3, aircraft traveling at relatively low altitude have the potential to elicit short-term behavioral responses in marine mammals. BOEM assumes aircraft transiting to and from the Offshore Project area would fly at sufficient altitudes to avoid behavioral effects on marine mammals, with the exception of WTG inspections, take-off, and landing. Additionally, Project aircraft would comply with current approach regulations for NARWs. Any behavioral responses elicited during low-altitude flight would be temporary, dissipating once the aircraft leave the area, and are not expected to be biologically significant.

Noise: G&G surveys. HRG surveys may be conducted during construction and installation to support site characterization activities, siting, and engineering design of the WTGs, OSSs, met tower, and export cables. As described in Section 3.5.6.3, survey noise could affect marine mammals through stress, disturbance, and behavioral responses. HRG survey equipment produces less-intense noise and operates in smaller areas than other G&G survey equipment (e.g., seismic air guns) and is unlikely to result in injury given that sound levels diminish rapidly with distance from the survey equipment (BOEM 2018). To evaluate noise impacts of HRG surveys, Atlantic Shores assumes HRG survey activities would commence during 2025 and estimates that a maximum of 60 survey days would occur per year over the subsequent 5 years (i.e., from 2025 through 2029). The maximum seasonal marine mammal densities to assess impacts on marine mammals for HRG surveys are provided in Table 3.5.6-7. Results of the noise evaluation for HRG survey activity, including estimated exposures and proposed take, are provided in Table 3.5.6-8.

Table 3.5.6-7. Maximum seasonal marine mammal densities used to analyze the annual HRG surveys for the Project area

Species	Maximum Seasonal Density[1,2] Animals/39 Square Miles (100 Square Kilometers)
Mysticetes	
Fin whale	0.114
Humpback whale	0.090
Minke whale	0.401
North Atlantic right whale	0.056
Sei whale	0.031
Odontocetes	
Atlantic spotted dolphin	0.033
Atlantic white-sided dolphin	0.278
Bottlenose dolphin	36.269
Common dolphin	1.473
Harbor porpoise	2.506
Long-finned pilot whale	0.004
Risso's dolphin	0.017
Short-finned pilot whale	0.003
Sperm whale	0.005
Pinnipeds	
Gray seal	4.319
Harbor seal	9.704

Source: Table 11 in NMFS 2023b.

[1] Based on waters within and around Lease Area OCS-A 0499 and the export cable routes.

[2] Density estimates are from habitat-based density modeling of the entire U.S. Atlantic EEZ from Roberts et al. (2016b, 2023).

Table 3.5.6-8. Calculated exposures and proposed take by behavioral disturbance (Level B harassment) during annual HRG surveys for the Atlantic Shores South survey area

Species	Exposures[1]
LFC	
Fin whale	2
Humpback whale	1
Minke whale	4
North Atlantic right whale	1
Sei whale	1
MFC	
Atlantic spotted dolphin	1
Atlantic white-sided dolphin	3
Bottlenose dolphin, coastal	113
Bottlenose dolphin, offshore	225
Common dolphin	14
Long-finned pilot whale	1
Risso's dolphin	1
Short-finned pilot whale	1
Sperm whale	1
HFC	
Harbor porpoise	24
Pinnipeds	
Gray seal	41
Harbor seal	91

Source: Table 23 in NMFS 2023b.

[1] If issued, the amount and manner of take authorized by NMFS would be identified in any final ITA. The amount of take authorized by NMFS may consider additional data sources (e.g., PSO data, group sizes) and may differ from the exposure estimates. Please see NMFS' website for more information, https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.

Atlantic Shores has proposed measures to avoid or minimize impacts of HRG survey noise on marine mammals, including utilization of protected species observers, who would be equipped with night vision devices, to monitor and enforce appropriate clearance and shutdown zones (MAR-07, MAR-08; Appendix G, Table G-1), and ramp-up and ramp-down procedures (MAR-12; Appendix G, Table G-1). Additionally, any G&G surveys conducted for the Proposed Action would comply with Project-specific Incidental Take Regulations, which would include measures to minimize impacts. Any impacts on individual marine mammals associated with G&G surveys for the Proposed Action would be short term and are not expected to result in stock- or population-level effects.

Noise: Impact and vibratory pile driving. The loudest source of underwater noise associated with the Proposed Action would be impact pile driving for WTG, OSS, and met tower foundation installation during construction and installation. Vibratory pile driving would be conducted in nearshore Project areas for the installation and removal of temporary cofferdams. Pressure amplitudes from vibratory pile driving are lower compared to those of impact pile driving (Tsouvalas and Metrikine 2014). As described in Section 3.5.6.3, pile driving can result in physiological and behavioral effects on marine mammals. As noted above, underwater sound propagation modeling for impact pile driving was conducted in support of the COP (Volume II, Appendix II-L; Atlantic Shores 2024).

Generally, in order to predict the number of individuals of a given species that may be exposed to harmful levels of sound from a specific activity, a series of modeling exercises are conducted. First, the sound field of a sound-generating activity is modeled based on characteristics of the source and the physical environment. From the sound field, the range to the U.S. regulatory acoustic threshold isopleths, described in Section 3.5.6.3 and in greater detail in Section B.5 of Appendix B, can be predicted. This approach is referred to as acoustic modeling. By overlaying the marine mammal density information for a certain species or population in the geographical area of the activity, the number of animals exposed within the acoustic threshold isopleths is then predicted. This is called exposure modeling. Some models further incorporate animal movement to make more realistic predictions of exposure numbers. Animal movement models may incorporate behavioral parameters including swim speeds, dive depths, course changes, or reactions to certain sound types, among other factors. Exposure modeling may be conducted for a range of scenarios including different seasons, hammer energy, mitigation strategies (e.g., 6 dB versus 10 dB of attenuation), and levels of effort (e.g., number of piles per day).

Modeling for the Project included two different pile diameters (39 feet [12 meters] and 49 feet [15 meters]) two different pile-driving scenarios for monopiles: one monopile per day or two monopiles per day. As the impacts associated with the 49-foot- (15-meter-) diameter monopiles were greater, the 39-foot (12-meter) monopiles were not carried forward in the analysis presented in this Final EIS. Modeling also included two different types of jacket foundation installation: pre-piled and post-piled. See Section 5 of Appendix B for a more detailed description of underwater noise modeling for the Project.

MMPA regulations define two levels of marine mammal harassment that fall under the term "take" as prohibited by the MMPA:

- Level A harassment: any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild, and
- Level B harassment: any act of pursuit, torment or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild (16 U.S.C. 1362).

To estimate radial distances to PTS thresholds (i.e., Level A harassment) for impact pile driving, NMFS (2018) hearing-group-specific, dual-metric thresholds for impulsive noise were used (Table 3.5.6-6). See Section B.5 of Appendix B for a discussion of acoustic thresholds for marine mammals. When expected marine mammal movements in the Offshore Project area are modeled, exposure ranges ($ER_{95\%}$) can be estimated. These ranges represent the radial distance from a pile-driving noise source that encompassed the closest point of approach for 95 percent of simulated animals (animats) exposed above relevant cumulate SEL injury thresholds. For further explanation of $ER_{95\%}$, see COP Volume II,

Appendix II-L, Section 2.7 (Atlantic Shores 2024). Exposure range estimates to PTS thresholds for 39-foot (12-meter) monopiles, 49-foot (15-meter) monopiles (i.e., the maximum foundation pile diameter modeled), and 16-foot (5-meter) pin piles (i.e., the maximum strike number modeled), with 10 dB noise mitigation, are presented in Table 3.5.6-9.

To estimate radial distances to behavioral thresholds, NMFS' impulsive noise threshold for Level B harassment under the MMPA was used (L_{rms} of 160 dB re 1 µPa). See Section B.5 of Appendix B for a discussion of acoustic thresholds for marine mammals. Maximum acoustic range estimates (i.e., the greatest of the two modeled locations) to the behavioral disturbance threshold for 39-foot (12-meter) monopiles, 49-foot (15-meter) monopiles (i.e., the maximum foundation pile diameter modeled), and 16-foot (5-meter) pin piles (i.e., the maximum strike number modeled), with 10 dB noise mitigation, are presented in Table 3.5.6-10.

Table 3.5.6-9. Exposure ranges ($ER_{95\%}$) (kilometers) to marine mammal PTS (SEL; Level A harassment) thresholds during impact pile driving, assuming 10 dB attenuation

Species	12-Meter Monopiles		15-Meter Monopiles		5-Meter Pin Piles	
	One Pile/Day	Two Piles/Day	One Pile/Day	Two Piles/Day	Four Piles/Day (Pre-Piled)	Four Piles/Day (Post-Piled)
LFC						
Fin whale	1.09	1.30	1.81	1.83	1.80	1.90
Humpback whale	1.08	1.01	1.25	1.29	1.07	1.56
Minke whale	0.33	0.38	0.35	0.41	0.40	0.69
North Atlantic right whale	0.56	0.67	0.72	0.72	0.73	1.06
Sei whale[1]	1.09	1.30	1.81	1.83	1.80	1.90
MFC						
Atlantic spotted dolphin	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic white-sided dolphin	0.00	0.00	0.00	0.00	0.00	0.01
Bottlenose dolphin, coastal	0.00	0.00	0.00	0.00	0.00	0.00
Bottlenose dolphin, offshore	0.00	0.00	0.00	0.00	0.00	0.00
Common dolphin	0.00	0.00	0.00	0.00	0.00	0.00
Long-finned pilot whale	0.00	0.00	0.00	0.00	0.00	0.00
Risso's dolphin	0.00	0.00	0.00	0.00	<0.01	<0.01
Short-finned pilot whale	0.00	0.00	0.00	0.00	0.00	0.00
Sperm whale	0.00	0.00	0.00	0.00	0.00	0.00
HFC						
Harbor porpoise	0.39	0.32	0.26	0.28	1.11	1.48
Pinnipeds						
Gray seal	0.01	0.00	0.02	0.00	0.15	0.24
Harbor seal	<0.01	<0.01	<0.01	<0.01	0.16	0.32

Source: Table 13 in NMFS 2023b.

[1] Fin whale exposure ranges are used as a proxy for sei whales.

Table 3.5.6-10. Flat Acoustic ranges (Flat $R_{95\%}$) (kilometers) to marine mammal behavioral disturbance (160 dB re 1 µPa SPL; Level B harassment) threshold during impact pile driving, not assuming 10 dB attenuation

Pile Type	Maximum Acoustic Range[1, 2]
12-meter monopile	4.26
15-meter monopile	4.31
5-meter pin pile (pre-piled)	2.47
5-meter pin pile (post-piled)	2.81

Source: Corrected values from Table 15 in NMFS 2023b.

[1] The greatest of the acoustic range estimates between the two modeled locations (i.e., L01 for all pile types).

[2] NMFS flagged a technical error that was made in the proposed rulemaking; the values presented here are representative of the values after corrections were made.

Marine mammal noise exposure was modeled for three construction schedules. Schedule 2, a 2-year construction schedule with monopiles used for the 111 WTG foundations and 1 met tower foundation in Project 1, with one monopile installed per day, and four-legged jacket foundations used for the 89 WTG foundations in Project 2, with four pin piles installed per day, resulted in the highest number of marine mammal exposures. Exposure estimates and proposed take, assuming 10 dB of noise attenuation, are provided in Table 3.5.6-11.

Table 3.5.6-11. Maximum exposure estimates and proposed takes by PTS (Level A harassment) and behavioral disturbance (Level B harassment) for foundation installation activities, assuming Schedule 2[1] and 10 dB attenuation

Species	Estimated Exposures[2,3]	
	PTS	Behavioral Disturbance
LFC		
Fin whale	6.26	17.43
Humpback whale	5.22	15.97
Minke whale	26.34	277.10
North Atlantic right whale	0.38	2.55
Sei whale	0.76	2.13
MFC		
Atlantic spotted dolphin	0	0
Atlantic white-sided dolphin	0.02	331.31
Bottlenose dolphin, coastal	0	50.32
Bottlenose dolphin, offshore	0	6,517.32
Common dolphin	0	0
Long-finned pilot whale	0	0
Risso’s dolphin	<0.01	11.61
Short-finned pilot whale	0	0
Sperm whale	0	0
HFC		
Harbor porpoise	13.90	89.08
Pinnipeds		
Gray seal	2.52	192.76
Harbor seal	8.32	448.91

Source: Table 19 in NMFS 2023b.

[1] Schedule 2: one 49-foot-diameter (15-meter-diameter) WTG or met tower monopile and four 16-foot-diameter (5-meter-diameter) OSS jacket piles per day in Year 1 and four 16-foot-diameter (5-meter-diameter) WTG jacket piles and four 16-foot-diameter (5-meter-diameter) OSS jacket piles per day in Year 2.

[2] Summed across the 2 years of foundation installation (i.e., 2026 and 2027).
[3] If issued, the amount and manner of take authorized by NMFS would be identified in any final ITA. The amount of take authorized by NMFS may consider additional data sources (e.g., PSO data, group sizes) and may differ from the exposure estimates. Please see NMFS' website for more information, https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.

Given the large radial distances to PTS and behavioral thresholds, noise impacts associated with pile driving for the Proposed Action could occur. Atlantic Shores has proposed measures to avoid or minimize impacts of pile-driving noise on marine mammals, including utilization of protected species observers to monitor and enforce appropriate clearance and shutdown zones (MAR-07, MAR-08; Appendix G, Table G-1), passive acoustic monitoring and night vision devices (e.g., night vision binoculars, infrared cameras) to detect marine mammals during low-visibility conditions (i.e., nighttime hours or inclement weather) (MAR-08, MAR-09; Appendix G, Table G-1), noise attenuation systems and use of soft starts (MAR-12; Appendix G, Table G-1), scheduling pile driving to avoid completion after dark (MAR-11; Appendix G, Table G-1), and seasonal pile-driving restrictions with no pile driving occurring between January and April to minimize risks to NARW (MAR-10; Appendix G, Table G-1). NMFS may require through the final rule for incidental take of marine mammals that additional coordination with federal agencies occur prior to any pile-driving activity to occur in December. If adopted in the final rule it could confer additional precautions in the month of December. Additionally, Atlantic Shores has committed to investigate the application of acoustic technologies, autonomous underwater vehicles, and unmanned aerial systems to monitor for protected species (MAR-13, MAR-14, and MAR-15; Appendix G, Table G-1).

Vibratory pile driving would be used for installation of temporary offshore cofferdams at the exit point of HDD for each of the export cable landfalls. Non-impulsive noise associated with vibratory pile driving has the potential to result in physiological or behavioral effects in marine mammals. Sound measurements by Illingworth and Rodkin (2017) were used to conduct underwater sound propagation modeling for vibratory pile driving of the temporary cofferdams to support Atlantic Shores' LOA application. To estimate radial distances to PTS and behavioral thresholds for vibratory pile driving of cofferdams, NMFS (2018) hearing-group specific injury thresholds for non-impulsive noise (Table 3.5.6-6) and NMFS non-impulsive, continuous noise threshold for Level B harassment under the MMPA (L_{rms} of 120 dB re 1 µPa) were used. The maximum monthly marine mammal densities to assess impacts on marine mammals for vibratory pile driving are provided in Table 3.5.6-12. Acoustic ranges to injury thresholds are expected to range from up to approximately 0 feet (0 meters) for MFC to up to 1,772 feet (540 meters) for HFC (Table 3.5.6-13). Marine mammals belonging to any hearing group that approach within up to 7.00 miles (11.27 kilometers) of vibratory pile driving may experience sound levels exceeding the behavioral threshold (Table 3.5.6-13).

Table 3.5.6-12. Maximum monthly[1] marine mammal density estimates (in animals/39 square miles [100 square kilometers])[2] used to analyze vibratory pile driving for cofferdam installation and removal

Common name	Monmouth Landfall	Atlantic Landfall
Mysticetes		
Fin whale	0.117	0.052
Humpback whale	0.132	0.114
Minke whale	0.526	0.136
North Atlantic right whale	0.035	0.092
Sei whale	0.046	0.018
Odontocetes		
Atlantic spotted dolphin	0.033	0.014
Atlantic white-sided dolphin	0.206	0.051
Bottlenose dolphin (northern coastal stock)	27.795	146.614
Bottlenose dolphin (offshore stock)	22.530	0.000
Common dolphin	2.058	0.524
Harbor porpoise	2.768	0.821
Long-finned pilot whale	0.000	0.000
Risso's dolphin	0.020	0.002
Short-finned pilot whale	0.000	0.000
Sperm whale	0.008	0.002
Pinnipeds		
Gray seal	4.477	9.029
Harbor seal	10.059	20.287

Source: Table 10 in NMFS 2023b.
[1] Based on September through May.
[2] Density estimates are from habitat-based density modeling of the entire U.S. Atlantic EEZ from Roberts et al. (2016b, 2023).

Table 3.5.6-13 Acoustic ranges ($R_{95\%}$) to PTS (Level A harassment) and behavioral disturbance (Level B harassment) thresholds for vibratory pile driving during temporary cofferdam installation and removal

Hearing Group	Atlantic Landfall				Monmouth Landfall			
	PTS (meters) SEL		Behavioral Disturbance (kilometers) L_{rms}		PTS (meters) SEL		Behavioral Disturbance (kilometers) L_{rms}	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
LFC	65	65	5.076	7.546	45	60	5.412	11.268
MFC	0	0			0	0		
HFC	490	540			425	450		
Pinnipeds	30	30			20	20		

Source: Table 20 in NMFS 2023b.

Given the small radial distances to injury thresholds and relatively shallow waters in which vibratory pile driving for cofferdam installation would occur, marine mammals are unlikely to be exposed to noise levels exceeding injury criteria.

Based on the large radial distances to the behavioral threshold, behavioral effects associated with vibratory pile driving could occur. Animal movement modeling results estimated that marine mammals exposed to sound levels exceeding the behavioral threshold range from less than 1 long-finned pilot whale, Risso's dolphin, short-finned pilot whale, and sperm whale to as many as approximately 2,443 bottlenose dolphins from the coastal stock (Table 3.5.6-14).

Table 3.5.6-14. The maximum predicted behavioral disturbance (Level B harassment) exposures and proposed take for cofferdam activities

Species	Exposure Estimates[1, 2]
LFC	
Fin whale	4.79
Humpback whale	6.13
Minke whale	20.36
North Atlantic right whale	2.38
Sei whale	1.85
MFC	
Atlantic spotted dolphin	1.34
Atlantic white-sided dolphin	7.95
Bottlenose dolphin, coastal	2,442.84
Bottlenose dolphin, offshore	307.29
Common dolphin	79.57
Long-finned pilot whale	0.01
Risso's dolphin	0.10
Short-finned pilot whale	0.01
Sperm whale	0.31
HFC	
Harbor porpoise	208.51
Pinnipeds	
Gray seal	271.9
Harbor seal	590.91

Source: Table 21 in NMFS 2023b.

[1] Summed across the Atlantic City and Monmouth landfalls.

[2] If issued, the amount and manner of take authorized by NMFS would be identified in any final ITA. The amount of take authorized by NMFS may consider additional data sources (e.g., PSO data, group sizes) and may differ from the exposure estimates. Please see NMFS' website for more information, https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.

Noise: Operational WTGs. As discussed in Section 3.5.6.3, operating WTGs generate non-impulsive, continuous underwater noise that is audible to marine mammals. Detailed information about the physical qualities of operational noise can be found in Section B.5 of Appendix B. Based on the currently available data for turbines smaller than 6.2 MW (Tougaard et al. 2020) and comparisons to acoustic impact thresholds (NMFS 2018a), underwater noise from turbine operations associated with the Proposed Action is unlikely to cause PTS or TTS in marine mammals but could cause behavioral and masking effects. It is expected that these effects would be at relatively short distances from the foundations. Using the least-squares fits from Tougaard et al. (2020), SPLs from 15 MW turbines (in 20 meters per second, gale-force wind) would be expected to fall below the same behavioral threshold within approximately 910 feet (277 meters). In lighter winds (approximately 20 knots [10 meters per second], a "fresh breeze" on the Beaufort scale), the predicted range to the behavioral disturbance threshold would be only approximately 525 feet (160 meters). A recent study by Holme et al. (2023) indicated that the Tougaard et al. (2020) equations may overestimate underwater sound levels generated by operating WTGs, particularly at short distances from the foundation, suggesting that SPLs may drop below the behavioral threshold at shorter distances than predicted. Sound levels are expected to reach ambient underwater noise levels within 0.6 mile (1 kilometer) of the foundations (Elliott et al. 2019; Tougaard et al. 2009a). Based on the currently available data on underwater noise from turbine operations, effects of the Proposed Action's WTGs on marine mammals would likely be similar to the effects outlined for planned offshore wind activities in Section 3.5.6.3 (i.e., potential behavioral disturbance and masking).

Noise: **Cable laying.** As described in Section 3.5.6.3, noise-producing activities associated with cable laying may include trenching, jet plowing, backfilling, and cable protection installation. The Proposed Action includes noise-producing activities associated with construction of 1,025 miles (1,650 kilometers) of export, interlink, and interarray cables. The impacts of the Proposed Action are not expected to exceed the noise impacts of cable-laying activities under the No Action Alternative, which are not expected to result in adverse effects on marine mammals associated with cable-laying noise.

Noise: Dredging. Dredge equipment used for the Proposed Action may include mechanical dredging (i.e., backhoe) or hydraulic dredging (i.e., trailing suction hopper or cutterhead). Detailed information about the physical qualities of dredging noise can be found in Section B.5 of Appendix B. As described in Section 3.5.6.3, dredging is unlikely to exceed marine mammal PTS thresholds, but if dredging occurs in one area for relatively long periods, TTS and behavioral thresholds could be exceeded and masking of marine mammal communications may occur (NMFS 2018b; Todd et al. 2015). Reported sound levels associated with mechanical dredging include 176 dB re 1 µPa L_{RMS} at 1 meter (BC MoTI 2016) and 107 to 124 dB re 1 µPa at 154 meters from the source with peak frequencies of 162.8 Hz (Dickerson et al. 2001; McQueen et al. 2019). Noise produced by hydraulic cutterhead dredging ranges in frequency from approximately 1 to 2 kilohertz, with reported L_{RMS} source levels of 172 to 190 dB re 1 µPa-m (McQueen et al. 2019; Robinson et al. 2011; Todd et al. 2015). Based on the available source level information, dredging by mechanical or hydraulic dredges is unlikely to exceed marine mammal PTS thresholds. However, if dredging occurs in one area for relatively long periods, exposure to sound levels above the TTS and behavioral thresholds and masking could occur (NMFS 2018b; Todd et al. 2015). As noted in Section 3.5.6.3, behavioral reactions and masking are more likely to occur in mysticetes and pinnipeds due to the low frequency of dredging noise and the low frequencies utilized by these species. Given that dredging sound levels do not exceed the PTS threshold and that dredging for the Proposed Action is not expected to occur for long periods, adverse impacts from dredging noise associated with the Proposed Action on marine mammals are unlikely to occur.

Noise: Other site preparation activities (e.g., boulder clearance, pre-lay grapnel run): Boulder clearance would take place prior to construction and installation to clear the cable corridor in preparation for trenching and burial operations. A combination of subsea grab or displacement plow may be used to clear boulders. Noise generated by boulder clearance is likely similar to that for mechanical dredging. The effects of site preparation noise on marine mammals under the Proposed Action are expected to be similar to those outlined in Section 3.5.6.2 under *Cumulative Impacts of Alternative A – No Action*. It is unlikely PTS thresholds would be exceeded in any marine mammals due to source levels being low enough to never accumulate to levels that would exceed PTS thresholds or that animals would have to remain at very close distances to the site preparation activity for several hours, which is unrealistic. The same concepts apply to TTS; therefore, TTS is also unlikely. Source levels generated by site preparation activities may exceed behavioral thresholds and could result in masking of marine mammal communications. However, any short duration and small spatial extent of masking or any slight behavioral changes are likely to be minimal. While some low-level behavioral reactions may occur, the degree of disturbance is not anticipated to rise to a level considered harassment.

Noise: Vessels. As described in Section 3.5.6.3, vessels associated with the Proposed Action would generate low-frequency, non-impulsive noise that could elicit minor behavioral or stress responses in marine mammals. It is estimated that up to 51 vessels could be utilized during construction and installation of the Proposed Action, though a maximum of 16 vessels are expected to operate at one time for a given construction activity (COP Volume I, Section 4.10.1; Atlantic Shores 2024). Effects of vessel noise on individual marine mammals are expected to be short term and localized with no appreciable impact on marine mammals. Effects are expected to be greatest for LFC due to low frequency of vessel noise and the relatively large propagation distances of low-frequency sounds. No stock- or population-level impacts are expected for any marine mammal species.

Noise: Summary of impacts. Noise generated from Project construction and installation would include impact pile driving, HRG surveys, vibratory pile driving, vessels, aircraft, cable laying, dredging, and other site preparation activities. Noise sources during operation would include turbine operation, vessels, and HRG surveys. Of those activities, the sophisticated modeling conducted by Atlantic Shores on construction noise sources indicates that only impact pile driving could cause PTS in marine mammals (see Appendix B, Section 5).

Foundation installation could result in PTS, which is a long-term, permanent impact. However, the auditory damage would be concentrated in the frequencies of the noise source and would not span entire hearing ranges for any given marine mammal hearing group. In addition, the shift in hearing would be expected to be small (only a few dB) given the nature of sources and the animal's ability to move away from the source before incurring more severe PTS. Only a few marine mammals of select species are anticipated to incur PTS incidental to impact pile driving (Table 3.5.6-11; Appendix B, Section 5). Mitigation measures are designed to avoid PTS to NARWs.

All audible noise sources have the potential to result in behavioral responses. Exposure to a noise source could result in *no reaction* to *more severe reactions* such as prolonged avoidance; cessation of behaviors such as foraging, socializing, and communication; and stress. Noise from construction is also likely to mask marine mammal communication to varying spatial and temporal degrees. No displacement or avoidance of critical habitat areas is expected, as no critical habitat for any marine mammal species is designated in the Project area. Critical habitat for NARW is approximately 270 miles (435 kilometers) north of the Project area. The Project area is located in a BIA for NARW migration. Animals migrating through the Project area are likely to be exposed to noise; however, it is anticipated that the amount of deflection from the migratory path would be minimal. No concentrated foraging areas for NARWs are present within the Project area. Other marine mammals are likely foraging in the Project area, particularly odontocetes; however, ample foraging habitat not affected by the Project would remain. For these reasons, any temporary avoidance of the area by marine mammals during construction and installation is not anticipated to result in any fitness consequences.

PTS, TTS, and behavioral responses of mysticetes (i.e., LFC), odontocetes (i.e., MFC and HFC), and pinnipeds due to construction activities in water are considered likely, varying by species. With implementation of known and highly effective mitigation and monitoring measures the impact of all underwater noise activities is considered moderate for mysticetes (except for NARW), odontocetes, and pinnipeds, as some members of each of these taxa may experience PTS. As no PTS is anticipated for NARW, no fitness consequences are anticipated due to any temporary avoidance or other behavioral responses, and the Atlantic Shores (and BOEM) proposed measures are anticipated to avoid or minimize impacts of noise on marine mammals (see Table G-1 in Appendix G), the impact of all underwater noise activities from the Proposed Action alone is considered minor for NARW.

During operations, noise sources would be primarily limited to WTG operation, vessel use, and HRG surveys. Impacts from these sources are anticipated to be minor for all marine mammals.

Presence of structures. The Proposed Action would include construction of up to 200 WTGs, 10 OSSs, 1 permanent met tower, and installation of up to 268 acres (108 hectares) of hard scour protection around the WTG foundations, up to 26 acres (10.5 hectares) of hard scour protection around the OSS foundations, and up to 595 acres (241 hectares) of hard cable protection (294 and 301 acres [119 and 122 hectares] around the export and interarray cables, respectively) (Appendix D, Table D.A2-2; COP Volume I, Table 4.4-2; Atlantic Shores 2024). As described in Section 3.5.6.3, the installation of WTGs, OSSs, and the met tower, as well as hard protection could result in hydrodynamic changes, habitat conversion and prey aggregation, entanglement or ingestion of lost fishing gear, avoidance or displacement, and behavioral disruption.

The presence of WTGs, OSSs, and the met tower could alter local hydrodynamic patterns at a fine scale, which could have localized impacts on prey distribution and abundance, as described in Section 3.5.6.3. The strong seasonal stratification of the Mid-Atlantic Bight is the dominant oceanographic feature limiting phytoplankton productivity, which then affects zooplankton prey productivity (Schofield et al. 2008). Localized turbulence and upwelling effects around the WTG, OSS, and met tower foundations are likely to transport nutrients into the surface layer, potentially increasing primary and secondary productivity. That increased productivity at a local scale could be partially offset by the formation of abundant colonies of filter feeders on the WTG, OSS, and met tower 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, the foundations would be spaced between 0.6 and 1 nautical mile (1.1 and 1.9 kilometers) apart, and the net effect over the spatial scale of the 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 associated with the WTG, OSS, and met tower structures are not likely to measurably affect the availability of prey resources for marine mammals. The presence of structures may have an artificial reef effect, which could result in beneficial impacts on odontocetes or pinnipeds due to prey aggregation. The aggregation of prey species would increase foraging opportunities for some marine mammals and could lead to measurable, long-term benefits. The artificial reef effect may also result in increased recreational fishing activity in the vicinity of the WTGs, OSSs, and the met tower. An increase in fishing activity would increase risk of entanglement for marine mammals, which could result in injury or death. Atlantic Shores has proposed to remove marine debris caught on Offshore Project structures to reduce the risk of marine mammal entanglement in lost fishing gear (MAR-06; Appendix G, Table G-1). The beneficial effects associated with the artificial reef effect have the potential to be offset by the increased risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.

Under the Proposed Action, WTG foundations would be placed in a grid-like pattern with a minimum approximate spacing of 0.6 nautical mile (1.1 kilometers) 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 0.6 nautical mile (1.1 kilometers) approximately 50 times over. This simple assessment of spacing relative to animal size indicates that the physical presence of the WTG 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.

The presence of offshore wind facility structures could result in avoidance and displacement of marine mammals, which could potentially move marine mammals into areas with lower habitat value or with higher risk of vessel collision (see the Traffic IPF in Section 3.5.6.3) or fisheries interactions. The evidence for long-term displacement is unclear and varies by species. For example, 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). The presence of structures could also displace commercial or recreational fishing vessels to areas outside of wind energy facilities or result in gear shifts. Gear shifts that result in an increased number of vertical lines in the water would increase the risk of marine mammal interactions with fishing gear, which is a significant threat to some mysticete species. As noted in Section 3.5.6.3, fishing efforts and their impacts on protected species are managed through state and federal regulations. The likelihood of an increased risk of entanglement directly resulting from the presence of proposed Project structures beyond existing commercial and recreational fishing conditions in the region is considered low. Thus, the addition of structures under the Proposed Action is not expected to lead to population-level effects for any mysticetes (including the NARW), odontocetes, or pinnipeds. Disruption of normal behaviors could occur due to the presence of offshore structures. The presence of structures could have long-term, intermittent impacts on foraging, migration, and other normal behaviors.

In summary, long-term reef and hydrodynamic effects resulting from the Proposed Action could result in minor beneficial effects on fish-eating marine mammals (such as odontocetes and pinnipeds) that benefit from increased prey abundance around the structures. These effects could cause localized changes to prey distribution but do not suggest a notable change in prey availability. Long-term reef and hydrodynamic effects could result in non-measurable, negligible effects on mysticetes (including the NARW) that forage on plankton and forage fish, but no perceptible consequences for individuals or populations are expected. BOEM concludes that the physical presence of WTG, OSS, and met tower foundations would pose a non-measurable, negligible risk of physical displacement by posing a barrier to movement for mysticetes (including the NARW), odontocetes, and pinnipeds, with no perceptible consequences for individuals or populations. Entanglement in debris caught on structures is unlikely to occur, and as a result, impacts due to entanglement are considered negligible, with no perceptible individual or population-level consequences for mysticetes (including the NARW), odontocetes, and pinnipeds.

Traffic: The Proposed Action would result in increased vessel traffic due to vessels transiting to and from the Project area during construction and installation, O&M, and decommissioning. As described in Section 3.5.6.3, vessel strikes are a significant concern for marine mammals and could result in injury or death (Hayes et al. 2021; Laist et al. 2001; Moore and Clarke 2002; NMFS 2024d). Atlantic Shores expects up to 51 vessels to be used during construction and installation of the Project, though a maximum of 16 vessels are expected to operate at one time for a given construction and installation activity. In total, the Proposed Action would generate approximately 1,745 vessel trips during the construction and installation phase. A majority of those trips (72 percent) would occur between the New Jersey Wind Port and the Lease Area. Eighteen percent of vessel trips during construction and installation would be between the Lease Area and Atlantic City, New Jersey, and 7 percent of trips would be between the Lease Area and Paulsboro, New Jersey. Repauno, New Jersey, Portsmouth, Virginia, and Corpus Christi, Texas, are each expected to receive 20 trips (approximately 1 percent of total construction and installation vessel traffic) from Project vessels. Construction vessels anticipated for the Proposed Action range from 82 to 722 feet (25 to 220 meters) in length, from 30 to 295 feet (9 to 90 meters) in beam, and draft from 1.5 to 10 feet (0.5 to 3 meters).

During O&M, Atlantic Shores generally expects 5 to 11 vessels to operate at a given time, though up to 22 vessels may be required in some repair scenarios. The Proposed Action would generate approximately 1,861 vessel trips annually during the O&M phase. A majority of those trips (98 percent) would occur between the O&M facility in Atlantic City and the Lease Area. Two percent of annual O&M vessel trips would be between the Lease Area and the New Jersey Wind Port, and the remaining vessel traffic would be split approximately evenly between ports in Paulsboro, Repauno, and Portsmouth. Vessels anticipated for O&M range from 82 to 328 feet (25 to 100 meters) in length, from 30 to 66 feet (9 to 20 meters) in beam, and draft from 1.5 to 8 feet (0.5 to 2.4 meters).

Compared to existing vessel traffic in the Lease Area (i.e., 4,105 vessel tracks annually; COP Volume II, Appendix II-S; Atlantic Shores 2024), construction and installation vessel traffic represents a 28 percent increase in traffic in the Lease Area, and O&M vessel traffic represents a 91 percent increase in traffic in the Lease Area. Though vessel traffic for the Proposed Action would result in a measurable or substantial increase in vessel traffic in the Lease Area, the increase in traffic associated with the Proposed Action would only be a small increase in overall traffic in the geographic analysis area. Waters near the Lease Area include those transited by vessels entering the Port of New York and New Jersey and the Delaware River, which is home to multiple major ports. The USCG's Port Access Route Study for the Seacoast of New Jersey (NJPARS) provides information on baseline vessel traffic in the waters surrounding the Lease Area. The study area for the waters encompassed by the NJPARS extends along the coast of Maryland, Delaware, and New Jersey from approximately 20 nautical miles (37 kilometers) south of the Delaware-Maryland border to slightly south of the entrance to New York Bay, including the Lease Area. AIS data indicated that there were 74,352 annual transits (i.e., one-way trips) through the NJPARS study area in 2019. The NJPARS study concluded that vessel traffic through the study area was largely associated with commercial fishing. Compared to annual traffic in the NJPARS study area, annual traffic during construction and installation of the Project and the O&M phase would represent an approximately 2 percent increase and 5 percent increase in vessel traffic, respectively.

As Project vessels would operate throughout the construction and installation, O&M, and decommissioning phases, the potential for a vessel to strike a marine mammal is considered continuous over the life of the Project. If a vessel strike does occur, the impact on individual marine mammals would be severe (ranging from injury to mortality); however, the population-level impacts would range from negligible to major, depending on the species and severity of the strike. However, Atlantic Shores has proposed vessel strike avoidance measures to avoid or minimize impacts associated with vessel traffic (MAR-01; Appendix G, Table G-1), including adherence to NMFS' (2021e) marine wildlife viewing and safe boating guidelines (MAR-02; Appendix G, Table G-1); crew training in marine mammal spotting, identification, reporting protocols, and strike avoidance procedures (MAR-03; Appendix G, Table G-1); vessel speed restriction in NARW SMAs and DMAs (MAR-04; Appendix G, Table G-1); and monitoring marine mammal activity in the Offshore Project area through NOAA Right Whale Slow Zones Program and the NOAA Right Whale Sighting Advisory System (MAR-05; Appendix G, Table G-1). These measures would minimize encounters that have a high risk of resulting in collision or injury by reducing both the encounter potential (e.g., adherence to NMFS marine wildlife viewing and safe boating guidelines) and severity potential (e.g., vessel speed restriction).

The mitigation measures proposed in the Project's LOA Application include a standard vessel avoidance plan that restricts vessel speeds to less than 10 knots for all Project vessels between November 1 and April 30 when NARW are likely to be present in higher densities. Year-round speed restrictions in the standard vessel avoidance plan include vessels of all sizes operating at 10 knots or less in any DMAs. In addition, between May 1 and October 31, all vessels traveling at greater 10 knots will have a dedicated visual observer (or NMFS-approved automated visual detection system) on duty at all times to monitor for marine mammals. An additional adaptive vessel avoidance plan is also outlined and includes measures to be implemented when crew safety is at risk, or labor restrictions, vessel availability, costs to the Project, or other unforeseen circumstances make the standard plan impracticable. Adaptive measures include the installation of a semi-permanent acoustic network comprising a near real-time acoustic monitoring system to monitor for the presence of NARWs year-round. When NARWs are detected in the area, slow-down to 10 knots would be required for the following 12-hour period. All vessel operators would receive training to ensure these mitigation measures are fully implemented for vessels in transit. As required in the proposed rule for the Project's LOA (NMFS 2023b), vessel operators would monitor the NMFS NARW reporting systems during all transits. Ultimately, the reduction in strike/injury risk relies on the ability for a responsive action to be taken if a marine mammal is detected. The deployment of trained observers on all vessels along with effective monitoring equipment would minimize the collision and injury risk. Measures to minimize vessel-marine mammal strikes are expected to be highly effective and reduce the likelihood of occurrence to low.

Therefore, with implementation of these known and effective measures such as reduced vessel speeds and maintenance of minimum separation distances from marine mammals, BOEM concludes that vessel strikes are unlikely to occur. As a result, there is no anticipated effect on marine mammals and collision effects due to Alternative B. The impact of vessel strikes would, therefore, be negligible for mysticetes (including NARW), odontocetes, and pinnipeds.

Impacts of the Connected Action

As described in Chapter 2, *Alternatives,* bulkhead repair and/or replacement and maintenance dredging activities have been proposed as a connected action under NEPA, per 40 CFR 1501.9I(1). Installation of a new bulkhead and maintenance dredging, the latter of which will be conducted in coordination with Atlantic City's dredging of the adjacent berths, have been proposed in Atlantic City's Inlet Marina, where the Atlantic City O&M facility would be located. Bulkhead installation and dredging may affect marine mammals. These activities in Atlantic City's Inlet Marina would be conducted regardless of the construction and installation of the Proposed Action. However, the bulkhead and dredging are necessary for the use of the O&M facility included in the Proposed Action. Therefore, the bulkhead and dredging activities are considered to be a connected action under NEPA. Atlantic Shores in currently in consultation with USACE for approval of the bulkhead activities, which may apply mitigation measures to this activity. Although the connected action has the potential to affect aquatic species, most marine mammals assessed in this analysis are not expected to occur in the area affected by the connected action as the activity is proposed in a shallower, inlet area. For those species that have a higher chance of occurring in this area (e.g., bottlenose dolphins) the activity is proposed to occur during winter/early spring when their presence in the area is lowest (Roberts et al. 2016b, 2023). No ESA-listed marine mammal species are expected to occur in the connected action activity area. Further, the connected action activities would occur in a shallow environment, which results in lower received sound levels (Graham et al. 2017). Therefore, the connected action could have minor impacts for marine mammals due to pile driving if individuals occur in the area.

Cumulative Impacts of Alternative B – Proposed Action

The cumulative impact analysis of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, including offshore wind activities, and the connected action. Ongoing and planned non-offshore wind activities within the geographic analysis area that contribute to impacts on marine mammals include undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; oil and gas activities; and onshore development activities. The connected action would involve installation of a new bulkhead and maintenance dredging at Atlantic City Inlet Marina. Ongoing and planned offshore wind activities in the geographic analysis area for marine mammals include the construction, O&M, and decommissioning of 27 planned offshore wind projects.

Accidental releases: The contribution of the Proposed Action to the cumulative impacts on marine mammals related to exposure to accidental releases from ongoing and planned activities would likely be undetectable. As noted above, Atlantic Shores has prepared an OSRP for the proposed Project, and other planned offshore wind projects would develop similar plans. The implementation of these plans and compliance with regulatory requirements 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. Impacts would likely occur in close temporal and spatial proximity, although these impacts would not be expected to be biologically significant. The cumulative accidental release and discharge impacts would likely be negligible for mysticetes (including NARW), odontocetes, and pinnipeds.

Cable emplacement and maintenance: The incremental impact of the Proposed Action would contribute an undetectable increment to the cumulative cable emplacement impacts on mysticetes (including NARW), odontocetes, and pinnipeds. The Proposed Action combined with planned offshore wind activities would disturb an estimated 72,273 acres (29,248 hectares) of seafloor from the offshore export cable and interarray cable installation activities, including anchoring (Appendix D, Table D.A2-2). The contribution of the Proposed Action to the cumulative cable emplacement impacts from ongoing and planned activities could occur if impacts are in close temporal and spatial proximity. However, these impacts from cable emplacement would be short term and expected to be negligible and not biologically significant.

Electric and magnetic fields and cable heat: The 1,025 miles (1,650 kilometers) of submarine cables associated with the Proposed Action represent 7 percent of the 13,869 miles (22,320 kilometers) of subsea cables anticipated for existing and planned offshore wind farms, including the Proposed Action. The contribution of the Proposed Action to the cumulative EMF and cable heat generated by ongoing and planned activities would be detectable. However, the cumulative impacts from EMF on mysticetes (including NARW), odontocetes, and pinnipeds would likely still be negligible, localized, and long term.

Gear utilization: The Proposed Action would contribute an undetectable increment to the cumulative impacts of gear utilization. As described above, entanglement or entrapment in gear is not anticipated to occur. The potential for impacts on mysticetes (including NARW), odontocetes, and pinnipeds from offshore wind activities is anticipated to be negligible. When including ongoing and planned non-offshore wind activities, the cumulative impacts from gear utilization would be moderate for mysticetes (except NARW), odontocetes, and pinnipeds and major for NARW.

Lighting: The Proposed Action would contribute an undetectable increment to the cumulative lighting impacts, which would likely be negligible, localized, and long term for mysticetes (including NARW), odontocetes, and pinnipeds.

Noise: Construction-related noise impacts (from activities including pile driving and HRG surveys) would occur within a limited time frame. However, long-term noise sources from operational turbines and O&M vessels would persist. All effects on marine mammals from noise (e.g., some PTS, TTS, behavioral changes, masking) are anticipated to be the same as described in Section 3.5.6.2 under *Cumulative Impacts of Alternative A – No Action*. The loudest sources of noise associated with the Proposed Action are expected to be impact pile driving. The up-to-211 structures for the Proposed Action represent less than 7 percent of the 3,192 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms, including the Proposed Action, although some foundations for the Project and at other planned wind farms may be installed without impact pile driving (Appendix D, Table D.A2-2). Though relatively small compared to the magnitude of ongoing and planned activities, the contribution of the Proposed Action to the cumulative noise impacts associated with ongoing and planned activities would be noticeable. Considering the incremental addition of noise from the Proposed Action, the cumulative impacts of noise from the Proposed Action would not be appreciably different from the cumulative impacts expected for the No Action Alternative (Section 3.5.6.3). Cumulative impacts of the Proposed Action from noise could result in moderate short-term impacts for marine mammals (including NARW) because impacts on an individual could result in population-level effects, though the potential for impact is increased for LFC (i.e., mysticetes except for NARW), MFC, HFC (i.e., odontocetes), and pinnipeds.

Port utilization: As port expansion is not proposed for the Project, the Proposed Action would not contribute to the cumulative impacts of port utilization associated with ongoing and planned activities in the geographic analysis area. The cumulative effects of port utilization for ongoing and planned activities would 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 up-to-211 structures for the Proposed Action represent less than 7 percent of the 3,192 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms, including the Proposed Action (Appendix D, Table D.A2-2). The contribution of the Proposed Action to the cumulative impacts due to the presence of structures associated with ongoing and planned activities would be noticeable. However, the cumulative impacts from the presence of structures would likely be minor for mysticetes (including NARW), odontocetes, and pinnipeds, as well as localized and long term and may include minor beneficial impacts for odontocetes and pinnipeds.

Traffic: The contribution of the Proposed Action to the cumulative impacts of vessel traffic associated with ongoing and planned activities would be noticeable. The cumulative traffic (i.e., vessel strike) impacts would be minor for pinnipeds and odontocetes, moderate for mysticetes (except for NARW), and major for NARW. The determination of major for NARW is due to ongoing vessel traffic, which is included in the baseline and continues to compromise the viability of the species given its low abundance and downward population trend. Impacts would occur in close spatial proximity to vessel routes but would be long term in temporal scale.

Conclusions

Impacts of Alternative B – Proposed Action. The incremental impact of the Proposed Action when compared to the No Action Alternative is summarized here. The analysis considered an incremental impact as an impact occurring because of the Proposed Action alone, without addition of baseline or other ongoing offshore wind and non-offshore wind activities. Noise produced by activities associated with the Proposed Action, primarily during construction and installation, would disturb marine mammals; however, behavioral disturbance is not anticipated to result in fitness level consequences. Noise could also potentially result in permanent impacts (i.e., PTS) for select species. In consideration of the proposed mitigation and monitoring measures (Appendix G), some marine mammal species (e.g., fin whale, humpback whale, minke whale, sei whale, Atlantic white-sided dolphin, Risso's dolphin, harbor porpoise, gray seal, harbor seal) could incur PTS. Thus, the impacts from noise for marine mammals (except for NARW) overall is expected to be moderate. The mitigation and monitoring measures (in Appendix G) would minimize noise exposure, and the potential for PTS for NARWs would be avoided. More severe impacts on marine mammals such as mortality or serious injury from vessel strikes and entanglement are not anticipated to occur due to the mitigation measures proposed by Atlantic Shores and that would be required as part of the environmental permitting processes included in Appendix G. The incremental impacts of the Proposed Action when compared to the No Action Alternative would range from negligible to moderate across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds. As described above, with mitigation and monitoring measures included in Appendix G, only a few marine mammals of select species are anticipated to incur PTS incidental to pile driving and vessel strike risk is very low and strikes are not anticipated to occur. The overall incremental impact of the Proposed Action when compared to the No Action Alternative would be **moderate** for species anticipated to experience PTS from the Project (e.g., fin whales, humpback whales, minke whales, sei whales, Atlantic white-sided dolphin, Risso's dolphin, harbor porpoise, gray seal, and harbor seal) because impacts on individuals would be of medium intensity (i.e., PTS) but no population-level effects are anticipated. The overall incremental impacts of the Proposed Action would be **minor** for other mysticetes, odontocetes, and pinnipeds because impacts would be detectable and measurable but no population-level impacts would occur. Mitigation measures would minimize noise exposure such that any PTS of NARWs would be avoided and, for all marine mammals, any behavioral responses would be short term and not result in fitness level consequences. Therefore, the incremental impact of the Proposed Action when compared to the No Action Alternative would be **minor** for NARWs from construction and installation given the likely outcome of noise exposure would be a deflection but not abandonment of their migratory path and no concentrated foraging habitat exists within the Offshore Project area. Collectively, BOEM does not expect impacts to have a measurable effect on an individual's fitness and therefore would not result in population-level effects.

When including the baseline status of marine mammals into the impact findings and considering all phases of the Project, the impacts of the Proposed Action on NARW would range from negligible to major across individual IPFs, with major impacts resulting from vessel strike and entanglement risk due to the ongoing activities described in Section 3.5.6.3 (noting vessel strike and entanglement from the construction and operation of the Project is not an expected outcome for the reasons described above).

Considering all IPFs together, impacts on NARW would be **major**. Impacts would range from negligible to moderate across individual IPFs for other mysticetes, odontocetes, and pinnipeds. Considering all IPFs together, impacts on mysticetes (except NARW), odontocetes, and pinnipeds would be **moderate**. Some **minor beneficial** impacts on odontocetes and pinnipeds could be realized through artificial reef effects. Beneficial effects, however, may be offset given the increased risk of entanglement due to derelict fishing gear on the structures.

BOEM expects that the connected action could have minor impacts on marine mammals due to pile-driving activities if individuals occur in the area, which is unlikely for most marine mammal species except dolphins (e.g., bottlenose dolphins) and seals (e.g., gray seal). No ESA-listed marine mammals species area expected to occur in the connected action activity area. Mitigation measures applied by USACE through permitting have the potential to reduce these impacts.

Cumulative Impacts of Alternative B – Proposed Action. Existing environmental trends and ongoing activities would continue, and mysticetes, odontocetes, and pinnipeds would continue to be affected by natural and human-caused IPFs. Planned activities would also contribute to impacts on marine mammals. The cumulative impacts on marine mammals from ongoing and planned activities, including the Proposed Action and the connected action, would range from negligible to moderate adverse across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds and negligible to major for NARW (due primarily to baseline conditions), and could include **minor beneficial** impacts for odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear. Impacts from the Proposed Action are not anticipated to substantially contribute to major long-term cumulative impacts for NARW.

Considering all IPFs together, BOEM anticipates that the cumulative impacts would result in **moderate** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and **major** impacts on NARW. BOEM made this determination because the anticipated impact would be notable and measurable, but most marine mammals are expected to recover completely when IPF stressors are removed, and remedial or mitigating actions are taken. However, impacts on individual NARWs could have severe population-level effects (e.g., vessel strikes if they were to occur). Impacts from the Proposed Action are not anticipated to substantially contribute to the major long-term cumulative impacts for NARW.

3.5.6.6 Impacts of Alternative C on Marine Mammals

Alternative C (Habitat Impact Minimization/Fisheries Habitat Impact Minimization) would avoid or minimize impacts on two AOCs identified by NMFS within the Lease Area that have pronounced bottom features (e.g., ridges, swales) and produce valuable habitats.

Onshore Activities and Facilities

Impacts associated with onshore activities and facilities for Alternative C would be identical to the impacts of onshore activities and facilities associated with the Proposed Action (Section 3.5.6.5).

Offshore Activities and Facilities

Offshore activities would not differ between the Proposed Action and Alternative C. However, the location of interarray and export cable routes may differ somewhat. Differences in location would be minor but would avoid one or, in the case of Alternative C4 or the combination of Alternatives C1 and C2, both AOCs. The avoidance or minimization of impacts on these valuable habitat areas would potentially benefit any marine mammal species that consumes prey that utilize these habitats. Though avoidance or minimization of impacts on these valuable habitats may benefit some marine mammal species, this benefit would not measurably reduce construction and installation impacts on marine mammals.

The number of WTG and OSS facilities may also differ under Alternative C; up to 29 WTGs and 1 OSS may be removed, which may also reduce the length of the interarray cable. A reduction in the number of WTGs and OSSs, and a reduction in the length of interarray cable, would reduce impacts due to cable emplacement and maintenance, EMF, noise, and the presence of structures. However, this reduction would not substantially reduce risk of exposure to these IPFs for marine mammals.

Cumulative Impacts of Alternative C

The contribution of Alternative C to the impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action. The cumulative impacts on marine mammals of ongoing and planned activities in combination with Alternative C would be the same level as described under the Proposed Action.

Conclusions

Impacts of Alternative C. Impacts of Alternative C would not be sufficiently reduced from the impacts of the Proposed Action to warrant a lower impact determination. Therefore, incremental impacts of construction and installation, O&M, and decommissioning of Alternative C would be **minor** for NARWs and **minor to moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds. When including the baseline status of marine mammals into the impact findings, BOEM anticipates that impacts of Alternative C would range from negligible to major across individual IPFs for NARW, resulting in an overall impact determination of **major**, and negligible to moderate across individual IPFs for other mysticetes, odontocetes, and pinnipeds, resulting in an overall impact determination of **moderate** and could include **minor beneficial** impacts on odontocetes and pinnipeds due to the presence of structures.

Cumulative Impacts of Alternative C. Cumulative impacts on marine mammals from ongoing and planned activities, including Alternative C, would range from negligible to moderate for individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds and negligible to major for NARW (due primarily to baseline conditions), and would also include **minor beneficial** impacts for odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear.

Considering all IPFs together, BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including Alternative C, would result in **moderate** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and **major** impacts on NARW. BOEM made this determination because the anticipated impact would be detectable and measurable but would not compromise viability of most marine mammal species at a local or range-wide scale. Effects on individual NARWs may have severe population-level effects (e.g., vessel strikes).

3.5.6.7 Impacts of Alternatives D and E on Marine Mammals

Alternative D (No Surface Occupancy at Select Locations to Reduce Visual Impacts) would include an alteration in WTG layout and number to minimize visual impacts. Alternative E (Wind Turbine Layout Modification to Establish a Setback Between Atlantic Shores South and Ocean Wind 1) would include modifications to the WTG layout to minimize impacts on existing ocean uses by creating a 0.81-nautical mile (1,500-meter) to 1.08-nautical mile (2,000-meter) setback between Atlantic Shores South and Ocean Wind 1 (OCS-A 0498).

Onshore Activities and Facilities

Impacts associated with onshore activities and facilities for Alternatives D and E would be identical to the impacts of onshore activities and facilities associated with the Proposed Action (Section 3.5.6.5).

Offshore Activities and Facilities

Offshore activities would not differ between the Proposed Action and Alternatives D and E. However, the location or number of WTGs would differ under Alternatives D and E. Under Alternative D, up to 31 WTGs may be removed. Under Alternative E, up to 5 WTGs may be removed or microsited. A reduction in the number of WTGs, if they are located at the ends of WTG array columns or rows, may also reduce the length of the interarray cable. A reduction in the number of WTGs, and a potential reduction in the length of interarray cable, would reduce impacts due to cable emplacement and maintenance, EMF, noise, and the presence of structures. However, this reduction would not substantially reduce risk of exposure to these IPFs for marine mammals.

Cumulative Impacts of Alternatives D and E

The contribution of Alternatives D and E to the impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action. The cumulative impacts on marine mammals of ongoing and planned activities in combination with Alternatives D and E would be the same level as described under the Proposed Action.

Conclusions

Impacts of Alternatives D and E. Impacts of Alternatives D and E would not be sufficiently reduced from the impacts of the Proposed Action to warrant a lower impact determination. Therefore, incremental impacts of construction and installation, O&M, and decommissioning of Alternatives D and E would be minor for NARWs and minor to moderate for mysticetes (except for NARW), odontocetes, and pinnipeds. When including the baseline status of marine mammals into the impact findings, BOEM anticipates that impacts of Alternatives D and E would range from negligible to major across individual IPFs for NARW (primarily due to baseline conditions), resulting in an overall determination of **major**, and negligible to moderate across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds, resulting in an overall determination of **moderate**, and could include **minor beneficial** impacts on odontocetes and pinnipeds due to the presence of structures.

Cumulative Impacts of Alternatives D and E. Cumulative impacts on marine mammals from ongoing and planned activities, including Alternative D or E, would range from negligible to moderate adverse across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds and negligible to major adverse across individual IPFs for NARW (primarily due to baseline conditions) and would also include **minor beneficial** impacts for odontocetes and pinnipeds.

Considering all IPFs together, BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including Alternative D or E, would result in **moderate** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and **major** impacts on NARW. BOEM made this determination because the anticipated impact would be notable and measurable but would not compromise viability of most marine mammal species at a local or range-wide scale. Effects on individual NARWs may have severe population-level effects (e.g., vessel strikes).

3.5.6.8 Impacts of Alternative F on Marine Mammals

Under the Proposed Action, a variety of foundation types may be used for the Project. Alternative F (Foundation Structures) addresses the possibility for one or more foundation types to be utilized for WTGs, OSSs, and the permanent met tower, and includes three sub-alternatives that detail the different foundation structures. Under Alternative F1, foundation types would be restricted to piled foundations; monopiles and piled jacked foundations would be used for up to 200 WTGs, 1 permanent met tower (Project 1), and either up to 10 small OSSs (monopile or piled jacket), up to 5 medium OSSs (piled jacket), or up to 4 large OSSs (piled jacket) for Project 1 and Project 2. Under Alternative F2, foundation types would be restricted to suction buckets; mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations would be used for up to 200 WTGs, 1 permanent met tower (Project 1), and either up to 10 small OSSs (mono-bucket or suction bucket jacket), up to 5 medium OSSs (suction bucket jacket), or up to 4 large OSSs (suction bucket jacket), for Project 1 and Project 2. Under Alternative F3, foundation types would be restricted to gravity-based foundations; gravity-pad tetrahedron and GBS foundations would be used for up to 200 WTGs, 1 permanent met tower (Project 1), and either up to 10 small OSSs, up to 5 medium OSSs, or up to 4 large OSSs, with GBS for Project 1 and Project 2.

Onshore Activities and Facilities

Impacts associated with onshore activities and facilities for Alternative F would be identical to the impacts of onshore activities and facilities associated with the Proposed Action (Section 3.5.6.5).

Offshore Activities and Facilities

Though all potential offshore activities under Alternative F were evaluated under the Proposed Action, sub-alternatives of Alternative F may exclude some activities evaluated under the Proposed Action. Activities would not differ between the Proposed Action and Alternative F1. Under Alternatives F2 and F3, no impact pile driving would be conducted. Therefore, there would be no underwater noise impacts on marine mammals due to impact pile driving. The avoidance of impact pile-driving noise impacts would reduce overall impacts on marine mammals under Alternatives F2 and F3 compared to the Proposed Action. Offshore impacts under some sub-alternatives may be reduced due to reductions in habitat conversion associated with some foundation types. Suction bucket foundations, under Alternative F2, would result in the greatest area of habitat conversion due to scour protection, and these impacts were evaluated under the Proposed Action. Alternatives F1 and F3 would result in a reduction in scour protection compared to the Proposed Action and Alternative F2. Such reductions would reduce impacts due to the presence of structures. Less scour protection would result in loss of less soft-bottom habitat. It would also result in a lower artificial reef effect, which may reduce foraging opportunities for some marine mammal species compared to the Proposed Action and Alternative F2 but may also reduce risk of entanglement in lost recreational fishing gear. Given that Alternatives F1 and F3 would result in reductions in both adverse impacts and beneficial impacts (i.e., reduced scour protection resulting in reduced artificial reef effect), impacts on marine mammals under these alternatives are not expected to be substantially reduced from those anticipated under the Proposed Action.

Cumulative Impacts of Alternative F

The contribution of Alternative F to the cumulative impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action. The cumulative impacts on marine mammals of ongoing and planned activities in combination with Alternative F would be the same level as described under the Proposed Action.

Conclusions

Impacts of Alternative F. Impacts of Alternative F1 would not be measurably different than the impacts of the Proposed Action. Therefore, incremental impacts of construction and installation, O&M, and decommissioning of Alternative F1 would be **minor** for NARW and **minor** to **moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds. When including the baseline status of marine mammals into the impact findings, BOEM anticipates that impacts of Alternative F1 would range from negligible to major across individual IPFs for NARW (primarily due to baseline conditions), resulting in an overall impact determination of **major**, and negligible to moderate across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds, resulting in an overall impact determination of **moderate**, and could include **minor beneficial** impacts on odontocetes and pinnipeds, due to the presence of structures.

Impacts of Alternatives F2 and F3 would be measurably different from the impacts of the Proposed Action due to the avoidance of impact pile-driving noise impacts, one of the greatest impacts on marine mammals. Therefore, incremental impacts of construction and installation, O&M, and decommissioning of Alternatives F2 and F3 would be **minor** for NARW, mysticetes (except for NARW), odontocetes, and pinnipeds. When including the baseline status of marine mammals into impact findings, BOEM anticipates that Alternatives F2 and F3 would have overall **major** impacts on NARW (primarily due to baseline conditions), and **moderate** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and could include **minor beneficial** impacts on odontocetes and pinnipeds due to the presence of structures.

Cumulative Impacts of Alternative F. Cumulative impacts on marine mammals from ongoing and planned activities, including Alternative F1, F2, or F3, would range from negligible to moderate adverse across individual IPFs for mysticetes (except for NARW), odontocetes, and pinnipeds and negligible to major adverse across individual IPFs for NARW (primarily due to baseline conditions), and would also include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.

Considering all IPFs together, BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including Alternative F, would result in **moderate** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and **major** impacts on NARW. BOEM made this determination because the anticipated impacts would be notable and measurable, but most marine mammals are expected to recover completely when IPF stressors are removed, and remedial or mitigating actions are taken. Effects on individual NARWs may have severe population-level effects (e.g., vessel strikes).

3.5.6.9 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2, G-3, and G-4 and summarized and assessed in Table 3.5.6-15. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts on marine mammals could be further reduced.

Table 3.5.6-15. Proposed mitigation measures – marine mammals

Measure	Description	Effect
Incorporate LOA requirements	The measures required by the final MMPA LOA will be incorporated into COP approval, and BOEM and/or BSEE will monitor compliance with these measures.	Compliance with LOA requirements would reduce risks for marine mammals under the Proposed Action. However, this measure would not alter impact determinations for marine mammals.
Reasonable and Prudent Measures and Terms and Conditions from the NMFS Biological Opinion	The Lessee must comply with measures in the Biological Opinion (see NMFS RPM 1 through RPM 5	RPMs and Terms and Conditions from the NMFS Biological Opinion would minimize impacts on marine

Measure	Description	Effect
	and T&C 1 through T&C 5 in Table G-2) and conduct sound field verification to ensure distances to thresholds for ESA-listed marine mammals are not exceeded during impact pile driving. Atlantic Shores must also report any effects to ESA-listed marine mammals or incidental take of these species.	mammals during construction and installation and O&M of the Project. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter impact determinations for marine mammals.
Marine debris awareness training	Vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP must complete marine trash and debris awareness training annually. Atlantic Shores must submit an annual report describing its marine trash and debris awareness training process and certify that the training process was followed for the previous calendar year.	Marine debris and trash awareness training would decrease the loss of marine debris which may represent entanglement and/ or ingestions risk. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter the impact determination of negligible for accidental spills and releases.
Sampling gear	All sampling gear must be hauled at least once every 30 days, and all gear must be removed from the water and stored on land between survey seasons to minimize risk of entanglement.	The regular hauling of sampling gear would reduce risk of entanglement in fisheries survey gear. While adoption of this measure would reduce risk under the Proposed Action, it would not alter the impact determination of negligible for gear utilization.
Gear identification	To facilitate identification of gear on any entangled animals, all trap/pot gear used in Project surveys must be uniquely marked to distinguish it from other commercial or recreational gear. Gear must be marked with a 3-foot-long (0.9-meter-long) strip of black and white duct tape within 2 fathoms of a buoy attachment. In addition, three additional marks must be placed on the top, middle and bottom of the line using black and white paint or duct tape.	Gear identification would improve accountability in the case of gear loss. While adoption of this measure would improve accountability under the Proposed Action, it would not alter the impact determination of negligible for gear utilization.
Lost survey gear	All reasonable efforts that do not compromise human safety must be undertaken to recover any lost survey gear. Any lost survey gear must be reported to NMFS and BSEE.	Lost survey gear would improve accountability in the case of gear loss. While adoption of this measure would improve accountability under the Proposed Action, it would not alter the impact determination of negligible for gear utilization.

Measure	Description	Effect
Periodic underwater surveys, reporting of monofilament and other fishing gear around WTG foundations	The Lessee must monitor potential loss of fishing gear in the vicinity of WTG foundations by surveying at least ten of the WTGs located closest to shore in each Project 1 and Project 2 area annually. Survey design and effort may be modified based upon previous survey results after review and concurrence by BOEM. The Lessee must conduct surveys by remotely operated vehicles, divers, or other means to determine the locations and amounts of marine debris.	Periodic underwater surveys and reporting of monofilament and other fishing gear around WTG foundations would reduce the risk of entanglement associated with the presence of structures. While adoption of this measure would reduce risk to marine mammals under the Proposed Action, it would not alter the impact determination of negligible for presence of structures.
Vessel strike avoidance for marine mammals and sea turtles	Atlantic Shores must continue to implement vessel strike avoidance measures[1] to include the identified vessel speed restrictions and minimum separation distances for crew transfer vessels agreed to in the Applicant-proposed measures (Table G-1, Measure # LOA-4).	Vessel strike avoidance for marine mammals and sea turtles measure would ensure effective separation distances from marine mammals, which will reduce potential interactions between Project-related vessels and marine mammals. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter the impact determination of negligible for vessel traffic.
Vessel strike avoidance for Rice's whale	Project vessels must implement vessel strike avoidance measures for Rice's whale when operating in the Gulf of Mexico.	Vessel strike avoidance for Rice's whale would minimize vessel strike risk for Rice's whale. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter the impact determination of negligible for Rice's whale associated with vessel traffic.
PDC minimize vessel interactions with listed species (from HRG Programmatic)	All vessels associated with survey activities must comply with the following vessel strike avoidance measures: if any ESA-listed marine mammal is sighted within 500 meters of the forward path of a vessel, the vessel operator must steer a course away from the whale at less than 10 knots until the minimum separation distance has been established; and if any ESA-listed marine mammal is sighted within 200 meters of the forward path of a vessel, the vessel	Compliance with Project Design Criteria to minimize vessel interactions would reduce risk of vessel strike. While adoption of this measure would reduce risk to marine mammals under the Proposed Action, it would not alter the impact determination of negligible for vessel traffic

Measure	Description	Effect
	operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 meters. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 meters. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements.	
Data collection BA BMPs	All Project Design Criteria and Best Management Practices incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) shall be applied to activities associated with the construction, maintenance, and operations of the Atlantic Shores Wind project as applicable.	Compliance with Project Design Criteria and BMPs for Protected Species would minimize risk to marine mammals during HRG surveys. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter the impact determination of minor for HRG activities.
Passive Acoustic Monitoring (PAM) Plan	Atlantic Shores must prepare a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the proposed uses of PAM for mitigation and long-term monitoring.	Development and implementation of a Passive Acoustic Monitoring Plan would minimize the potential for Level A or Level B exposures during impact pile driving. While adoption of this measure would decrease risk to marine mammals during impact pile driving under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and pinnipeds for impact pile-driving noise.
Long-term PAM	The Lessee must conduct long-term PAM to record ambient noise and marine mammal calls in the Lease Area. Alternately, Atlantic Shores may make a financial contribution to BOEM's Environmental Studies Partnership for an Offshore Wind Energy Regional Observation Network to support PAM monitoring on non-lease areas.	Development and implementation of long-term PAM would improve our understanding of marine mammal habitat use within and outside lease areas. While adoption of this measure would improve our understanding for future impact evaluations, it would not alter impact determinations for marine mammals.
Pile Driving Monitoring Plan	Atlantic Shores must prepare and submit a Pile Driving Monitoring Plan detailing all plans and procedures for sound attenuation as well as for monitoring ESA-listed	Development and implementation of a Pile Driving Monitoring Plan would increase the accountability of underwater noise mitigation during pile driving. While adoption

Measure	Description	Effect
	sea turtles during all impact and vibratory pile driving.	of this measure would increase accountability during this construction activity under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and pinnipeds for impact pile-driving noise.
Alternative Monitoring Plan for pile driving	The Lessee must develop an Alternative Monitoring Plan for pile driving operations during low-visibility conditions (e.g., darkness, inclement weather) that prevent visual monitoring of the full extent of the clearance and shutdown zones. This plan must include identification of any night vision devices proposed for detection of protected species during low visibility conditions; a demonstration of the capability of the proposed monitoring methodology to detect protected species within the full extent of the clearance and shutdown zones with the same effectiveness as daytime visual monitoring; a discussion of the efficacy of each device proposed for low visibility monitoring; and reporting procedures, contacts, and timeframes.	Development and implementation of an Alternative Monitoring Plan would minimize the potential for Level A or Level B exposures during impact pile driving. While adoption of this measure would decrease risk to marine mammals during impact pile driving under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and pinnipeds for impact pile-driving noise.
PSO coverage	PSO coverage must be sufficient to reliably detect ESA-listed whales at the surface in clearance and shutdown zones to execute any pile-driving delays or shutdown requirements.	PSO coverage would minimize the potential for Level A or Level B exposures during impact pile driving. While adoption of this measure would decrease risk to marine mammals during impact pile driving under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and pinnipeds for impact pile-driving noise.
Minimum visibility requirement	In order to commence pile driving at foundations, PSOs must be able to visually monitor a 6,244-foot (1,900-meter) radius for at least 60	The minimum visibility requirement would ensure adequate monitoring during piling, minimizing the potential for exposure to sound levels above

Measure	Description	Effect
	minutes immediately prior to commencement. In order to commence pile driving at trenchless installation sites, PSOs must be able to visually monitor a 3,280-foot (1,000-meter) radius from their observation points for at least 30 minutes immediately prior to piling commencement.	regulatory thresholds. While adoption of this measure would decrease risk to marine mammals during impact pile driving under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and pinnipeds for impact pile-driving noise.
Sound field verification of foundation installation	The Lessee must submit a Sound Field Verification Plan consistent with requirements of the NMFS Biological Opinion. The results of sound field verification must be compared to modeled injury and disturbance isopleths for marine mammals.	Development and implementation of the Sound Field Verification Plan would verify that modeled acoustic ranges to marine mammal regulatory thresholds were conservative enough to not underestimate the number of marine mammal exposures during foundation installation.
Sound field verification of foundation installation	The Lessee must conduct thorough SFV monitoring of the first 3 pile installations of the Project, the first installation in each calendar year, and any subsequent foundations with differences in installation parameters that may affect sound transmission. Abbreviated SFV must be conducted for all other installations. Atlantic Shores must also submit an SFV Plan that includes measurement procedures and results reporting, approximations of expected variation of key parameters, and selection process for thorough SFV monitoring locations. The results of sound field verification must be compared to modeled injury and disturbance isopleths for marine mammals.	SFV would increase the accountability of underwater noise mitigation during pile driving. While adoption of this measure would increase accountability during this construction activity under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and pinnipeds for impact pile-driving noise.
Sound field verification	If the clearance and/or shutdown zones are expanded due to the verification of sound fields from Project activities, PSO coverage must be sufficient to reliably monitor the expanded clearance and/or shutdown zones.	SFV would increase the accountability of underwater noise mitigation during pile driving. While adoption of this measure would increase accountability during this construction activity under the Proposed Action, it would not alter the impact determination of minor for NARW and minor to moderate for other mysticetes, odontocetes, and

Measure	Description	Effect
		pinnipeds for impact pile-driving noise.
Adaptive shutdown zones	BOEM and USACE may consider reductions in the shutdown zones based upon sound field verification of a minimum of three piles. However, BOEM/USACE would ensure that the shutdown zone is not reduced to less than 0.6 mile (1,000 meters) for sei, fin, or sperm whales. No reductions in the clearance or shutdown zones for NARWs would be considered regardless of the results of sound field verification.	Adaptive shutdown zones would maintain minimum shutdown zones for ESA-listed marine mammals, minimizing the potential for Level A or Level B exposures during impact pile driving for these species. While adoption of this measure would decrease risk to ESA-listed marine mammals during impact pile driving under the Proposed Action, it would not alter the impact determinations for impact pile-driving noise.
Operational Sound Field Verification Plan	The Lessee must develop an operational sound field verification plan to determine the operational noises emitted from the offshore wind area.	The development of an Operational Sound Field Verification Plan would allow BOEM to confirm that impacts of operating WTG noise does not exceed predicted impacts based on existing monitoring data and modeling efforts. While adoption of this measure would improve accountability of WTG operational noise under the Proposed Action, it would not alter the impact determination of negligible for WTG noise.
Reporting	The Lessee must report to BOEM and BSEE within 24 hours of confirmation any incidental take of an endangered or threatened species.	Reporting requirements to document take would improve accountability for documenting marine mammal take associated with the Proposed Action. While adoption of this measure would increase accountability during this construction activity under the Proposed Action, it would not alter impact determinations for marine mammals.
Monthly/annual reporting requirements	To document the amount or extent of take that occurs during all phases of the Proposed Action, Atlantic Shores must submit monthly reports during the construction phase and during the first year of operation and must submit annual reports beginning in year 2 of operation.	Reporting requirements to document take would improve accountability for documenting marine mammal take associated with the Proposed Action. While adoption of these measures would improve accountability, it would not alter impact determinations for marine mammals.

[1] This measure would take effect after the expiration of the Project's LOA and require Atlantic Shores to continue to utilize vessel strike avoidance measures required under the Project's LOA.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits or proposed by BOEM listed in Table 3.5.6-15 and Tables G-2, G-3, and G-4 in Appendix G are incorporated in the Preferred Alternative. These measures, if adopted, would further define how the effectiveness and enforcement of mitigation measures would be ensured and improve accountability for compliance with mitigation measures by requiring the submittal of plans for approval by the enforcing agencies and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with mitigation measures that are already analyzed as part of the Proposed Action, these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.5.6.5.

3.5.6.10 Comparison of Alternatives

Construction and installation, O&M, and decommissioning of Alternatives C, D, E, and F1 would have the same moderate adverse impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, major adverse impacts on NARW, and minor beneficial impacts on odontocetes and pinnipeds as described under the Proposed Action. Alternative C would result in slightly less effects on some marine mammals due to the avoidance and minimization of impacts on valuable habitats and the potential removal or micrositing of up to 29 WTGs, 1 OSS, and associated interarray cables. The combination of Alternatives C1 and C2 would further reduce effects on some marine mammals by avoiding impacts on both valuable habitat areas in the Lease Area. Alternatives D and E would result in slightly less effects on marine mammals due to the potential removal of up to 31 and up to 5 WTGs and associated interarray cables, respectively. Alternatives F2 and F3 would result in measurably less effects on marine mammals due to avoidance of impact pile-driving noise effects. However, moderate impacts would still be expected due to ongoing activities.

3.5.6.11 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of the Proposed Action and Alternatives C4, D3, and E, as well as two BOEM-proposed mitigation measures, as described in Section 2.1.7. Under the Preferred Alternative, 29 WTGs, 1 OSS, and their associated interarray cables would be microsited outside of the 1,000-foot (305-meter) buffer of the sand ridge and swale features within AOC 1 (Lobster Hole) and AOC 2 (NMFS-identified sand ridge complex); WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and a maximum blade tip height of 932 feet (284 meters); two WTGs would be removed and 1 WTG would be microsited to establish a 0.81 nautical mile (1,500 meter) setback between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area; and no permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. Additionally, one WTG sited approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site) would be removed. The Preferred Alternative would include up to 195 WTGs,[11] up to 10 OSSs, up to 4 temporary meteorological and oceanographic (metocean) buoys (up to 3 metocean buoys in Project 1, 1 metocean buoy in Project 2), up to 1 permanent met tower (Project 1), and interarray and interlink cables. Micrositing 29 WTGs and 1 OSS and associated interarray cables outside of AOCs 1 and 2 may result in a small decrease in impacts on benthic-foraging marine mammal species (Section 3.5.6.6).

The mitigation measure related to the spacing and alignment of permanent structures in the Lease Area would not affect impacts on marine mammals. The mitigation measure to remove the WTG in proximity to the observed Fish Haven would result in a very small decrease in impacts in the Lease Area. Although the Preferred Alternative would reduce impacts on marine mammals, BOEM anticipates that impacts on marine mammals under the Preferred Alternative would not be measurably different from those anticipated under the Proposed Action. Therefore, the impacts of the Preferred Alternative on NARW would range from negligible to major across individual IPFs, and negligible to moderate for other mysticetes. Impacts of the Preferred Alternative on odontocetes and pinnipeds would range from negligible to moderate across individual IPFs with some **minor beneficial** impacts.

BOEM anticipates that the cumulative impacts of ongoing and planned activities, including the Preferred Alternative and connected action, would result in similar impacts as the Proposed Action: **major** on NARW, **moderate** on pinnipeds, odontocetes, and other mysticetes; **minor beneficial** on pinnipeds and odontocetes.

[11] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

3.5.7 Sea Turtles

The reader is referred to Appendix F, *Assessment of Resources with Moderate (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.

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3.5.8 Wetlands

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

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3.6 Socioeconomic Conditions and Cultural Resources

3.6.1 Commercial Fisheries and For-Hire Recreational Fishing

This section discusses potential impacts on commercial and for-hire recreational fisheries resources from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area for commercial and for-hire recreational fisheries, as shown on Figure 3.6.1-1, spans more than 200 million acres and includes waters within the Greater Atlantic Region managed by the NEFMC and MAFMC 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 within the Greater Atlantic Region (from 0 to 3 nautical miles [5.6 kilometers] from the coastline) extending from Maine through Cape Hatteras, North Carolina. The Project area includes the Lease Area, which is in federal waters, and offshore export cable corridors, which are in federal and state waters. 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 proposed Project.

Due to size of the geographic analysis area, the analysis for this Final 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.

3.6.1.1 Description of the Affected Environment and Future Baseline Conditions

Most fisheries resources in federal waters of the New England and Mid-Atlantic regions are managed under the MSA (16 USC 1801 et seq.) through two Regional Fishery Management Councils, NEFMC and MAFMC. The Regional Fishery Management Councils develop species-specific Fisheries Management Plans (FMP), which establish fishing quotas, seasons, and closure areas, as well as establishing protections for EFH. The Regional Fishery Management Councils work with NMFS to assess and predict the status of fish stocks, set catch limits, promote compliance with fisheries regulations, and reduce bycatch.

Within the New Jersey state waters of the Project 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) and by the Atlantic States Marine Fisheries Commission (ASMFC), a deliberative body of the Atlantic coastal states that coordinates the conservation and management of 27 nearshore, migratory fish species. Each coastal state has its own structure of agencies and plans that govern fisheries resources. In New Jersey, NJDEP’s Bureau of Marine Fisheries administers all laws relating to marine fisheries (Part 7:25, Subchapter 18 – Marine Fisheries) and is responsible for the development and enforcement of state and federal regulations pertaining to marine fish and fisheries in New Jersey state waters, including the management of diadromous species (e.g., American eel, striped bass, river herring, sturgeon).

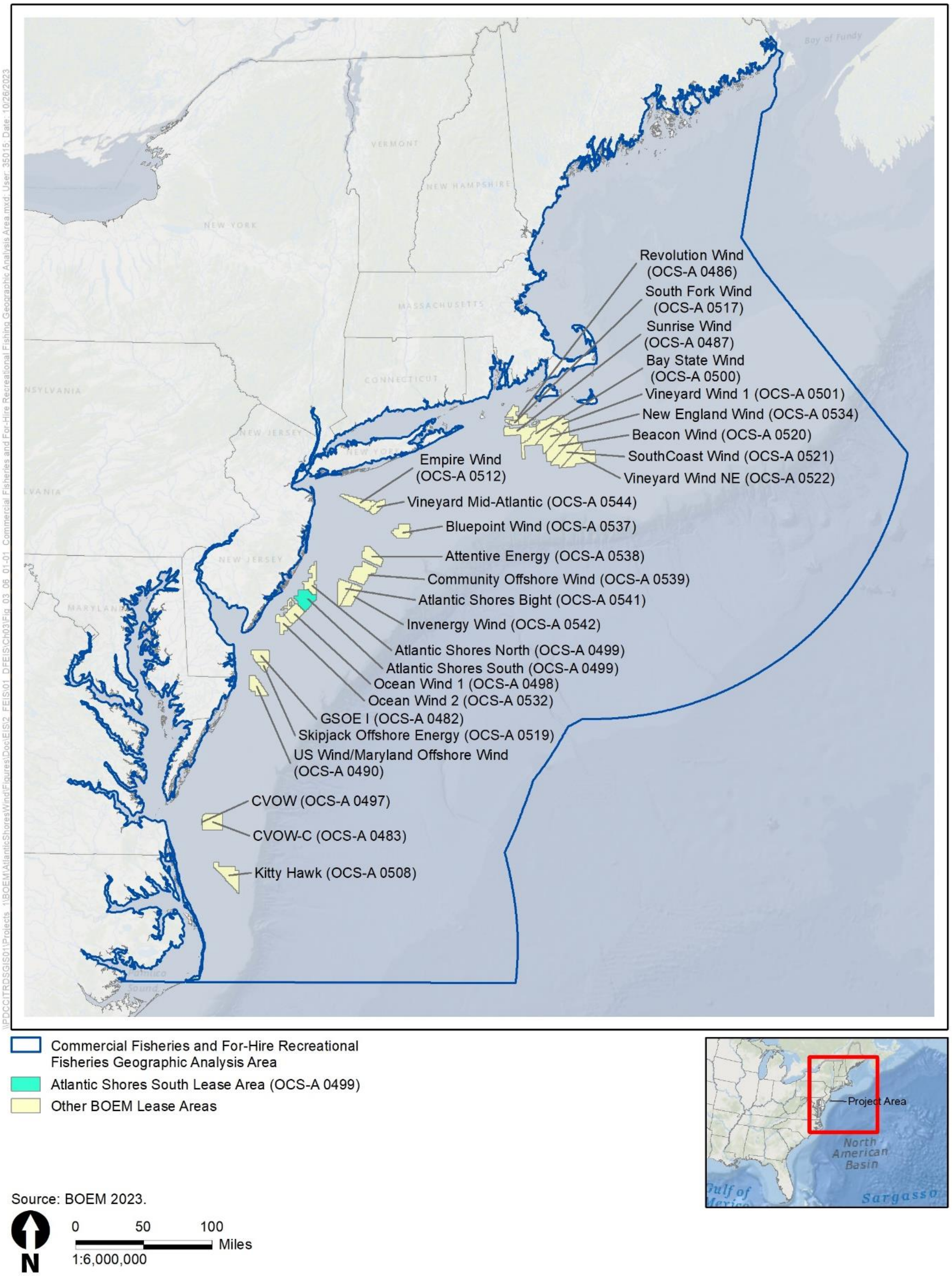

Figure 3.6.1-1. Commercial fisheries and for-hire recreational fishing geographic analysis area

Commercial Fisheries

The primary source of data used to describe commercial fisheries in the geographic analysis area for the purposes of this assessment was the NMFS commercial fisheries statistics database (NMFS 2023a), which summarizes commercial fisheries landings and ex-vessel revenue data for fish and shellfish that are landed and sold in the United States. The primary source of data used to describe the commercial fisheries in the Lease Area was NMFS' Socioeconomics Impacts of Atlantic Offshore Wind Development reports, which summarize fisheries effort and landings within wind energy lease areas (NMFS 2023b). These reports are based on combined data from Vessel Trip Reports and dealer reports submitted by those issued a permit for managed species in federal waters. In addition, figures developed by BOEM based on NMFS Vessel Monitoring System (VMS) data provided by NMFS are included in the commercial fisheries analysis. It is important to note that the data regarding the scale of commercial fisheries activity in the Lease Area presented in Section 3.6.1 likely underestimate revenue exposure associated with the Proposed Action because the data do not include vessels without federal permits and fishing for species managed by ASMFC (e.g., Atlantic menhaden) or states (e.g., conch, welk) and by NMFS for highly migratory species. Further, the data presented in this section are based solely on ex-vessel revenue and do not include an evaluation of fishery impacts on coastal communities, which will be separately analyzed in accordance with a BOEM-proposed mitigation measure (see Section 3.6.1.8, *Proposed Mitigation Measures*).

Regional Setting

Commercial fisheries in federal waters of the New England and Mid-Atlantic regions harvest a variety of finfish and shellfish species, including clams, crabs, groundfish, herring, lobster, squid, scallops, and skates. These species are harvested with a variety of fishing gear, including mobile gear (e.g., bottom trawl, midwater trawl, dredge) and fixed gear (e.g., demersal gillnet, lobster trap, crab trap, pots). The fishery resources are managed under numerous FMPs, including the Atlantic Herring FMP, Monkfish FMP, Northeast Multispecies (large- and small-mesh) FMP,[1] Red Crab FMP, Sea Scallop FMP, and Skate FMP (NEFMC 2022); Bluefish FMP, Mackerel/Squid/Butterfish FMP, Spiny Dogfish FMP, Summer Flounder/Scup/Black Sea Bass FMP, Surfclam/Ocean Quahog FMP, and Tilefish FMP (MAFMC 2022); Highly Migratory Species FMP (NMFS 2006); and Atlantic Menhaden FMP, Lobster FMP, and Jonah Crab FMP (ASMFC 2022).

The predominant commercial fish and shellfish species in the geographic analysis area based on landed weight and ex-vessel revenue are summarized by species for the years 2008 through 2022 in Table 3.6.1-1 and Table 3.6.1-2, respectively. During this period, the species with the highest average annual landed weight included Atlantic menhaden, which represented 34 percent of the average landed weight, American lobster, Atlantic herring, blue crab, sea scallop, and surfclam. The most valuable species over

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[1] The Northeast Multispecies (large-mesh) FMP includes Acadian redfish, American plaice, Atlantic cod, Atlantic haddock, Atlantic halibut, Atlantic wolffish, ocean pout, pollock, white hake, witch flounder, windowpane flounder, winter flounder, and yellowtail flounder. The Northeast Multispecies small-mesh FMP includes offshore hake, red hake, and silver hake.

this period were sea scallop and American lobster, which together represented 58 percent of the average annual ex-vessel revenue. Other valuable species harvested in state and federal waters included Atlantic herring, Atlantic menhaden, Atlantic surfclam, longfin and northern shortfin squid, summer flounder, and monkfish.

Table 3.6.1-1. Commercial fishing landings of the top 20 species by landed weight within the geographic analysis area (New England and Mid-Atlantic), 2008–2022

Species	FMP Fishery	Average Annual Landing (millions of lbs.)	Maximum Annual Landing (millions of lbs.)
Atlantic menhaden	Atlantic Menhaden	423.6	504.8
American lobster	American Lobster	131.7	159.4
Atlantic herring	Atlantic Herring	127.1	224.5
Blue crab	No federal FMP	67.7	119.0
Sea scallop	Sea Scallop	48.5	60.6
Atlantic surfclam	Surfclam and Ocean Quahog	37.6	51.6
Skates	Skate	32.0	40.1
Shortfin squid	Mackerel, Squid, and Butterfish	27.8	61.4
Longfin squid	Mackerel, Squid, and Butterfish	25.5	40.6
Monkfish	Monkfish	19.6	24.5
Ocean quahog	Surfclam and Ocean Quahog	17.6	31.7
Atlantic mackerel	Mackerel, Squid, and Butterfish	17.3	49.9
Spiny dogfish	Spiny Dogfish	14.8	24.1
Jonah crab	Jonah Crab	13.9	20.2
Silver hake	Northeast Multispecies (Small-Mesh)	13.6	17.8
Scup	Summer Flounder, Scup, and Black Sea Bass	13.3	17.8
Haddock	Northeast Multispecies (Large-Mesh)	13.2	22.4
Pollock	Northeast Multispecies (Large-Mesh)	10.5	22.0
Acadian redfish	Northeast Multispecies (Large-Mesh)	8.4	12.9
Summer flounder	Summer Flounder, Scup, and Black Sea Bass	8.2	13.0
All species[1]		**1,239.5**	**1,454.0[2]**

Source: NMFS 2023a.

[1] Includes 250 species and taxonomic groups (e.g., drums, skates) for which there were recorded landings. For comparison, the sum of the average annual landings of all individual species listed in the table is 1,078 million pounds.

[2] Reflects a single year in which the sum of landings across all species was highest.

Table 3.6.1-2. Commercial fishing revenue of the top 20 species by revenue within the geographic analysis area (New England and Mid-Atlantic), 2008–2022

Species	FMP Fishery	Average Annual Revenue (millions of dollars)	Maximum Annual Revenue (millions of dollars)
American lobster	American Lobster	$534.9	$927.9
Sea scallop	Sea Scallop	$492.7	$671.4
Blue crab	No federal FMP	$93.3	$127.5
Eastern oyster[1]	No federal FMP	$67.8	$108.1
Atlantic menhaden	Atlantic Menhaden	$52.3	$129.2
Northern quahog[1]	No federal FMP	$44.8	$76.5
Longfin squid	Mackerel, Squid, and Butterfish	$31.6	$60.6
Atlantic surfclam	Surfclam and Ocean Quahog	$29.1	$50.7
Soft-shell clam	No federal FMP	$24.3	$34.3
Summer flounder	Summer Flounder, Scup, and Black Sea Bass	$22.5	$27.4
Atlantic Herring	Atlantic Herring	$20.7	$31.8
Monkfish	Monkfish	$18.4	$27.1
Striped bass	No federal FMP	$16.9	$22.0
Haddock	Northeast Multispecies (Large-Mesh)	$14.9	$22.4
American eel	No federal FMP	$14.1	$39.7
Ocean quahog	Surfclam and Ocean Quahog	$13.3	$26.3
Atlantic Cod	Northeast Multispecies (Large-Mesh)	$13.0	$32.6
Shortfin squid	Mackerel, Squid, and Butterfish	$12.0	$27.3
Jonah crab	Jonah Crab	$11.6	$21.9
Silver hake	Northeast Multispecies (Small-Mesh)	$9.9	$11.3
All species[2]		**$1,772.6**	**$2,464.4[3]**

Source: NMFS 2023a.
[1] Farmed.
[2] Includes 250 species and taxonomic groups (e.g., drums, skates) for which there were recorded landings.
[3] Reflects a single year in which the sum of revenue across all species was highest.

Commercial fisheries provide economic benefits to the coastal communities of New England and the Mid-Atlantic region by contributing to the income of vessel crews and owners and by creating demand for dockside services to process seafood products and maintain vessels. Table 3.6.1-3 summarizes the average annual revenue by port of landing from 2008 through 2022 for ports in the geographic analysis area. Landings in New Bedford, Massachusetts, represented approximately 32 percent of the average annual commercial fishing revenue in this area. The ports with the next highest revenues—Cape May, New Jersey, and Reedville, Virginia—represented 7 percent and 5 percent, respectively.

Table 3.6.1-3. Commercial fishing landings and revenue for the top 20 highest revenue ports in the geographic analysis area (New England and Mid-Atlantic), 2008–2022

Port and State	Average Annual Landings (millions of lbs.)	Maximum Annual Landings (millions of lbs.)	Average Annual Revenue (millions of dollars)	Maximum Annual Revenue (millions of dollars)
New Bedford, MA	123.8	170.0	$372.9	$569.7
Cape May-Wildwood, NJ	68.7	113.5	$78.1	$147.7
Reedville, VA	347.4	426.1	$64.5	$466.5
Hampton Roads Area, VA	14.7	19.3	$58.4	$88.3
Gloucester, MA	69.9	122.3	$54.4	$80.3
Point Judith, RI	45.2	57.3	$50.7	$72.1
Stonington, ME	17.3	25.4	$50.1	$73.2
Vinalhaven, ME	9.5	13.4	$35.5	$55.8
Provincetown-Chatham, MA	18.3	26.5	$29.0	$38.9
Point Pleasant, NJ	24.7	43.3	$28.7	$35.7
Long Beach-Barnegat, NJ	7.0	8.9	$28.5	$64.6
Portland, ME	40.7	62.4	$28.0	$38.1
Wanchese-Stumpy Point, NC	18.1	25.6	$22.3	$26.6
Friendship, ME	6.4	9.1	$22.2	$40.7
Beals Island, ME	6.6	8.1	$20.9	$35.6
Newington, NH	3.9	4.7	$20.6	$30.0
Atlantic City, NJ	25.7	35.3	$19.2	$24.1
Montauk, NY	11.6	14.8	$16.9	$21.2
Boston, MA	14.6	20.2	$16.5	$19.3
Spruce Head, ME	4.5	6.3	$16.4	$31.5
All New England and Mid-Atlantic ports[1]	**989.2**	**1,073.7**	**$1,180.0[2]**	**$2,207**

Source: NMFS 2023a.
[1] Includes 54 ports within the New England and Mid-Atlantic regions.
[2] Reflects a single year in which the sum of landings or revenue across all ports was highest.

Project Area

The Project area contains spawning habitat for species that are valued in commercial and recreational fisheries. Species that have designated EFH for eggs in the Project area, indicative of having spawning habitat there, include Atlantic butterfish, Atlantic cod, Atlantic sea scallop, Atlantic mackerel, bluefish, longfin inshore squid, monkfish, ocean pout, red hake, silver hake, summer flounder, windowpane flounder, winter flounder, witch flounder, and yellowtail flounder (COP Volume II, Appendix J; Atlantic Shores 2024).

Commercial fishing effort in the Project 1 and Project 2 WTAs[2] varies among species, fishing ports, and fishing gear types. Fishing effort within the WTAs from 2008 through 2022 is summarized by species for Project 1 and Project 2 in Table 3.6.1-4, by species for both WTAs combined in Table 3.6.1-5, by port for

[2] The Project 1 and Project 2 WTAs each include the area of overlap between the two projects.

Project 1 and Project 2 in Table 3.6.1-6, by port for both WTAs combined in Table 3.6.1-7, by gear type for Project 1 and 2 in Table 3.6.1-8, and by gear type for both WTAs combined in Table 3.6.1-9. Annualized commercial fishing effort in the WTAs by species, port, and gear type is provided in Table B.3-1 through Table B.3-18 in Appendix B, *Supplemental Information and Additional Figures and Tables*. The species with the highest number of vessel trips to each WTA was Atlantic surfclam, which accounted for 18 percent of trips to the combined WTAs. Other species that were commonly targeted in both WTAs included American lobster, Atlantic sea scallop, black sea bass, longfin squid, monkfish, and summer flounder. Fishing effort in the WTAs is broadly distributed across ports ranging from North Carolina to Massachusetts, although the majority of the fishing effort comes from New Jersey ports. Fishing effort by port was similar between the Project 1 and Project 2 WTAs, with an annual average of 140 vessels making 502 trips to the Project 1 WTA and 141 vessels making 528 trips to the Project 2 WTA, although it should be noted that many of these vessels probably visited both WTAs. The fishing port with the highest number of vessel trips to each WTA was Atlantic City, New Jersey, which accounted for 56 percent of trips to the combined WTAs. Other fishing ports that accounted for a large share of trips to both WTAs included Cape May and Barnegat, New Jersey; Point Judith, Rhode Island; New Bedford, Massachusetts; and Newport News and Hampton, Virginia. Cape May, New Jersey accounted for the highest number of vessels that fished in the WTAs. The distribution of fishing effort among the different types of fishing gears was similar between the Project 1 and Project 2 WTAs. The fishing gears that had the highest number of vessel trips to each of the WTAs were the clam dredge and bottom trawl, which collectively accounted for 68 percent of vessel trips to the combined WTAs. The fishing gears that had the highest number of vessels that fished in each of the WTAs were the bottom trawl and scallop dredge, which collectively accounted for 80 percent of vessels that fished in the combined WTAs.

Table 3.6.1-4. Annual average and maximum number of commercial fishing vessel trips and commercial fishing vessels in the Project 1 and Project 2 WTAs by species, 2008–2022

Project 1[1]					Project 2[2]				
Species[3]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels	Species[3]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels
Atlantic surfclam	195	355	15	20	Atlantic surfclam	213	410	14	20
Atlantic sea scallop	122	326	68	159	Atlantic sea scallop	134	338	69	153
Monkfish	109	248	61	130	Monkfish	118	251	65	127
Black sea bass	103	146	39	56	Summer flounder	100	154	58	93
Summer flounder	99	163	55	95	Black sea bass	100	139	41	61
Longfin squid	83	141	40	59	Longfin squid	86	139	42	63
American lobster	59	81	10	20	American lobster	52	79	10	19
Bluefish	42	86	28	47	Bluefish	42	84	28	47
Scup	36	59	25	39	Scup	42	74	28	43
Butterfish	34	52	20	33	Butterfish	34	50	20	30
Shortfin squid	26	67	7	11	Shortfin squid	25	64	7	11
Jonah crab	22	41	5	10	Silver hake	22	39	15	25
Silver hake	20	35	14	24	John dory	19	34	11	18
John dory	19	34	10	16	Jonah crab	18	39	4	10
Red hake	15	36	9	24	Atlantic mackerel	14	27	10	19
Channeled whelk	14	46	4	10	Weakfish	13	34	10	22
Weakfish	14	33	11	21	Red hake	13	32	9	23
Atlantic mackerel	13	27	9	16	Atlantic croaker	11	32	6	20
Dogfish smooth	13	30	7	14	Golden tilefish	10	21	7	14
Atlantic croaker	12	35	7	22	Channeled whelk	10	45	2	6
All species[4]	**1,146**	**1,688**	**498**	**841**	**All species[4]**	**1,148**	**1,717**	**505**	**814**

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Species are sorted by average vessel trips in descending order.

[4] Includes all species with documented trips in each of the WTAs (54 species in the Project 1 WTA, 50 species in the Project 2 WTA).

Note: Data are for vessels issued federal fishing permits by GARFO.

Table 3.6.1-5. Annual average and maximum number of commercial fishing vessel trips and commercial fishing vessels in the combined Project 1 and Project 2 WTAs by species, 2008–2022

Species[1]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels
Atlantic surfclam	235	423	15	20
Atlantic sea scallop	144	368	74	168
Monkfish	128	285	68	138
Black sea bass	111	155	44	63
Summer flounder	110	170	60	99
Longfin squid	90	149	43	63
American lobster	60	81	11	21
Bluefish	47	97	30	51
Scup	43	74	29	44
Butterfish	37	55	22	33
Shortfin squid	27	69	7	11
Jonah crab	23	41	5	10
Silver hake	23	39	15	25
John dory	21	36	11	18
Red hake	16	36	10	24
Weakfish	15	34	11	22
Atlantic mackerel	15	29	10	19
Channeled whelk	14	46	4	10
Smooth dogfish	14	30	8	14
Atlantic croaker	12	35	7	22
All species[2]	**1,290**	**1,944**	**545**	**880**

Source: NMFS 2023b.

[1] Species are sorted by average vessel trips in descending order.

[2] Incudes 55 species that were landed in the combined Project 1 and Project 2 WTAs.

Note: Data are for vessels issued federal fishing permits by GARFO.

Table 3.6.1-6. Annual average and maximum number of commercial fishing vessel trips and commercial fishing vessels in the Project 1 and Project 2 WTAs by fishing port, 2008–2022

Project 1[1]					Project 2[2]				
Port and State[3]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels	Port and State[3]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels
Atlantic City, NJ	271	469	19	30	Atlantic City, NJ	309	550	19	29
Cape May, NJ	78	189	39	88	Cape May, NJ	73	179	38	82
New Bedford, MA	26	82	18	55	New Bedford, MA	24	70	17	47
Barnegat, NJ	24	64	8	14	Barnegat, NJ	23	64	7	13
Newport News, VA	21	65	13	33	Newport News, VA	22	63	14	37
Point Judith, RI	15	23	8	17	Hampton, VA	16	32	11	19
Hampton, VA	14	27	9	18	Point Judith, RI	15	27	8	17
Point Pleasant, NJ	9	20	6	11	Point Pleasant, NJ	11	22	7	12
North Kingstown, RI	8	34	1	5	North Kingstown, RI	7	36	1	5
Beaufort, NC	6	11	5	10	Beaufort, NC	6	11	6	10
Ocean City, MD	6	16	4	9	Ocean City, MD	5	11	3	6
Sea Isle City, NJ	5	28	1	4	Wanchese, NC	5	15	3	12
Barnegat Light, NJ	5	49	< 1	3	Davisville, RI	4	19	1	4
Davisville, RI	4	19	1	4	Chincoteague, VA	2	10	1	5
Wanchese, NC	4	12	3	9	Oriental, NC	2	8	2	7
Chincoteague, VA	2	9	1	5	Sea Isle City, NJ	2	9	1	3
Long Beach, NJ	2	27	1	12	Long Beach, NJ	1	21	1	13
Oriental, NC	2	7	1	7	Montauk, NY	1	7	1	5
Wildwood, NJ	1	15	< 1	4	Hobucken, NC	< 1	5	< 1	4
Montauk, NY	1	7	1	5	Shinnecock, NY	< 1	5	< 1	4
Shinnecock, NY	< 1	5	< 1	4	Belford, NJ	< 1	3	< 1	3
All ports	**502**	**859**	**140**	**252**	Wildwood, NJ	< 1	3	< 1	3
					All ports	**528**	**912**	**141**	**245**

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Ports are sorted by average vessel trips in descending order.

Note: Data are for vessels issued federal fishing permits by GARFO.

Table 3.6.1-7. Annual average and maximum number of commercial fishing vessel trips and commercial fishing vessels in the combined Project 1 and Project 2 WTAs by fishing port, 2008–2022

Port and State[1]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels
Atlantic City, NJ	322	567	20	31
Cape May, NJ	84	208	41	89
New Bedford, MA	28	86	20	58
Barnegat, NJ	26	65	8	15
Newport News, VA	23	66	14	37
Hampton, VA	16	33	11	19
Point Judith, RI	16	28	9	18
Point Pleasant, NJ	11	22	7	13
North Kingstown, RI	9	36	1	5
Beaufort, NC	7	11	6	10
Ocean City, MD	6	16	4	9
Sea Isle City, NJ	6	28	1	4
Barnegat Light, NJ	5	49	< 1	3
Wanchese, NC	5	15	3	12
Davisville, RI	4	19	1	4
Chincoteague, VA	2	10	1	5
Long Beach, NJ	2	32	1	13
Oriental, NC	2	8	2	7
Wildwood, NJ	1	15	< 1	4
Montauk, NY	1	7	1	5
Hobucken, NC	< 1	5	< 1	4
Shinnecock, NY	< 1	5	< 1	4
Belford, NJ	< 1	3	< 1	3
All ports[1]	**577**	**988**	**152**	**266**

Source: NMFS 2023b.

[1] Ports are sorted by average vessel trips in descending order.

Note: Data are for vessels issued federal fishing permits by GARFO.

Table 3.6.1-8. Annual average and maximum number of commercial fishing vessel trips and commercial fishing vessels in the Project 1 and Project 2 WTAs by fishing gear, 2008–2022

Project 1[1]					Project 2[2]				
Gear Type[3]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels	Gear Type[3]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels
Dredge-clam	218	385	16	22	Dredge-clam	254	456	16	22
Trawl-bottom	149	226	61	89	Trawl-bottom	151	224	64	91
Dredge-scallop	93	310	58	155	Dredge-scallop	98	305	58	150
Pot-other	74	107	8	12	Pot-other	62	106	7	10
Gillnet-sink	13	29	4	9	Gillnet-sink	5	23	3	8
Pot-lobster	4	15	2	6	Pot-lobster	3	13	2	6
Trawl-midwater	1	11	1	9	Trawl-midwater	1	12	1	10
All gear	**552**	**935**	**150**	**260**	**All gear**	**576**	**980**	**151**	**251**

Source: NMFS 2023.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Gear types are sorted by average vessel trips in descending order.

Notes: Data are for vessels issued federal fishing permits by GARFO. Differences in totals are the result of rounding.

Table 3.6.1-9. Annual average and maximum number of commercial fishing vessel trips and commercial fishing vessels in the combined Project 1 and Project 2 WTAs by fishing gear, 2008–2022

Gear Type[1]	Average Vessel Trips	Maximum Vessel Trips	Average Number of Vessels	Maximum Number of Vessels
Dredge-clam	266	471	16	22
Trawl-bottom	162	239	66	92
Dredge-scallop	108	335	63	165
Pot-other	74	108	9	12
Gillnet-sink	14	38	4	9
Pot-lobster	4	15	2	7
Trawl-midwater	1	12	1	10
All gear	**629**	**1,061**	**161**	**274**

Source: NMFS 2023b.

[1] Gear types are sorted by average vessel trips in descending order.

Notes: Data are for vessels issued federal fishing permits by GARFO. Differences in totals are the result of rounding.

Annual average commercial fishing landings and revenue within the WTAs from 2008 through 2022 are summarized by species for Project 1 and Project 2 in Table 3.6.1-10 and for both WTAs combined in Table 3.6.1-11. Annualized commercial fishing landings and revenue in the WTAs are summarized by species in Table B.3-19 through Table B.3-24 in Appendix B. Commercial fishing activity landed an annual average weight of 540,398 pounds in the Project 1 WTA and 500,400 pounds in the Project 2 WTA. The species with the highest landed weight in both the Project 1 and Project 2 WTAs was surfclam, which accounted for 75 percent of the landed weight in the combined Project 1 and Project 2 WTAs. Other species that had substantial landings in both WTAs included Atlantic herring, Atlantic sea scallop, Atlantic mackerel, Atlantic menhaden, shortfin and longfin squid, and summer flounder. There were substantially higher landings of Atlantic herring, Atlantic menhaden, black sea bass, and squid in the Project 1 WTA compared to the Project 2 WTA, whereas there were substantially higher landings of ocean quahog in the Project 2 WTA. Species that were not harvested under a federal FMP also had substantial landings in both WTAs.

Commercial fishing activity, including both FMP and non-FMP fisheries, generated an average annual revenue of $468,421 in the Project 1 WTA and $444,954 in the Project 2 WTA. The species that generated the highest revenue in both WTAs were surfclam and sea scallop, which together accounted for 90 percent of the revenue generated in the combined Project 1 and Project 2 WTAs. Other species that generated substantial revenue in both WTAs included Atlantic menhaden, black sea bass, longfin shortfin squid, and summer flounder. There was substantially higher revenue generated by harvest of American lobster, Atlantic menhaden, and black sea bass in the Project 1 WTA compared to the Project 2 WTA, whereas there was substantially higher revenue generated by harvest of ocean quahog in the Project 2 WTA. Species that were not harvested under a federal FMP also generated a substantial amount of revenue in both WTAs.

Annual average percentages of commercial landings and revenue in the geographic analysis area that were harvested within the Project 1 and Project 2 WTAs from 2008 through 2022 are summarized by species for Project 1 and Project 2 in Table 3.6.1-12 and for both WTAs combined in Table 3.6.1-13. Annualized percentages of commercial fishing landings and revenue from the Project 1 and Project 2 WTAs are summarized by species in Table B.3-25 through Table B.3-30 in Appendix B. Percentages of commercial landings and revenue are only presented for species managed by GARFO because percentages cannot be accurately estimated from the available data for other species. The species with the highest percentages of landings and revenue harvested in the Project 1 WTA were surfclam and black sea bass. The species with the highest percentage of landings and revenue harvested in the Project 2 WTA was surfclam; no other species had more than 0.05 percent of its revenue generated in the Project 2 WTA. There were substantial differences between the Project 1 and Project 2 WTAs in terms of the percentages of landings and revenue of species. In particular, the Project 1 WTA accounted for a much higher percentage of landings and revenue of black sea bass.

Table 3.6.1-10. Annual average and maximum commercial fishing landings and revenue in the Project 1 and Project 2 WTAs by species, 2008–2022

Project 1[1]					Project 2[2]				
Species[3]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)	Species[3]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
Atlantic surfclam	365,083	1,173,386	$280,375	$985,955	Atlantic surfclam	403,636	1,230,107	$305,078	$992,534
Atlantic sea scallop	12,007	37,790	$131,249	$363,606	Atlantic sea scallop	9,981	38,761	$105,791	$362,883
All others	52,897	305,420	$13,038	$63,157	All others	52,723	439,216	$12,185	$66,595
Atlantic menhaden	83,535	712,532	$12,284	$88,660	Summer flounder	1,340	4,218	$4,198	$15,266
Black sea bass	2,742	5,156	$7,711	$14,757	Longfin squid	2,655	4,184	$3,573	$6,325
Summer flounder	1,604	4,593	$4,835	$16,329	Shortfin squid	4,945	19,244	$3,143	$13,285
Longfin squid	3,537	5,480	$4,768	$8,897	Atlantic menhaden	15,407	161,984	$2,601	$23,320
Shortfin squid	6,744	28,561	$4,277	$19,705	Ocean quahog	2,735	33,453	$2,586	$31,116
American lobster	831	1,636	$3,950	$7,573	Black sea bass	719	1,325	$2,088	$3,194
Smooth dogfish	1,563	7,773	$1,255	$8,345	American lobster	171	350	$820	$1,840
Ocean quahog	832	7,608	$796	$7,327	Atlantic mackerel	2,058	15,435	$598	$3,202
Atlantic mackerel	2,599	22,445	$695	$4,659	Monkfish	207	923	$512	$2,171
Atlantic croaker	1,350	6,387	$624	$2,934	Smooth dogfish	509	2,041	$436	$2,003
Monkfish	203	789	$508	$2,111	Atlantic croaker	758	2,937	$364	$1,379
Scup	617	1,964	$405	$962	Scup	535	1,422	$338	$818
Channeled whelk	99	421	$315	$2,349	Atlantic herring	1,108	13,510	$115	$1,349
Atlantic herring	2,520	21,650	$310	$2,209	Silver hake	136	880	$100	$602
Tautog	88	619	$241	$1,403	Channeled whelk	23	131	$65	$541
Winter skate	258	1,768	$144	$1,462	Winter skate	77	780	$50	$623
Silver hake	186	1,607	$130	$1,098	Tautog	14	121	$48	$291
All species	**540,398**	**1,458,556**	**$468,421**	**$1,412,140**	**All species[4]**	**500,400**	**1,325,947**	**$444,954**	**$1,268,321**

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Species are sorted by average revenue in descending order.

[4] Includes all species that were landed in each of the WTAs (54 species in the Project 1 WTA, 50 species in the Project 2 WTA).

Notes: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-11. Annual average and maximum commercial fishing landings and revenue in the combined Project 1 and Project 2 WTAs by species, 2008–2022

Species[1]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
Atlantic surfclam	660,487	1,895,999	$502,320	$1,539,207
Atlantic sea scallop	18,723	64,265	$202,110	$610,463
All others	62,310	351,367	$15,747	$74,700
Atlantic menhaden	99,041	788,465	$14,697	$98,115
Black sea bass	3,150	5,756	$8,903	$16,527
Summer flounder	2,535	7,405	$7,803	$26,488
Longfin squid	5,279	7,987	$7,105	$13,042
Shortfin squid	9,918	41,394	$6,297	$28,564
American lobster	921	1,784	$4,377	$8,231
Ocean quahog	3,289	37,928	$3,107	$35,340
Smooth dogfish	1,823	8,920	$1,468	$9,347
Atlantic mackerel	3,991	32,331	$1,111	$6,706
Monkfish	360	1,398	$892	$3,439
Atlantic croaker	1,844	8,263	$861	$3,808
Scup	980	2,979	$634	$1,425
Atlantic herring	3,599	30,258	$450	$3,039
Channeled whelk	114	502	$356	$2,706
Tautog	97	680	$271	$1,536
Silver hake	270	2,045	$193	$1,399
Jonah crab	325	747	$158	$509
All species[2]	**880,666**	**2,244,447**	**$779,581**	**$2,228,224**

Source: NMFS 2023b.

[1] Species are sorted by average revenue in descending order.

[2] Includes 55 species that were landed in the WTAs.

Notes: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-12. Annual average commercial fishing landings and revenue in the Project 1 and Project 2 WTAs as a percentage of annual average landings and revenue in the geographic analysis area by species, 2008–2022

Project 1[1]			Project 2[2]		
Species[3]	Percentage of Landings	Percentage of Revenue	Species[3]	Percentage of Landings	Percentage of Revenue
Atlantic surf clam	0.912	0.783	Atlantic surf clam	1.002	0.845
Black sea bass	0.166	0.121	Clearnose skate	0.060	0.036
Atlantic sea scallop	0.024	0.024	Black sea bass	0.040	0.031
Shortfin squid	0.019	0.023	Atlantic sea scallop	0.020	0.019
Clearnose skate	0.028	0.020	Shortfin squid	0.014	0.017
Summer flounder	0.016	0.017	Summer flounder	0.013	0.015
Atlantic mackerel	0.011	0.013	Atlantic mackerel	0.009	0.011
Longfin squid	0.014	0.013	Longfin squid	0.011	0.010
Scup	0.007	0.006	Ocean quahog	0.008	0.009
Bluefish	0.005	0.005	Scup	0.006	0.005
Ocean pout	0.009	0.003	Bluefish	0.003	0.003
Butterfish	0.003	0.003	Monkfish	0.002	0.002
Winter skate	0.004	0.003	Butterfish	0.002	0.002
Ocean quahog	0.002	0.003	Red hake	0.001	0.001
Monkfish	0.002	0.002	Winter skate	0.001	0.001
Red hake	0.002	0.001	Ocean pout	0.002	0.001
Atlantic herring	0.002	0.001	Silver hake	0.001	0.001
Silver hake	0.001	0.001	Atlantic herring	0.001	< 0.001

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Species are sorted by percentage of revenue in descending order.

Notes: Data are for vessels issued federal fishing permits by GARFO. Proportionate landings and revenue are only presented for species managed by GARFO.

Table 3.6.1-13. Annual average commercial fishing landings and revenue in the combined Project 1 and Project 2 WTAs as a percentage of annual average landings and revenue in the geographic analysis area by species, 2008–2022

Species[1]	Percentage of Landings	Percentage of Revenue
Atlantic surf clam	1.643	1.395
Black sea bass	0.189	0.139
Clearnose skate	0.077	0.050
Atlantic sea scallop	0.038	0.037
Shortfin squid	0.027	0.034
Summer flounder	0.025	0.028
Atlantic mackerel	0.018	0.021
Longfin squid	0.021	0.020
Ocean quahog	0.010	0.011
Bluefish	0.007	0.007
Butterfish	0.005	0.004
Ocean pout	0.010	0.004
Monkfish	0.004	0.004
Winter skate	0.004	0.003
Red hake	0.003	0.002
Silver hake	0.002	0.002
Atlantic herring	0.002	0.002
Little skate	0.001	0.001
Atlantic deep-sea red crab	0.001	0.001

Source: NMFS 2023b.
[1] Species are sorted by percentage of revenue in descending order.
Notes: Data are for vessels issued federal fishing permits by GARFO. Proportionate landings and revenue are only presented for species managed by GARFO.

Annual average commercial fishing landings and revenue within the WTAs from 2008 through 2022 are summarized by fishing port for Project 1 and Project 2 in Table 3.6.1-14 and for both WTAs combined in Table 3.6.1-15. Annualized commercial fishing landings and revenue in the WTAs are summarized by fishing port in Table B.3-31 through Table B.3-36 in Appendix B. The fishing port with the highest landed weight and revenue in both WTAs was Atlantic City, New Jersey by a wide margin. Atlantic City accounted for approximately 75 percent of the landed weight and 67 percent of revenue from the combined Project 1 and Project 2 WTAs. Other fishing ports that accounted for substantial landings and revenue in were similar in the Project 1 and Project 2 WTAs and included Cape May and Barnegat, New Jersey; New Bedford, Massachusetts; and Hampton and Newport New, Virginia. Although overall landings and revenue were similar between the Project 1 and Project 2 WTAs, there were some differences between these WTAs in terms of landings and revenue among ports. In particular, Beaufort, North Carolina, Cape May, and New Bedford and had higher landings and revenue from the Project 1 WTA, whereas Point Pleasant, New Jersey had higher landings and revenue from the Project 2 WTA.

Annual average commercial fishing landings and revenue within the WTAs from 2008 through 2022 are summarized by state for Project 1 and Project 2 in Table 3.6.1-16 and for both WTAs combined in Table 3.6.1-17. Annualized commercial fishing landings and revenue in the WTAs are summarized by state in Table B.3-43 through Table B.3-48 in Appendix B. The state with the highest landings and revenue in both WTAs was New Jersey, which landed 880,066 pounds and generated $779,580 from the combined Project 1 and Project 2 WTAs annually. New Jersey accounted for approximately 90 percent of landings and 80 percent of revenue in the combined Project 1 and Project 2 WTAs. Other states that accounted for substantial landings and revenue were similar in the Project 1 and Project 2 WTAs and included Massachusetts, Virginia, Rhode Island, North Carolina, and New Hampshire.

Annual average percentages of commercial revenue in the geographic analysis area that were harvested in the WTAs from 2008-2022 are summarized by fishing port for Project 1 and Project 2 in Table 3.6.1-18 and for both WTAs combined in Table 3.6.1-19. Annualized percentages of commercial fishing landings and revenue from the WTAs are summarized by fishing port in Table B.3-37 through Table B.3-42 in Appendix B. These percentages are likely overestimated because they do not include landings and revenue of vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species. The fishing port with the highest percentages of landings and revenue harvested in the Project 1 and Project 2 WTAs by a wide margin was Atlantic City, New Jersey, which generated 2.42 percent of its landings and 1.98 percent of its revenue from the combined Project 1 and Project 2 WTAs. Other ports that had substantial percentages of their landings and revenue from the Project 1 and Project 2 WTAs included Newport News, Virginia and Cape May, New Jersey. There were some differences between the Project 1 and Project 2 WTA in terms of the percentages of landings and revenue of fishing ports. In particular, Beaufort, North Carolina and Cape May and Sea Isle City, New Jersey generated a higher percentage of their landings and revenue in the Project 1 WTA.

Table 3.6.1-14. Annual average and maximum commercial fishing landings and revenue in the Project 1 and Project 2 WTAs by fishing port, 2008–2022

Project 1[1]					Project 2[2]				
Port and State	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)	Port and State	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
Atlantic City, NJ	368,483	1,172,482	$292,971	$1,000,516	Atlantic City, NJ	411,121	1,241,970	$314,411	$1,017,547
Cape May, NJ	99,122	715,554	$54,302	$116,786	Cape May, NJ	48,819	440,129	$39,781	$109,496
All others	51,586	274,975	$33,912	$86,819	Newport News, VA	2,961	16,448	$26,839	$152,181
New Bedford, MA	5,405	27,582	$30,659	$174,198	All others	21,677	137,532	$26,044	$66,833
Newport News, VA	3,370	14,756	$29,497	$134,366	New Bedford, MA	2,965	9,380	$17,756	$51,100
Barnegat, NJ	2,870	8,183	$8,401	$32,689	Barnegat, NJ	1,977	7,606	$5,519	$14,394
Hampton, VA	1,139	3,620	$6,511	$31,123	Hampton, VA	917	2,835	$5,332	$23,781
Beaufort, NC	455	4,635	$4,376	$60,052	Point Pleasant, NJ	4,077	29,369	$3,370	$21,632
North Kingstown, RI	2,594	13,089	$1,657	$7,211	Davisville, RI	2,176	26,641	$1,155	$12,447
Point Pleasant, NJ	1,013	7,576	$1,425	$4,452	North Kingstown, RI	1,802	10,397	$1,136	$5,758
Davisville, RI	2,021	21,666	$1,339	$13,013	Beaufort, NC	207	997	$991	$9,409
Point Judith, RI	670	1,189	$851	$1,441	Ocean City, MD	675	5,675	$877	$4,701
Ocean City, MD	478	2,464	$831	$3,994	Point Judith, RI	595	1,462	$748	$1,272
Sea Isle City, NJ	104	590	$384	$3,283	Wanchese, NC	133	549	$219	$724
Wildwood, NJ	360	5,350	$286	$3,889	Long Beach, NJ	39	585	$210	$3,153
Wanchese, NC	168	799	$275	$1,021	Sea Isle City, NJ	23	166	$208	$2,389
Chincoteague, VA	240	2,951	$249	$2,414	Chincoteague, VA	72	596	$110	$660
Long Beach, NJ	69	1,035	$241	$3,620	Oriental, NC	39	270	$76	$427
Oriental, NC	56	389	$111	$611	Montauk, NY	74	818	$65	$642
Barnegat Light, NJ	101	1,020	$49	$536	Shinnecock, NY	42	636	$52	$784
Montauk, NY	55	718	$46	$582	Wildwood, NJ	5	70	$42	$632
Shinnecock, NY	39	592	$46	$688	Hobucken, NC	4	63	$7	$108
All ports	**540,399**	**1,458,556**	**$468,421**	**$1,412,142**	**All ports**	**500,400**	**1,325,946**	**$444,954**	**$1,268,320**

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-15. Annual average and maximum commercial fishing landings and revenue in the combined Project 1 and Project 2 WTAs by fishing port, 2008–2022

Port and State[1]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
Atlantic City, NJ	663,090	1,913,786	$518,395	$1,538,526
Cape May, NJ	116,830	792,438	$79,052	$189,496
All others	65,634	365,812	$51,117	$132,449
Newport News, VA	5,428	25,975	$48,243	$242,011
New Bedford, MA	7,254	33,164	$41,578	$208,227
Barnegat, NJ	4,140	13,126	$12,122	$35,096
Hampton, VA	1,739	5,216	$9,950	$45,004
Beaufort, NC	593	5,130	$4,970	$65,181
Point Pleasant, NJ	4,710	33,998	$4,194	$24,333
North Kingstown, RI	3,907	19,505	$2,498	$10,492
Davisville, RI	3,669	42,358	$2,163	$22,086
Ocean City, MD	1,010	6,074	$1,492	$5,563
Point Judith, RI	1,079	2,266	$1,360	$2,221
Sea Isle City, NJ	122	668	$520	$4,751
Wanchese, NC	270	1,160	$439	$1,514
Long Beach, NJ	97	1,448	$384	$5,762
Wildwood, NJ	418	6,179	$347	$4,417
Chincoteague, VA	286	3,345	$319	$2,836
Oriental, NC	82	566	$161	$889
Montauk, NY	118	1,284	$105	$1,016
Shinnecock, NY	73	1,090	$88	$1,314
Barnegat Light, NJ	111	1,134	$67	$585
Hobucken, NC	8	127	$15	$228
Belford, NJ	2	25	$5	$70
All ports	**880,667**	**2,244,446**	**$779,581**	**$2,228,225**

Source: NMFS 2023b.

[1] Fishing ports are sorted by average revenue in descending order.

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-16. Annual commercial fishing landings and revenue in the Project 1 and Project 2 WTAs by state, 2008–2022

Project 1[1]					Project 2[2]				
State[3]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)	State[3]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
New Jersey	473,775	1,226,960	$361,156	$1,130,314	New Jersey	466,788	1,288,077	$365,905	$1,107,986
Virginia	6,427	22,878	$53,607	$197,010	Virginia	5,571	23,476	$49,128	$213,911
Massachusetts	37,708	274,295	$35,848	$174,830	Massachusetts	15,327	135,454	$19,914	$51,532
Rhode Island	9,582	23,088	$7,208	$14,818	Rhode Island	8,141	27,583	$5,751	$13,651
North Carolina	915	4,678	$5,274	$60,155	North Carolina	584	1,873	$1,802	$9,523
New Hampshire	11,222	168,329	$3,826	$57,385	New Hampshire	3,065	45,979	$1,046	$15,675
Maryland	499	2,464	$850	$3,994	Maryland	680	5,675	$896	$4,701
Connecticut	48	269	$343	$2,348	New York	202	1,557	$249	$1,518
New York	207	1,407	$264	$1,370	Connecticut	34	203	$242	$1,752
All states	**540,398**	**1,458,556**	**$468,421**	**$1,412,142**	Delaware	8	100	$21	$199
					All states	**500,400**	**1,325,946**	**$444,953**	**$1,268,320**

Source: NMFS 2023b.
[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).
[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).
[3] States are sorted by average revenue in descending order.
Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-17. Annual fishing landings and revenue in the combined Project 1 and Project 2 WTAs by state, 2008–2022

State[1]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
New Jersey	791,550	2,007,715	$619,743	$1,765,298
Virginia	10,213	37,467	$87,145	$342,791
Massachusetts	47,665	363,711	$48,178	$209,148
Rhode Island	15,152	44,352	$11,055	$24,616
North Carolina	1,307	5,205	$6,428	$65,361
New Hampshire	13,310	199,644	$4,538	$68,060
Maryland	1,030	6,074	$1,511	$5,563
Connecticut	69	402	$483	$3,491
New York	350	2,554	$440	$2,502
Delaware	22	227	$58	$476
All states	**880,666**	**2,244,446**	**$779,580**	**$2,228,225**

Source: NMFS 2023b.

[1] States are sorted by average revenue in descending order.

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-18. Annual average percentage of commercial fishing landings and revenue in fishing ports that were derived from the Project 1 and Project 2 WTAs, 2008–2022

Project 1[1]			Project 2[2]		
Port and State[3]	Percentage of Landings	Percentage of Revenue	Port and State[3]	Percentage of Landings	Percentage of Revenue
Atlantic City, NJ	1.356	1.127	Atlantic City, NJ	1.497	1.190
Beaufort, NC	0.030	0.092	Newport News, VA	0.048	0.063
Newport News, VA	0.051	0.067	Cape May, NJ	0.069	0.045
Cape May, NJ	0.129	0.065	Hampton, VA	0.024	0.032
Sea Isle City, NJ	0.026	0.051	Sea Isle City, NJ	0.006	0.024
Hampton, VA	0.030	0.039	Beaufort, NC	0.014	0.023
Barnegat, NJ	0.051	0.032	Barnegat, NJ	0.037	0.022
Davisville, RI	0.022	0.017	Davisville, RI	0.023	0.014
North Kingstown, RI	0.012	0.012	Ocean City, MD	0.013	0.012
Ocean City, MD	0.008	0.011	Point Pleasant, NJ	0.020	0.011
Wildwood, NJ	0.025	0.009	North Kingstown, RI	0.008	0.008
New Bedford, MA	0.005	0.007	New Bedford, MA	0.003	0.004
Chincoteague, VA	0.009	0.007	Oriental, NC	0.005	0.003
Oriental, NC	0.007	0.005	Wanchese, NC	0.002	0.003
Point Pleasant, NJ	0.005	0.004	Chincoteague, VA	0.003	0.003
Wanchese, NC	0.002	0.004	Point Judith, RI	0.001	0.001
Point Judith, RI	0.002	0.002	Shinnecock, NY	0.001	0.001
Barnegat Light, NJ	0.007	0.002	Long Beach, NJ	0.001	0.001
Long Beach, NJ	0.001	0.001	Wildwood, NJ	0.001	0.001
Shinnecock, NY	0.001	0.001	Montauk, NY	0.001	0.000
Montauk, NY	0.001	0.000	Hobucken, NC	0.001	0.000
			Belford, NJ	0.000	0.000

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Fishing ports are sorted by percentage of revenue in descending order.

Note: Percentages are likely overestimated because they do not include landings and revenue of vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-19. Annual average percentage of commercial fishing landings and revenue in fishing ports that were derived from the combined Project 1 and Project 2 WTAs, 2008–2022

Port and State[1]	Percentage of Landings	Percentage of Revenue
Atlantic City, NJ	2.424	1.976
Newport News, VA	0.084	0.111
Beaufort, NC	0.039	0.106
Cape May, NJ	0.153	0.093
Sea Isle City, NJ	0.030	0.067
Hampton, VA	0.045	0.060
Barnegat, NJ	0.076	0.047
Davisville, RI	0.040	0.027
Ocean City, MD	0.019	0.020
North Kingstown, RI	0.018	0.018
Point Pleasant, NJ	0.023	0.013
Wildwood, NJ	0.030	0.011
New Bedford, MA	0.007	0.010
Chincoteague, VA	0.011	0.008
Oriental, NC	0.010	0.007
Wanchese, NC	0.004	0.007
Point Judith, RI	0.003	0.003
Barnegat Light, NJ	0.008	0.002
Shinnecock, NY	0.002	0.002
Long Beach, NJ	0.002	0.002
Hobucken, NC	0.002	0.001
Montauk, NY	0.001	0.001
Belford, NJ	0.000	0.000

Source: NMFS 2023b.

[1] Fishing ports are sorted by percentage of revenue in descending order.

Note: Percentages are likely overestimated because they do not include landings and revenue of vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Annual average commercial fishing landings and revenue within the WTAs from 2008 through 2022 are summarized by fishing gear for Project 1 and Project 2 in Table 3.6.1-20 and for both WTAs combined in Table 3.6.1-21. Annualized commercial fishing landings and revenue in the WTAs are summarized by fishing gear in Table B.3-49 through Table B.3-54 in Appendix B. The gear type with the highest landed weight and revenue in both WTAs was the clam dredge, which accounted for approximately 75 percent of the landed weight and 65 percent of the revenue from the combined Project 1 and Project 2 WTAs. The scallop dredge generated the second highest revenue in each WTA and accounted for approximately 26 percent of the revenue from the combined Project 1 and Project 2 WTAs. Although overall landings and revenue were similar between the Project 1 and Project 2 WTAs, there were some differences between these WTAs in terms of landings and revenue among gear types. In particular, the scallop dredge, bottom trawl, and pots had higher landings and revenue from the Project 1 WTA, whereas the clam dredge had higher landings and revenue from the Project 2 WTA.

Annual average percentages of commercial landings and revenue in the geographic analysis area that were harvested in the WTAs from 2008 through 2022 are summarized by fishing gear for Project 1 and

Project 2 in Table 3.6.1-22 and for both WTAs combined in Table 3.6.1-23. Annualized percentages of commercial fishing landings and revenue from the WTAs are summarized by fishing gear in Table B.3-55 through Table B.3-60 in Appendix B. The gear type with the highest percentages of landings and revenue harvested in both the Project 1 WTA and Project 2 WTAs was the clam dredge by a wide margin, which generated 0.91 of its landings and 0.75 of its revenue from the combined Project 1 and Project 2 WTAs. The only other gear that generated more than 0.05 percent of its landings or revenue from the area was pots, which generated 0.09 percent of its landings and 0.13 percent of its revenue from the combined Project 1 and Project 2 WTAs. There were some differences between the Project 1 and Project 2 WTAs in terms of the percentages of landings and revenue of gear types. In particular, the Project 1 WTA had a much higher percentage of landings and revenue from pots other than lobster.

Table 3.6.1-20. Annual commercial fishing landings and revenue in the Project 1 and Project 2 WTAs by fishing gear, 2008–2022

Project 1[1]					Project 2[2]				
Gear Type	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)	Gear Type	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
Dredge-clam	366,188	1,173,520	$282,000	$986,714	Dredge-clam	414,670	1,263,848	$312,990	$1,026,074
Dredge-scallop	12,031	38,142	$130,031	$364,095	All others	57,091	440,167	$8,878	$56,280
All others	132,207	719,397	$22,003	$97,076	Trawl-bottom	14,717	27,385	$14,686	$26,773
Trawl-bottom	20,024	38,788	$18,740	$35,795	Dredge-scallop	9,984	39,026	$104,498	$362,532
Pot-other	6,442	27,662	$14,411	$35,867	Trawl-midwater	1,884	24,417	$203	$2,642
Gillnet-sink	996	6,212	$744	$3,978	Pot-other	1,719	8,502	$3,324	$10,913
Trawl-midwater	2,430	36,451	$247	$3,703	Gillnet-sink	311	1,207	$302	$1,423
Pot-lobster	78	389	$245	$1,023	Pot-lobster	23	102	$73	$285
All gear	**540,398**	**1,458,556**	**$468,421**	**$1,412,140**	**All gear**	**500,399**	**1,325,946**	**$444,954**	**$1,268,321**

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-21. Annual commercial fishing landings and revenue in the combined Project 1 and Project 2 WTAs by fishing gear, 2008–2022

Gear Type[1]	Average Landings (pounds)	Maximum Landings (pounds)	Average Revenue (2022 dollars)	Maximum Revenue (2022 dollars)
Dredge-clam	664,267	1,934,347	$507,112	$1,543,469
Dredge-scallop	18,744	64,790	$199,933	$610,609
Trawl-bottom	29,686	57,270	$28,603	$53,685
All others	155,307	796,139	$26,087	$107,535
Pot-other	7,426	32,617	$16,218	$42,296
Gillnet-sink	1,175	6,565	$921	$4,202
Trawl-midwater	3,968	52,257	$411	$5,427
Pot-lobster	93	432	$296	$1,160
All gear	**880,666**	**2,244,447**	**$779,581**	**$2,228,224**

Source: NMFS 2023b.

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-22. Annual average commercial fishing landings and revenue in the Project 1 and Project 2 WTAs as a percentage of annual average landings and revenue in the geographic analysis area by fishing gear, 2008–2022

Project 1[1]			Project 2[2]		
Gear Type[3]	Percentage of Landings	Percentage of Revenue	Gear Type[3]	Percentage of Landings	Percentage of Revenue
Dredge-clam	0.502	0.419	Dredge-clam	0.567	0.462
Pot-other	0.078	0.111	Pot-other	0.021	0.025
Dredge-scallop	0.024	0.024	Dredge-scallop	0.020	0.019
Trawl-bottom	0.011	0.009	Trawl-bottom	0.008	0.007
Gillnet-sink	0.003	0.002	Trawl-midwater	0.001	0.001
Trawl-midwater	0.002	0.001	Gillnet-sink	0.001	0.001
Pot-lobster	< 0.001	< 0.001	Pot-lobster	< 0.001	< 0.001

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

[3] Gear types are sorted by percentage of revenue in descending order.

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Table 3.6.1-23. Annual average commercial fishing landings and revenue in the combined Project 1 and Project 2 WTAs as a percentage of annual average landings and revenue in the geographic analysis area by fishing gear, 2008–2022

Gear Type[1]	Percentage of Landings	Percentage of Revenue
Dredge-clam	0.909	0.750
Pot-other	0.089	0.125
Dredge-scallop	0.038	0.037
Trawl-bottom	0.016	0.014
Gillnet-sink	0.003	0.003
Trawl-midwater	0.003	0.002
Pot-lobster	< 0.001	< 0.001

Source: NMFS 2023b.

[1] Gear types are sorted by percentage of revenue in descending order.

Note: Landings and revenue are likely underestimated because they do not include vessels without GARFO permits and fishing for species managed by ASMFC or states and by NMFS for highly migratory species.

Indicators of commercial fishing engagement and reliance for fishing communities that generate the highest commercial fishing revenue in the Lease Area are summarized in Table 3.6.1-24. The most recent available indicators for these communities are for the year 2020 (NMFS 2023c). Each of the fishing communities has a high level of fishing engagement but the amount of fishing reliance varies substantially among communities, with reliance ranging from low in Atlantic City, New Jersey and Hampton and Newport News, Virginia, to high in Barnegat and Cape May, New Jersey. Fishing communities that have a high level of fishing engagement but a low level of fishing reliance (e.g., Atlantic City, New Jersey, and Hampton and Newport News, Virginia) support valuable fisheries but also have other industries that produce a sufficient economic output to reduce reliance on the fishing industry. Social vulnerability indicators (i.e., personal disruption, population consumption, and poverty) and gentrification pressure indicators (i.e., retiree migration and urban sprawl) for each of these fishing communities are described in Section 3.6.3, *Demographics, Employment, and Economics*, and Section 3.6.4, *Environmental Justice*.

Table 3.6.1-24. Commercial fishing engagement and reliance indicators (2020) for fishing communities that generate the highest commercial fishing revenue in the Project 1 and Project 2 WTAs

Port and State	Average Annual Revenue from Combined WTAs (2008-2022)	Percentage of Revenue from Combined WTAs (2008-2022)	Commercial Fishing Engagement Indicator (2020)[1]	Commercial Fishing Reliance Indicator (2020)[2]
Atlantic City, New Jersey	$518,395	1.976	High	Low
Cape May, New Jersey	$79,052	0.093	High	High
Newport News, Virginia	$48,243	0.111	High	Low
New Bedford, Massachusetts	$41,578	0.010	High	Medium
Barnegat, New Jersey	$12,122	0.047	High	High
Hampton, Virginia	$9,950	0.060	High	Low
Beaufort, North Carolina	$4,970	0.106	High	Medium

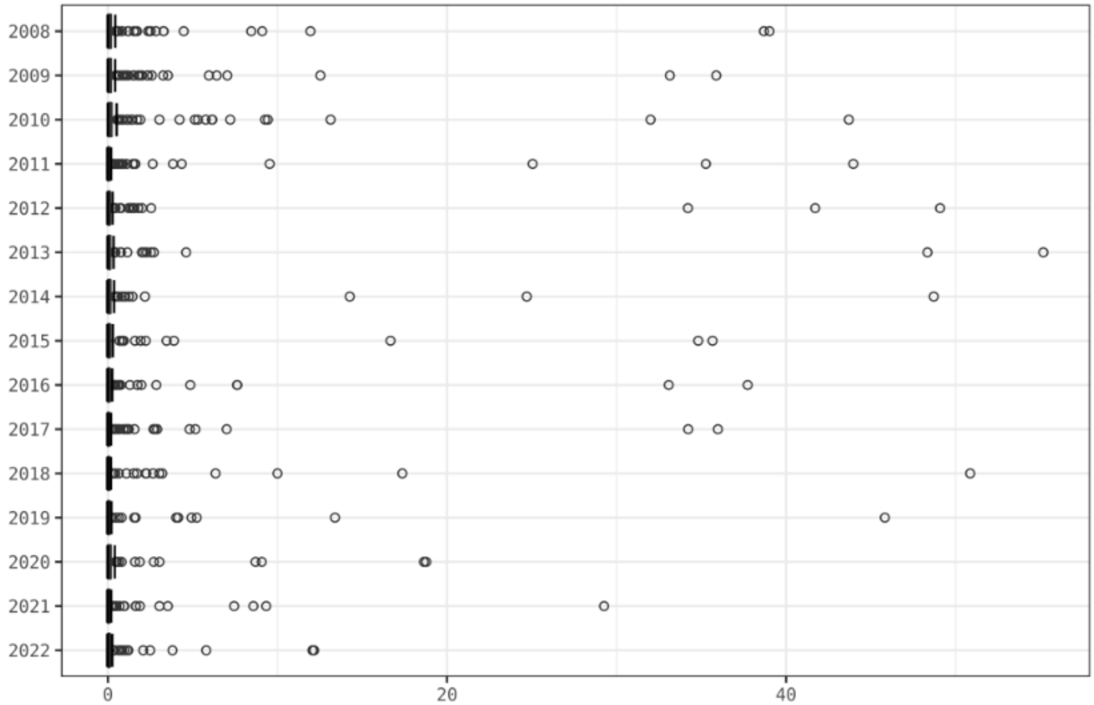
Sources: NMFS 2023b, 2023c.

[1] Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings.

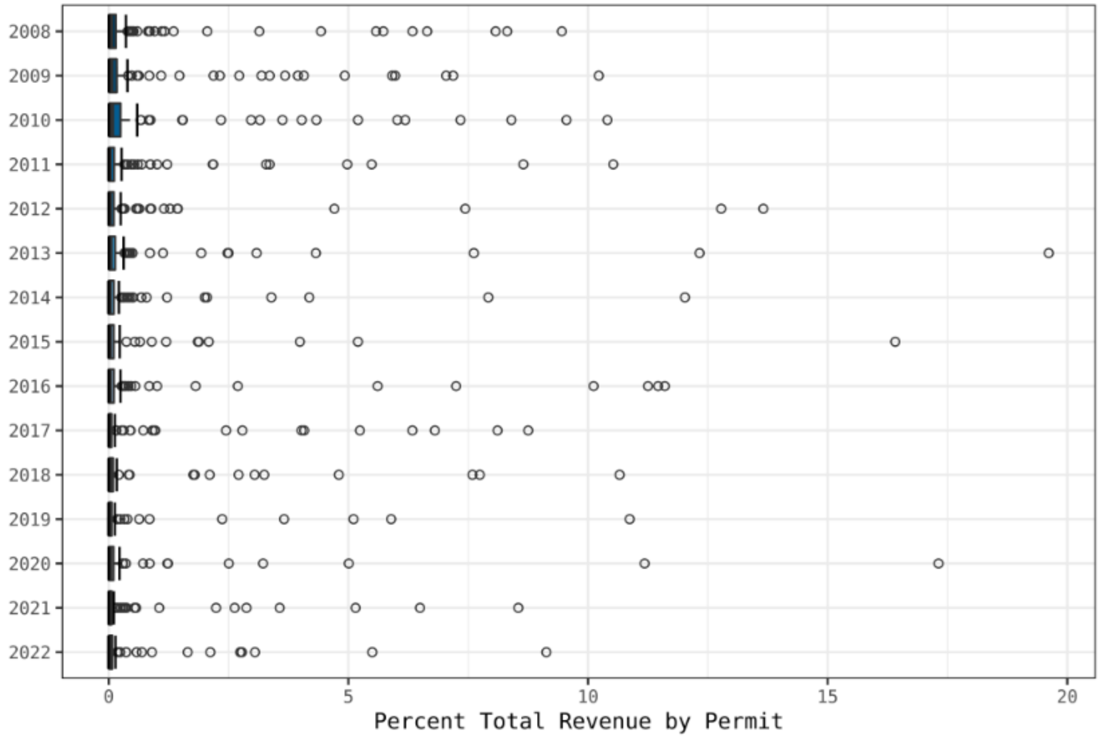
[2] Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity.

To analyze differences in the economic importance of fishing grounds in the WTAs across the commercial fishing fleet, NMFS analyzed the percentage of each permit's total commercial fishing revenue attributed to catch within the WTAs from 2008 through 2022 (NMFS 2023b). The distribution of the vessel-level annual revenue percentages for the Project 1 and Project 2 WTAs is summarized in the boxplots in Figures 3.6.1-2 and 3.6.1-3. The points in these boxplots represent vessels that derived an exceptionally high proportion of their annual revenue from the WTA in comparison to other vessels that fished in the area. Although some vessels derived a high proportion of their annual revenue from the Project 1 and Project 2 WTAs in comparison to other vessels that fished in these areas, in any given year, the revenue percentage for the majority of vessels was below 10 percent. Therefore, while some vessels depended heavily on the WTAs for their commercial fishing revenue, most derived a small percentage of their total annual revenue from these areas.

Project 1 WTA

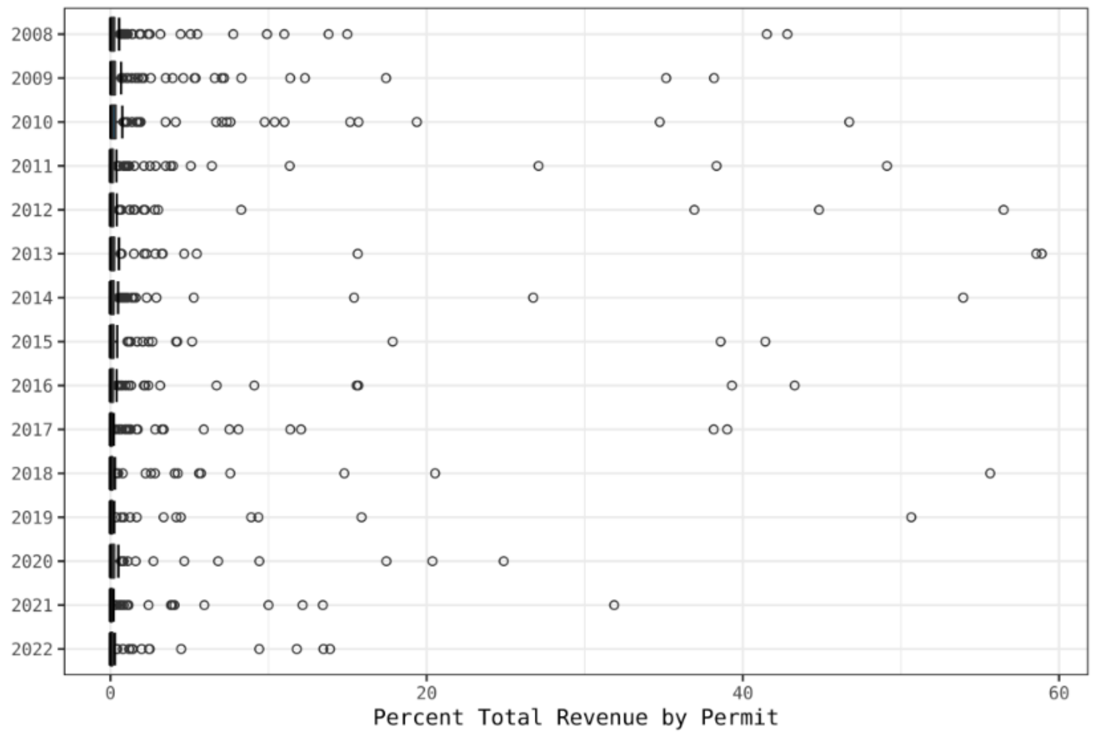


Project 2 WTA



Source: NMFS 2023b.

Figure 3.6.1-2. Percentage of commercial fisheries revenue harvested from the Project 1 and Project 2 WTAs by commercial fisheries permit holders, 2008–2022



Source: NMFS 2023b

Figure 3.6.1-3. Percentage of commercial fisheries revenue harvested from the combined Project 1 and Project 2 WTAs by commercial fisheries permit holders, 2008–2022

Table 3.6.1-25 summarizes the minimum, first quartile, median, third quartile, and maximum values of the percentages of revenue of commercial permit holders harvested from the Project 1 and Project 2 WTAs from 2008 through 2022. A total of 75 percent (i.e., third quartile) of the permitted vessels that fished in the WTAs derived less than 0.14 percent and 0.12 percent of their total annual revenue from the Project 1 and Project 2 WTAs, respectively. The highest percentage of total annual revenue attributed to catch within the WTAs was 55 percent in the Project 1 WTA in 2013 and 20 percent in the Project 2 WTA in 2013. A total of 75 percent of vessels that fish in the WTAs derived less than 0.21 percent of their total annual revenue from the combined Project 1 and 2 WTAs. The highest percentage of total annual revenue attributed to catch within the combined Project 1 and 2 WTAs was 59 percent.

Table 3.6.1-25. Summary of percentage of revenue harvested from the Project 1 and Project 2 WTAs by commercial fisheries permit holders, 2008–2022

WTA	Minimum Revenue Percentage Value	First Quartile	Median	Third Quartile	Maximum Revenue Percentage Value[1]
Project 1	0	0	0.03	0.14	55
Project 2	0	0	0.02	0.12	20
Project 1 and 2	0	0	0.04	0.21	59

Source: NMFS 2023b.

[1] Maximum value is inclusive of outliers.

To characterize the amount of fishing revenue from the Lease Area that is generated by small businesses, NMFS conducted a small business analysis. The analysis defined a small business as a business that is 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 for all its affiliated operations worldwide. The analysis was conducted upon unique business interests, which can represent multiple vessel permits. The number of small and large businesses engaged in federally managed fishing and the revenue of those businesses from 2020 through 2022 are summarized for the geographic analysis area in Table 3.6.1-26 and for the Lease Area in Table 3.6.1-27. During this 3-year time period, an annual average of 1,092 businesses fished in the geographic analysis area, of which 1,081 (99 percent) were small businesses and 11 (1 percent) were large businesses. Businesses engaged in fishing in the geographic analysis area generated an annual average revenue of approximately $610 million, of which $434 million (71 percent) was attributed to small businesses and $177 million (29 percent) was attributed to large businesses. During this same time period, an annual average of 82 businesses fished in the Lease Area, of which 75 (91 percent) were small businesses and 7 (9 percent) were large businesses. Businesses generated an annual average revenue of $369,000 in the Lease Area, of which $275,000 (75 percent) was attributed to small businesses and $93,000 (25 percent) was attributed to large businesses. Small businesses that fished inside the Lease Area generated an annual average of 0.250 percent of their total revenue from the Lease Area, while large businesses that fished inside the Lease Area generated 0.074 percent of their total revenue from the Lease Area, demonstrating that small businesses were more reliant on revenue generated from the Lease Area.

Table 3.6.1-26. Number and Revenue of small and large businesses engaged in federally managed commercial fishing within the geographic analysis area, 2020–2022

Year	Business Type	Number of Entities	Revenue (thousands of dollars)[1]
2020	Large business	11	$172,982
	Small business	1,042	$394,946
2021	Large business	11	$209,355
	Small business	1,086	$530,723
2022	Large business	11	$147,391
	Small business	1,116	$376,978
Annual Average	**Large business**	**11**	**$176,576**
	Small business	**1,081**	**$434,216**

[1] Revenue values have been deflated to 2021 dollars and rounded to the nearest thousand.

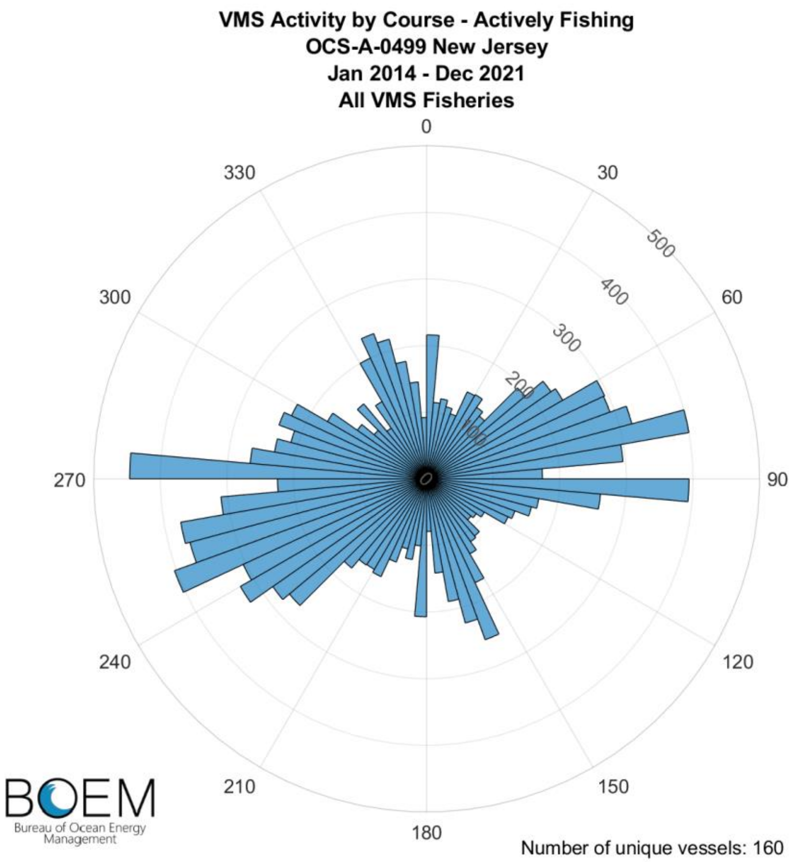
Table 3.6.1-27. Number and revenue of small and large businesses inside the lease area compared to the total revenue of those businesses, 2020–2022

Year	Business Type	Number of Entities	Revenue from Lease Area (thousands of dollars)[1]	Total Revenue (thousands of dollars)[1]	Percentage of Revenue from Lease Area
2020	Large business	7	$171	$117,026	0.146
	Small business	70	$284	$96,104	0.296
2021	Large business	9	$91	$176,691	0.052
	Small business	93	$341	$168,100	0.203
2022	Large business	6	$18	$83,577	0.022
	Small business	61	$201	$65,761	0.306
Annual Average	**Large business**	**7**	**$93**	**$125,765**	**0.074**
	Small business	**75**	**$275**	**$109,988**	**0.250**

[1] Revenue values have been delated to 2021 dollars and rounded to the nearest thousand.

NMFS uses a VMS to monitor some fisheries under its jurisdiction. VMS data are useful for characterizing the spatial distribution of fishing activity. In 2018, there were 912 VMS-enabled vessels operating in the Northeast across all fisheries, which represented 20 percent of the 4,328 commercial fishing vessels that were permitted in the Northeast Region (NMFS pers. comm. 2020). VMS vessels generated a substantial percentage (71–87 percent) of landings of summer flounder, scup, black sea bass, and skate, and greater than 90 percent of landings of scallops, squid, monkfish, herring, mackerel, large-mesh multispecies, small-mesh multispecies, surfclams, and ocean quahogs. However, VMS vessels represented less than 20 percent of highly migratory species and 10 percent of lobster/Jonah crab landings. Of these vessels, approximately 67 percent fished or transited the WTAs and 10 percent fished or transited in the Lease Area in 2018.

Polar histograms depicting the orientation of VMS-enabled vessels actively fishing in and transiting through the Lease Area were developed using individual vessel position reports from January 2014 through December 2021. Vessels moving at speeds of less than 5 knots were assumed to be actively fishing. The size of the bars in the polar histograms is proportional to the number of position reports showing fishing vessels moving in a certain direction within the Lease Area. The polar histograms differ with respect to their scales. Most of the 160 actively fishing VMS-enabled vessels followed either an east-west bearing or a slightly northeast-southwest bearing, whereas most of the 422 transiting vessels followed either a north-south bearing or a northwest-southeast bearing (Figure 3.6.1-4). Most of the actively fishing and transiting non-days-at-sea vessels followed a northeast-southwest bearing (Figure 3.6.1-5). Vessels fishing under the Surfclam and Ocean Quahog FMP and Sea Scallop FMP fished extensively in the Lease Area. Scallop vessels generally followed either a north or northwest bearing when fishing and a north-south bearing when transiting (Figure 3.6.1-6). Clam vessels generally followed either an east-west or northeast-southwest bearing when fishing and a northwest-southeast bearing when transiting (Figure 3.6.1-7). Squid and finfish vessels primarily used the Lease Area for transiting and followed a northeast-southwest bearing when fishing and transiting (Figure 3.6.1-8 through Figure 3.6.1-11).



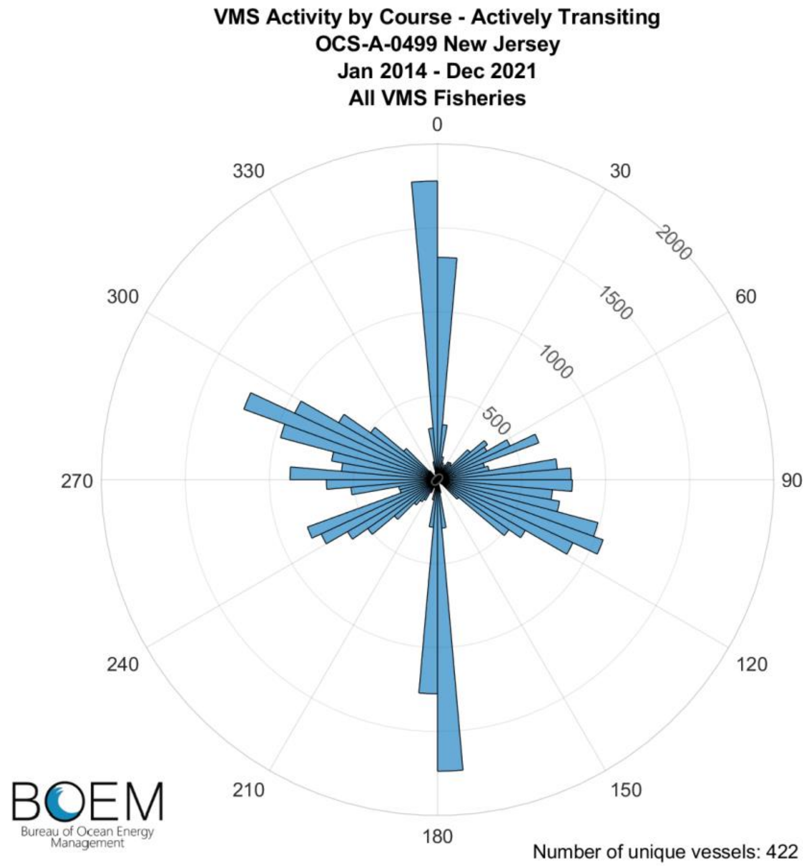


Figure 3.6.1-4. Bearings of all VMS-enabled vessels actively fishing and transiting in the Lease Area, January 2014 through December 2021

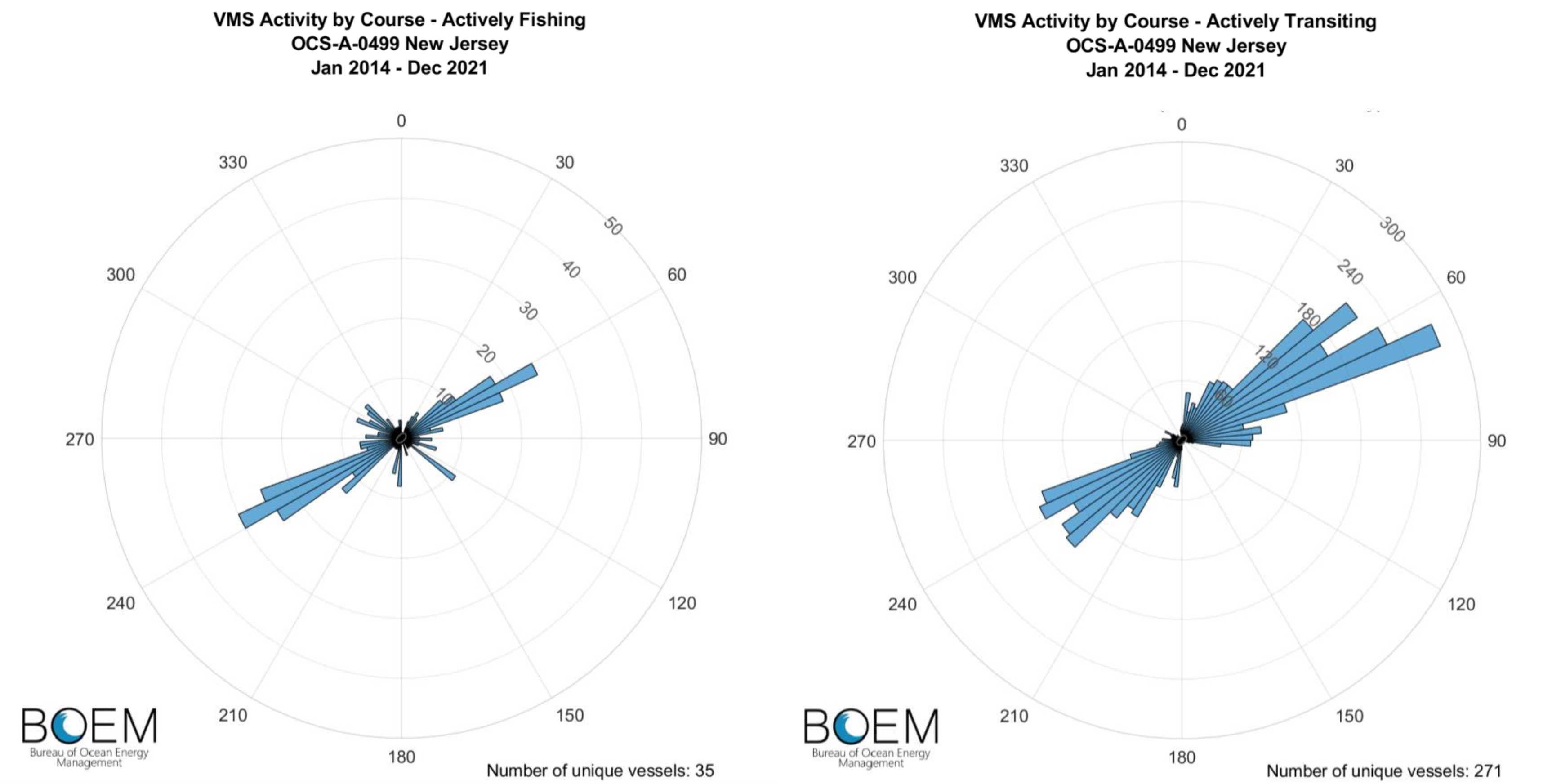


Figure 3.6.1-5. Bearings of non-days-at-sea vessels actively fishing and transiting in the Lease Area: Non-days-at-seas fisheries, January 2014 through December 2021

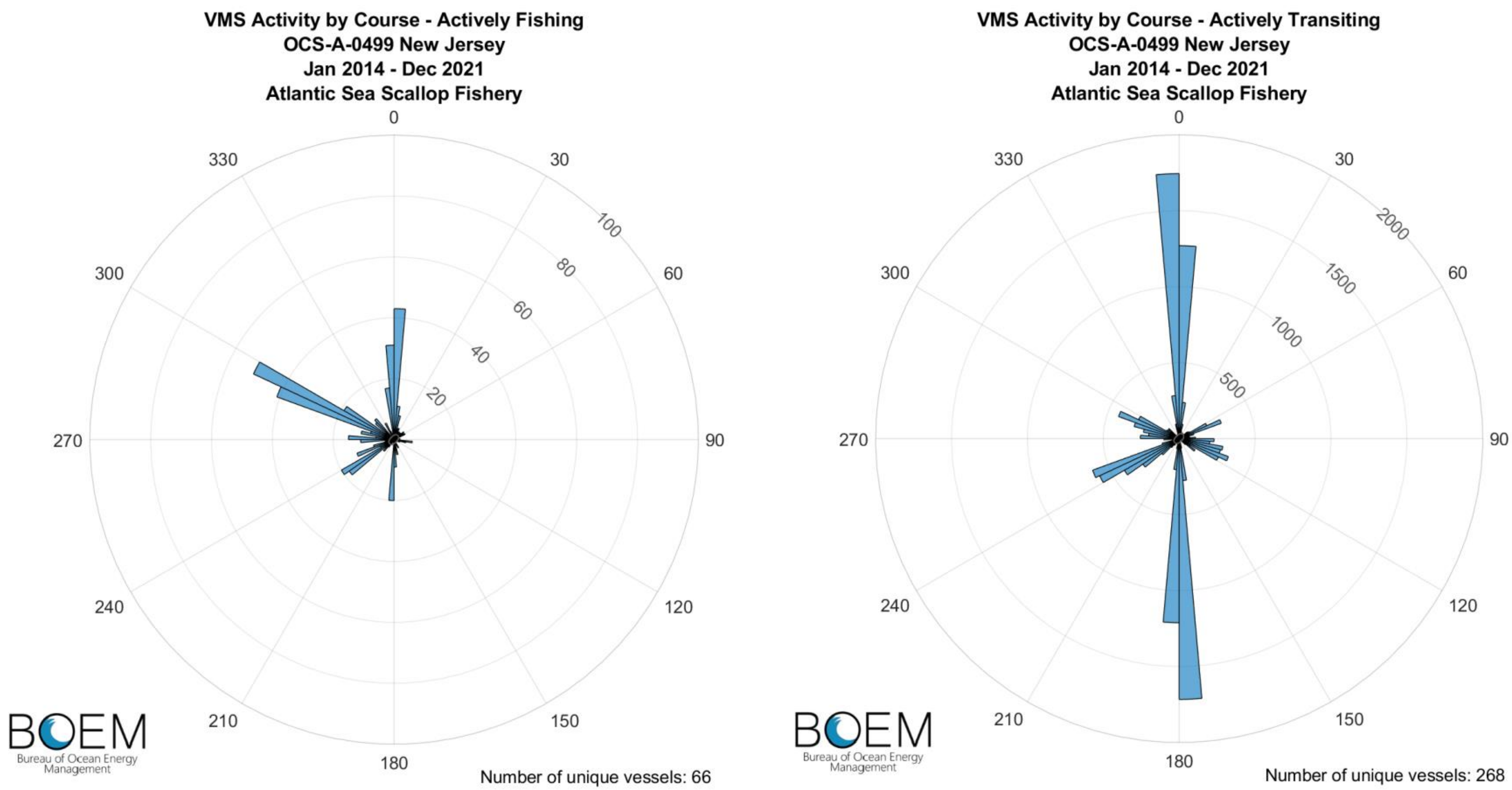


Figure 3.6.1-6. Bearings of VMS-enabled vessels actively fishing and transiting in the Lease Area: Sea Scallop FMP, January 2014 through December 2021

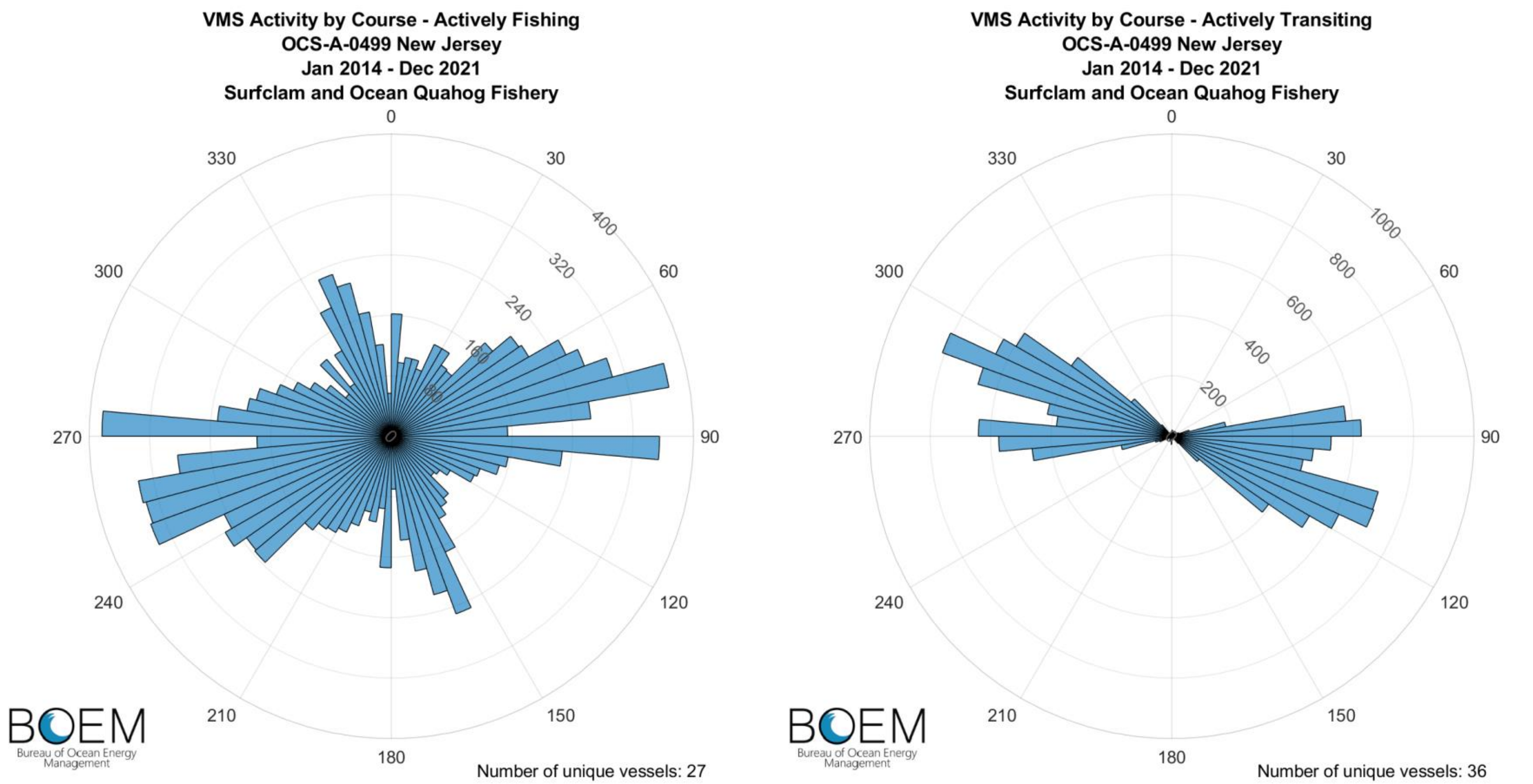
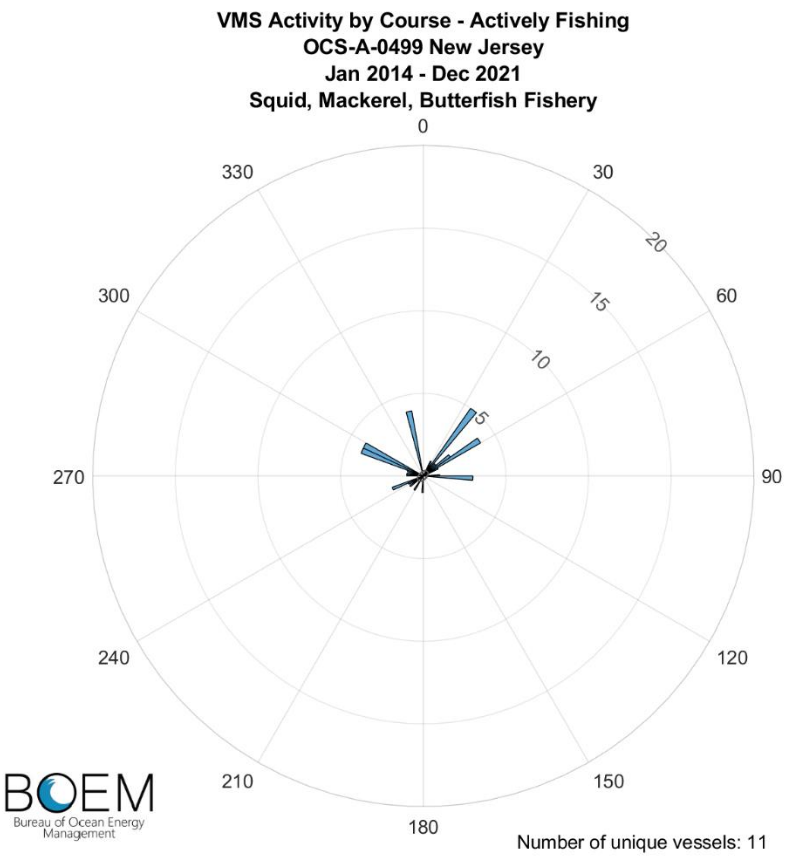


Figure 3.6.1-7. Bearings of VMS-enabled vessels actively fishing and transiting in the Lease Area: Surfclam and Ocean Quahog FMP, January 2014 through December 2021



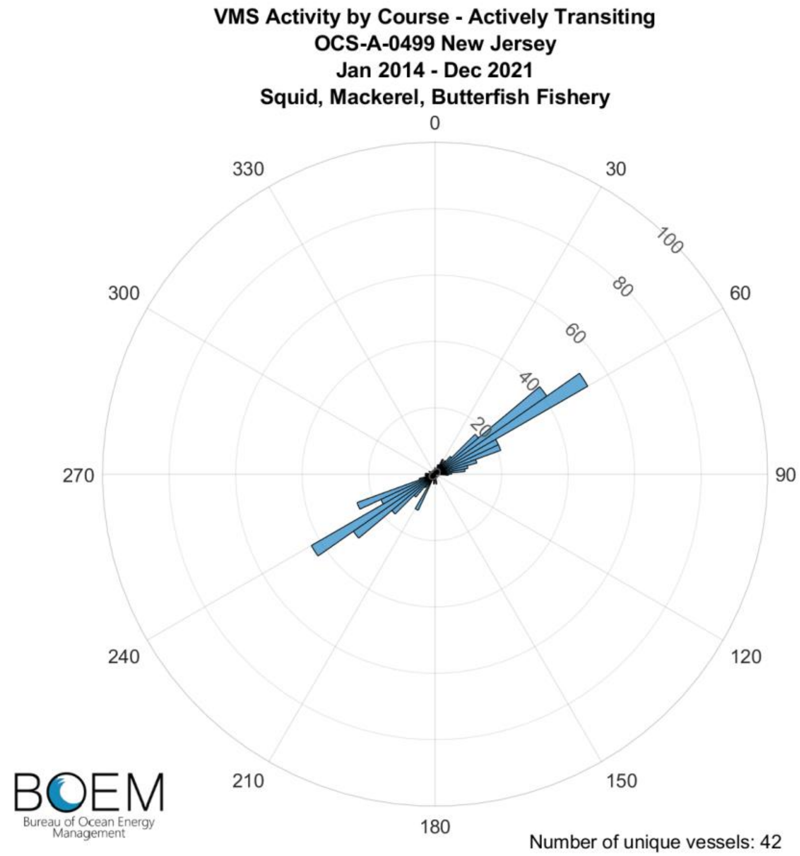
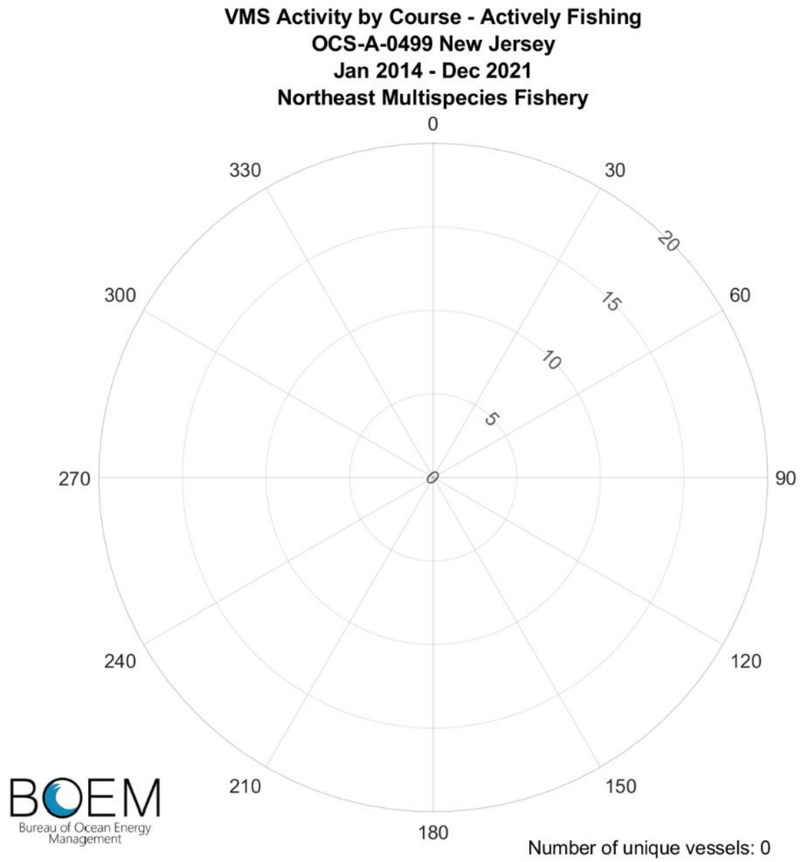


Figure 3.6.1-8. Bearings of VMS-enabled vessels actively fishing and transiting in the Lease Area: Squid, Mackerel, Butterfish FMP, January 2014 through December 2021



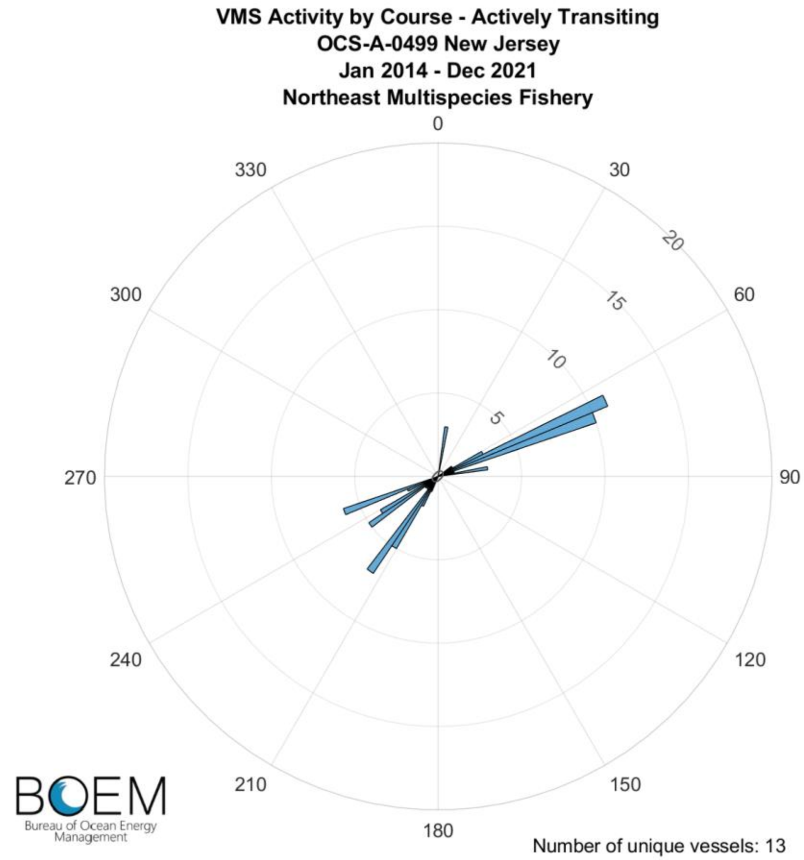


Figure 3.6.1-9. Bearings of VMS-enabled vessels actively fishing and transiting in the Lease Area: Northeast Multispecies FMP, January 2014 through December 2021

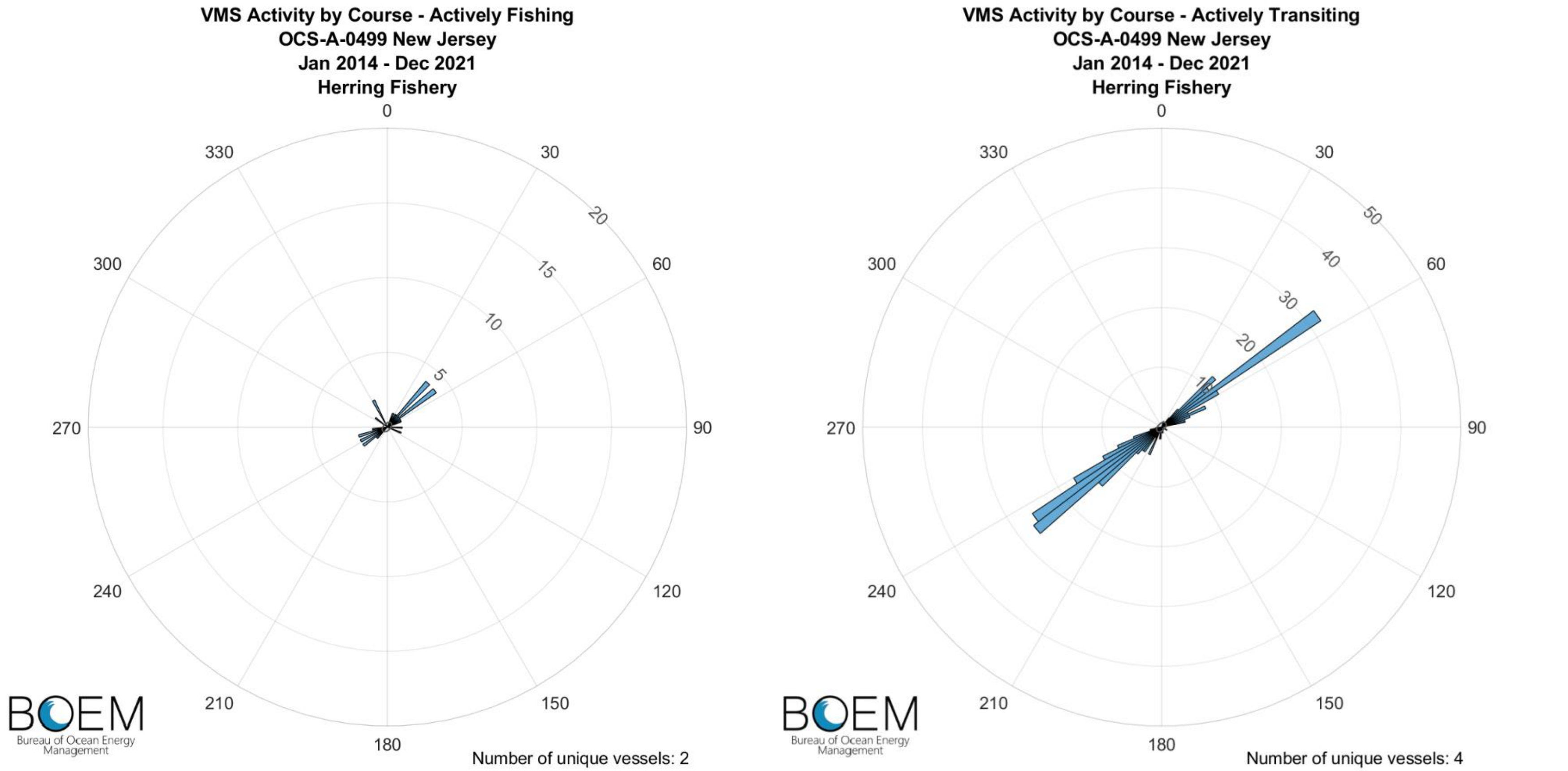


Figure 3.6.1-10. Bearings of VMS-enabled vessels actively fishing and transiting in the Lease Area: Atlantic Herring FMP, January 2014 through December 2021

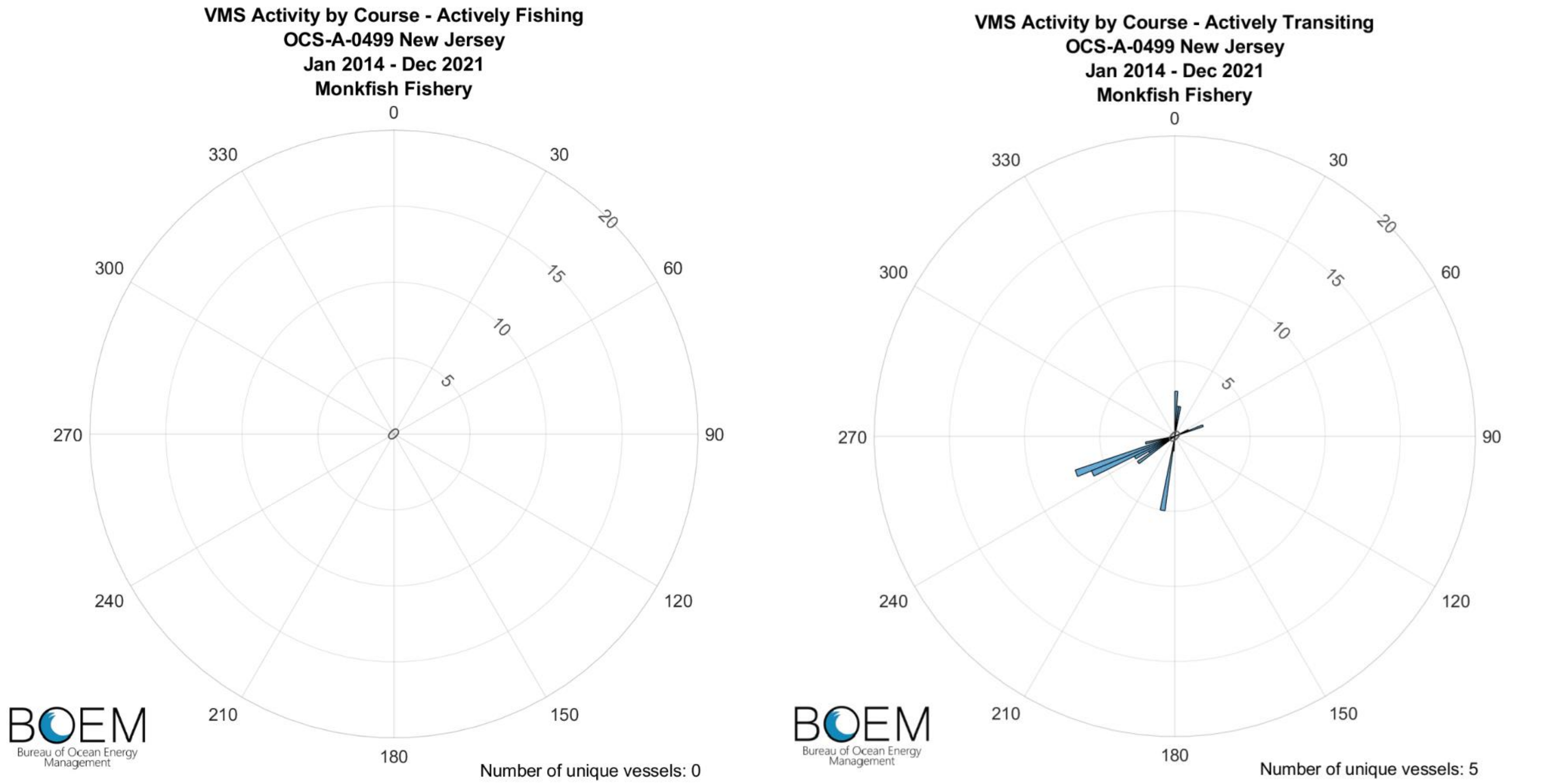


Figure 3.6.1-11. Bearings of VMS-enabled vessels actively fishing and transiting in the Lease Area: Monkfish FMP, January 2014 through December 2021

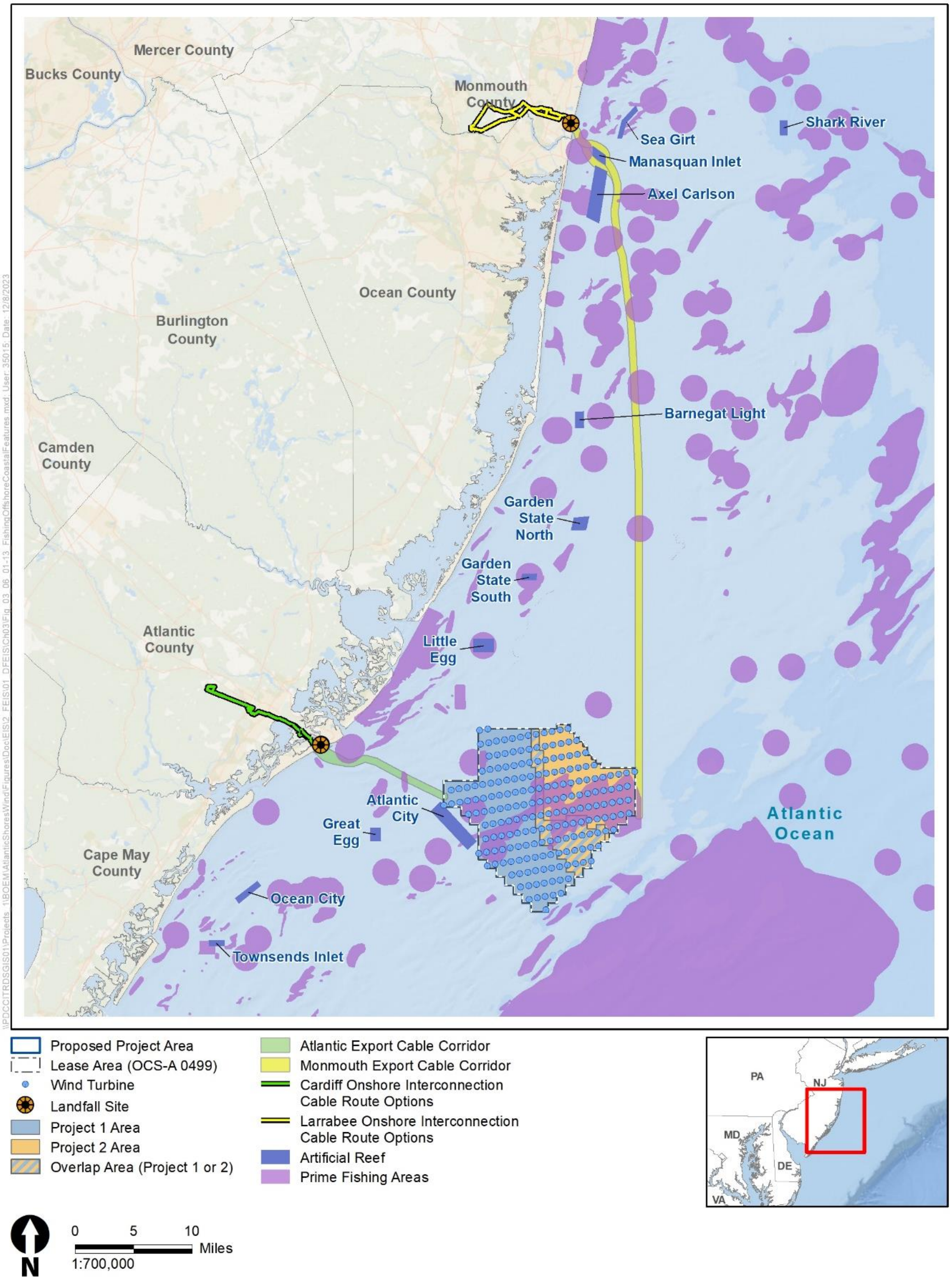
For-Hire Recreational Fishing

For-hire recreational fishing boats are operated by licensed captains for businesses that sell recreational fishing trips to anglers. These boats include both party (head) boats, defined as boats on which fishing space and privileges are provided for a fee, and charter boats, defined as boats operating under charter for a price, time, etc. and the participants are part of a preformed group of anglers. The primary sources of data used to describe the for-hire recreational fisheries in the Lease Area were NMFS Socioeconomics Impacts of Atlantic Offshore Wind Development reports summarizing fisheries effort and landings within wind energy lease areas (NMFS 2023b). For-hire recreational fisheries revenue data in New York and New Jersey were also taken from Fisheries Economics of the United States reports (NMFS 2023d).

For-hire recreational fishing vessels fish in or traverse the Lease Area and offshore export cable corridors while targeting several different fisheries. For-hire recreational fishing vessels that fish in the waters of the Project area are likely to originate from various ports on the coast of New Jersey. For-hire recreational fisheries in the waters of New Jersey catch a variety of finfish species, including black sea bass, bluefish, red hake, scup, sea robins, summer flounder, and tautog. Recreational saltwater fishing in the region occurs year-round but is most intensive from May through October, with a peak in the months of July and August (NMFS 2022a).

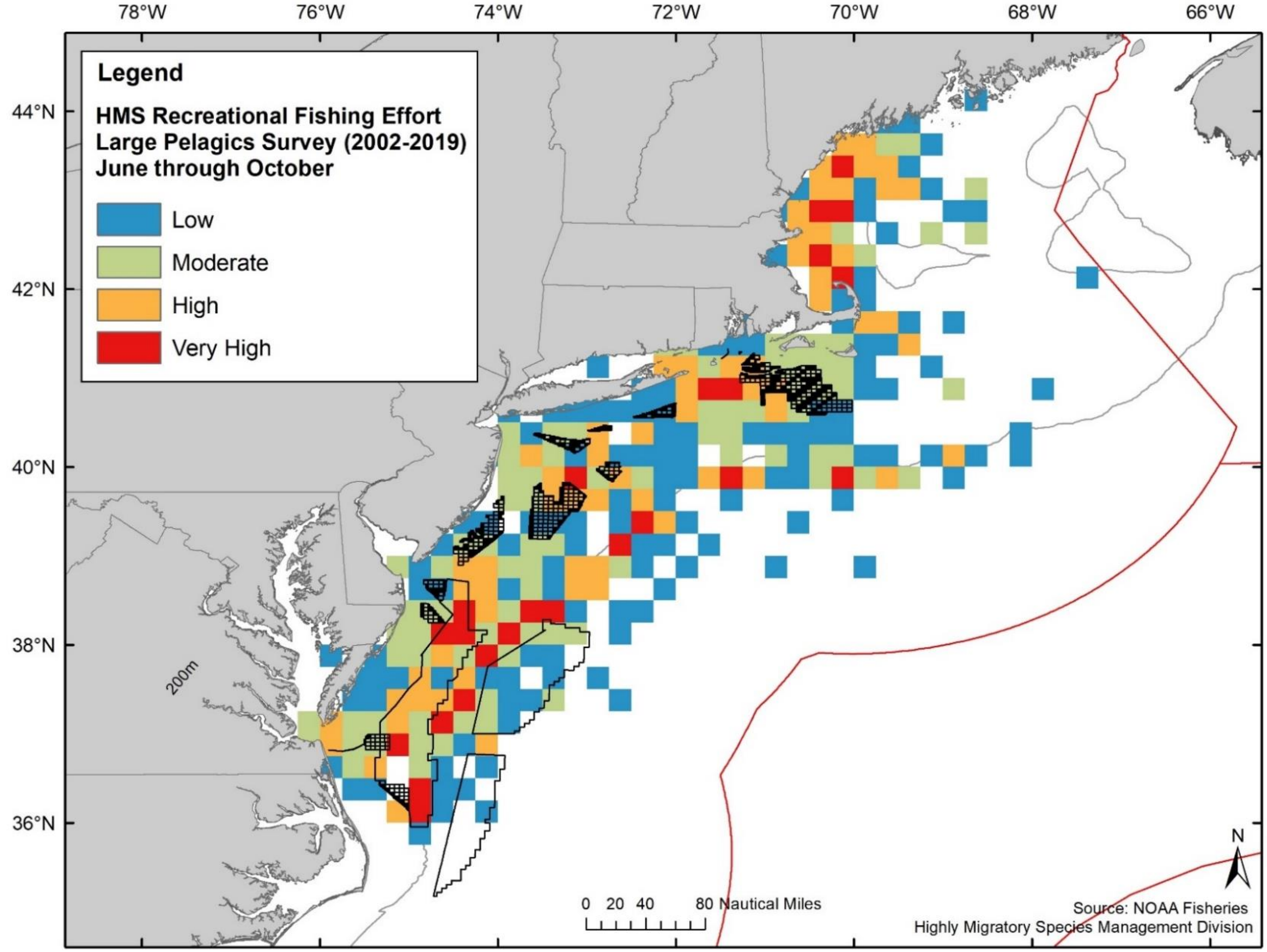
There are several known recreational fishing areas within and surrounding the Project area, including a large recreational fishing area known as Lobster Hole that is almost entirely overlapped by the Lease Area and a large expanse of several recreational fishing areas southeast of the Lease Area (Figure 3.6.1-12). There are also several locations near the Project area where artificial reefs have been established as productive recreational fishing areas (Figure 3.6.1-12). New Jersey's Artificial Reef Program has been under the stewardship of the Marine Resource Administration (MRA) since 1984 (NJDEP 2019). The MRA is permitted to deploy materials (e.g., ships barges, construction materials) at 17 artificial reef sites, located 2 to 25 miles (3 to 40 kilometers) off the coast, and deployments are ongoing to create and connect patch reefs within reef areas. Deployments of artificial reefs are planned carefully to increase productivity, attract marine life, and provide opportunities for fishing and scuba diving at accessible locations for New Jersey residents and visitors. Artificial reefs are identified as Special Areas in the New Jersey Coastal Zone Management Rules. While none of these artificial reefs are within the Project area, several of them are close to the Project area, including the Manasquan Inlet Reef and Axel Carlson Reef near the landfall of the Monmouth offshore export cable and the Atlantic City Reef near the western edge of the Lease Area (Figure 3.6.1-12). Fishermen targeting these artificial reefs for sportfish may transit through the Project area. Recreational fishing for highly migratory species also occurs in the Lease Area and along the Atlantic and Monmouth ECC. Based on the NMFS Large Pelagics Survey, an intercept survey that includes both for-hire and private fishing, the level of recreational fishing effort for highly migratory species from 2002-2019 ranged from low to moderate in the Project area, with the highest levels of effort occurring north of the Lease Area, within the Monmouth ECC (Figure 3.6.1-13).

Annual average for-hire recreational angler trips and vessel trips from 2008 through 2022 are summarized by fishing port for the Project 1 and Project 2 WTAs in Table 3.6.1-28 and for both WTAs combined in Table 3.6.1-29. Annualized for-hire recreational angler trips and vessel trips to the WTAs are summarized by fishing port in Table B.3-61 through Table B.3-66 in Appendix B. For-hire fishing vessels originating from Atlantic City, New Jersey accounted for the highest level of fishing effort of any one port, with an annual average of 51 angler trips and 8 vessel trips to the Project 1 WTA. For-hire fishing vessels originating from other ports in New Jersey accounted for the highest level of fishing effort in the Project 1 WTA and all of the fishing effort in the Project 2 WTA, with an annual average of 104 angler trips and 14 vessel trips to the Project 1 WTA and an annual average of 32 angler trips and 3 vessel trips to the Project 2 WTA. Ports in New Jersey accounted for nearly all of the fishing effort in the WTAs. The only other state with substantial fishing effort in the WTAs, New York, accounted for an annual average of 24 angler trips and 1 vessel trip. However, there were no angler trips from New York to the WTAs in most years, and the annual average of 24 angler trips was primarily the result of a single year, 2022, when there were 332 angler trips to the Project 1 WTA.



Source: Atlantic Shores 2023; NJGIN 2021; NJDEP 2021, 2022.

Figure 3.6.1-12. Offshore and coastal features associated with for-hire recreational fishing



Note: Data are based on intercept surveys and include both for-hire and private fishing for highly migratory species

Figure 3.6.1-13. Fishing effort for highly migratory species in the Greater Atlantic

Table 3.6.1-28. Annual average and maximum number of for-hire recreational angler trips and vessel trips to the Project 1 and Project 2 WTAs by fishing port, 2008–2022

Project 1[1]					Project 2[2]				
Port[3]	Average Angler Trips[4]	Maximum Angler Trips	Average Vessel Trips	Maximum Vessel Trips	Port[3]	Average Angler Trips[4]	Maximum Angler Trips	Average Vessel Trips	Maximum Vessel Trips
Other Ports, NJ	104	262	14	35	Other Ports, NJ	32	96	3	8
Atlantic City, NJ	51	307	8	49					
Other Ports, NY	24	332	1	12					
Long Beach, NJ	6	51	1	5					
No Port Data	0	4	0	1					
Other Ports, MD	0	6	0	1					
Total	**186**	**466**	**23**	**60**					

Source: NMFS 2023b.
[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).
[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).
[3] Fishing ports are sorted by average vessel trips in descending order.
[4] Angler trips is the number of passengers reported on Vessel Trip Reports for party and charter vessels.
Note: Differences in totals are the result of rounding.

Table 3.6.1-29. Annual average and maximum number of for-hire recreational angler trips and vessel trips to the combined Project 1 and Project 2 WTAs by fishing port, 2008–2022

Port[1]	Average Angler Trips[2]	Maximum Angler Trips	Average Vessel Trips	Maximum Vessel Trips
Other Ports, NJ	117	274	15	37
Atlantic City, NJ	53	307	8	49
Other Ports, NY	24	332	1	12
Long Beach, NJ	6	51	1	5
Ocean City, NJ	6	85	0	3
No Port Data	0	4	0	1
Other Ports, MD	0	6	0	1
Total	**207**	**549**	**25**	**62**

Source: NMFS 2023b.
[1] Fishing ports are sorted by average vessel trips in descending order.
[2] Angler trips is the number of passengers reported on Vessel Trip Reports for party and charter vessels.
Note: Differences in totals are the result of rounding.

To understand the relative importance of the Project 1 and 2 WTAs to the regional for-hire recreational fishing industry, Table 3.6.1-30 compares the fishing effort in the WTAs to the entire Northeast Region by year from 2008 through 2022. The years with the highest percentages of fishing effort in the Project 1 WTA relative to the region were 2011, 2014, 2015, and 2022, when more than 10 percent of annual angler trips were made to that area. The percentage of fishing effort in the Project 2 WTA was considerably less than in the Project 1 WTA, with the highest annual effort, observed in 2022, only amounting to 0.03 percent of the Northeast Region.

Table 3.6.1-30. For-hire recreational fishing effort in Project 1 and Project 2 WTAs as a percentage of total Northeast Region, 2008–2022

Year	Vessel Trips as % of Total Vessel Trips in the Northeast Region		Angler Trips as % of Total Angler Trips in the Northeast Region		Number of Vessels as % of Total Number of Vessels in the Northeast Region	
	Project 1[1]	Project 2[2]	Project 1[1]	Project 2[2]	Project 1[1]	Project 2[2]
2008	0.06	0.01	3.67	3.91	1.06	0.45
2009	0.14	0.02	6.66	5.04	1.52	0.46
2010	0.06	No Trips	2.07	No Trips	0.89	No Trips
2011	0.18	No Trips	11.55	No Trips	1.64	No Trips
2012	0.11	No Trips	2.75	No Trips	1.03	No Trips
2013	0.08	0.01	6.72	0.57	1.08	0.54
2014	0.11	No Trips	12.22	No Trips	0.76	No Trips
2015	0.16	0.02	11.64	1.75	1.39	0.99
2016	0.07	0.01	4.90	3.86	1.58	0.68
2017	0.06	No Trips	2.51	No Trips	1.43	No Trips
2018	No Trips	No Trips	No Trips	No Trips	No Trips	No Trips
2019	No Trips	No Trips	No Trips	No Trips	No Trips	No Trips
2020	No Trips	No Trips	No Trips	No Trips	No Trips	No Trips
2021	No Trips	No Trips	No Trips	No Trips	No Trips	No Trips
2022	0.17	0.03	18.37	3.29	1.18	0.79

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

The predominant for-hire recreational fish species that were landed in the Project 1 and Project 2 WTAs are summarized from 2008 through 2022 in Table 3.6.1-31. During this 15-year period, the species with the highest total landings in the Project 1 WTA were black sea bass, which accounted for 45 percent of the landings in that WTA, followed by tautog, summer flounder, bluefish, and red hake; together, these five species represented 58 percent of the landings that occurred in the WTA. Species with fewer than three permits, which were grouped together, had the second highest landings in the Project 1 WTA. In the Project 2 WTA, species with fewer than three permits accounted for 84 percent of landings in the WTA. Black sea bass accounted for the second most landings in the Project 2 WTA, followed by summer flounder.

Table 3.6.1-31. For-hire recreational fishing total fifteen-year landings in the Project 1 and Project 2 WTAs, 2008–2022

Project 1[1]			Project 2[2]		
Species	Landings in WTA (number of fish)	Landings in WTA as % of Total Northeast Region	Species	Landings in WTA (number of fish)	Landings in WTA as % of Total Northeast Region
Black sea bass	4,413	0.08	All Others	1,571	--
All others	4,038	--	Black Sea Bass	282	0.01
Tautog	389	0.07	Summer Flounder	8	< 0.01
Summer flounder	379	0.03	**Total**	**1,861**	**--**
Bluefish	288	0.01			
Red hake	260	0.01			
Atlantic cod	44	< 0.01			
Sea robins	23	0.01			
Scup	21	< 0.01			
Spiny dogfish	5	0.01			
Total	**9,860**	**--**			

Source: NMFS 2023b.

[1] Project 1 values computed as the sum of the Project 1 Area and Overlap Area (see Figure 1-1).

[2] Project 2 values computed as the sum of the Project 2 Area and Overlap Area (see Figure 1-1).

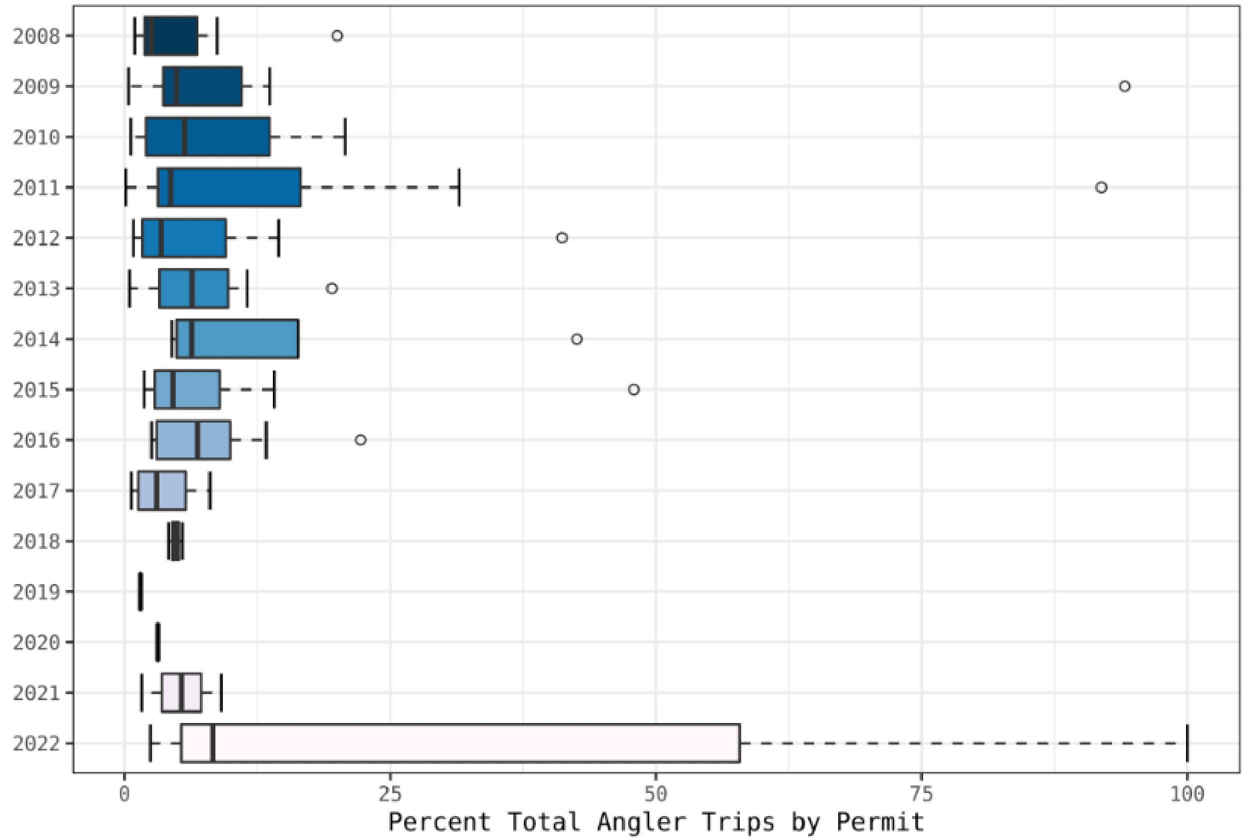
The economic value associated with recreational saltwater fishing is driven by angler expenditures. Table 3.6.1-32 compares the for-hire recreational fishing revenue generated by fishing ports in New Jersey, the state that accounted for 88 percent of angler trips and 96 percent of vessel trips to the WTAs, to the revenue generated from for-hire recreational fishing trips to the combined Project 1 and 2 WTAs. From 2008 through 2017, for-hire recreational fisheries based out of ports in New Jersey generated an average annual revenue of $61.9 million. Over this same time period, the average annual revenue generated by for-hire recreational fishing trips to the Project 1 and 2 WTAs was approximately $21 thousand. Collectively, the average annual revenue generated from for-hire recreational fishing trips to the Project 1 and 2 WTAs represented 0.03 percent of the average annual revenue generated by for-hire recreational fisheries trips from the ports of New Jersey.

Table 3.6.1-32. For-hire recreational fishing revenue in New Jersey in comparison to the combined Project 1 and Project 2 WTAs, 2008–2017[1]

Year	Revenue in New Jersey (thousands of dollars)[1]	Revenue from WTAs (thousands of dollars)[2]	Percentage of Revenue from WTAs
2008	$66,881	$12	0.02
2009	$75,112	$25	0.03
2010	$55,509	$14	0.03
2011	$62,526	$35	0.06
2012	$61,825	$26	0.04
2013	$102,472	$23	0.02
2014	$97,175	$18	0.02
2015	$88,203	$30	0.03
2016	$33,359	$12	0.04
2017	$36,089	$14	0.04
Average	**$67,915**	**$21**	**0.03**

Sources: (1) NMFS 2023d, (2) NMFS 2023b.
[1] For-hire recreational fishing revenue in the Project 1 and Project 2 WTAs is suppressed beyond 2017.
Notes:
Available for-hire recreational revenue data for New Jersey were limited to the period of 2010–2017.

To analyze differences in the importance of fishing grounds in the WTAs for the for-hire recreational fishery, NMFS analyzed the percentage of each permit's total angler trips in the combined Project 1 and Project 2 WTAs from 2008 through 2022 (NMFS 2023b). Results are summarized in Figure 3.6.1-14, which presents the data in boxplots. The points in these boxplots represent for-hire recreational permit holders that made an exceptionally high proportion of their trips to the WTAs in comparison to other for-hire recreational vessels that fished in the area. Although some permit holders made a high proportion of their trips the Project 1 and Project 2 WTAs in comparison to other permit holders that fished in these areas, the percentage of trips for the majority of vessels was below 10 percent. Therefore, while some vessels depended heavily on the WTAs for their recreational fishing effort, most derived a small percentage of their total fishing effort from these areas.



Source: NMFS 2023b.

Figure 3.6.1-14. Percentage of angler trips to the combined Project 1 and Project 2 WTAs by for-hire recreational fisheries permit holders

Table 3.6.1-33 summarizes the minimum, first quartile, median, third quartile, and maximum values of percentage revenue harvested from the Project 1 and Project 2 WTAs by for-hire recreational fisheries permit holders from 2008 through 2022. A total of 75 percent (i.e., third quartile) of the permitted vessels that fished in the WTAs derived less than 9 percent and 5 percent of their total annual revenue from the Project 1 and Project 2 WTAs, respectively. The highest percentage of total annual revenue attributed to catch within the WTAs was 100 percent in the Project 1 WTA in 2022 and 13 percent in the Project 2 WTA in 2016. A total of 75 percent (i.e., third quartile) of the permitted vessels that fished in the combined Project 1 and Project 2 WTAs derived less than 9 percent of their total annual revenue from the WTAs. The highest percentage of total annual revenue attributed to catch within the combined Project 1 and Project 2 WTAs was 100 percent in 2022.

Table 3.6.1-33. Summary of percentage of angler trips to the Project 1 and Project 2 WTAs by for-hire recreational fisheries permit holders, 2008–2022

WTA	Minimum Revenue Percentage Value	First Quartile	Median	Third Quartile	Maximum Revenue Percentage Value[1]
Project 1	0.39	2	5	9	100
Project 2	0.12	2	2	5	13
Combined	**0.12**	**2**	**5**	**9**	**100**

Source: NMFS 2023b.

[1] Maximum value is inclusive of outliers.

A business primarily engaged in for-hire recreational fishing activities is classified as a small business if it is 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 for all its affiliated operations worldwide. Small Business Administration principles of affiliation are used to define a business entity, meaning the following analysis is conducted upon unique business interests, which can represent multiple vessel permits. As such, this section presents the total number of entities, by business category, and the total revenue generated by that business category from 2018 through 2022 in Table 3.6.1-34. During this 5-year time period, an annual average of 350 small businesses engaged in for-hire recreational fishing in the geographic analysis area, generating an annual average revenue of approximately $83 million. There was insufficient for-hire recreational fishing activity in the Lease Area to summarize the revenue generated there.

Table 3.6.1-34. Number and revenue of small businesses engaged in for-hire recreational fishing within the geographic analysis area, 2018–2022

Year	Business Type	Number of Entities	Revenue (thousands of dollars)[1]
2018	Small business	307	$89,010
2019	Small business	318	$86,981
2020	Small business	322	$66,666
2021	Small business	358	$81,119
2022	Small business	446	$92,285
Annual Average	**Small business**	**350**	**$83,212**

[1] Revenue values have been deflated to 2021 dollars and rounded to the nearest thousand.

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

This Final EIS uses a four-level classification scheme to characterize potential impacts of the alternatives, including the Proposed Action, as shown in Table 3.6.1-35. See Section 3.3, *Definition of Impact Levels,* for a comprehensive discussion of the impact level definitions.

Table 3.6.1-35. 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.
	Beneficial	No effect or no measurable effect.
Minor	Adverse	Impacts 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 condition with no measurable effects.
	Beneficial	Small or measurable effects that would result in an economic improvement.
Moderate	Adverse	The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the Project. Once the affecting agent is eliminated, the affected activity or community would return to a condition with no measurable effects if mitigation measures are implemented.
	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.
	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

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

Impacts of Alternative A – No Action

Under the No Action Alternative, baseline conditions for commercial and for-hire recreational fisheries described in Section 3.6.1.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. Ongoing activities other than offshore wind within the geographic analysis area that have impacts on commercial and for-hire recreational fisheries 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, marine transportation, oil and gas activities, onshore development activities, fisheries use and management, and climate change (see Section D.2 in Appendix D for a description of ongoing activities). Some of these activities may also result in bottom disturbance or habitat conversion and may alter the distribution of fishery-targeted species and increase individual mortality. 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. If these risks 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.

Commercial and for-hire recreational fisheries would continue to be affected by ongoing fisheries use and management. "Regulated fishing effort" refers to fishery management measures necessary to maintain maximum sustainable yield under the MSA, including catch quotas, effort allocations, special management areas, and closed areas. Activities of NMFS and fishery management councils could 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. Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by the State of New Jersey or NOAA, depending on jurisdiction, will affect commercial fisheries and for-hire recreational fishing by modifying the nature, distribution, and intensity of fishing-related impacts. Fishery management measures affect fishing operations differently for each fishery.

Commercial and for-hire recreational fisheries would continue to be affected by ongoing environmental trends, particularly climate change. The primary effects of climate change include 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, 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). 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 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 location of fishing grounds in commercial and for-hire recreational fisheries could change if the distribution of important fish stocks changes, and 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). See

Appendix D, Table D.A1-6 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for commercial fisheries and for-hire recreational fisheries.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on commercial and for-hire recreational fisheries (based on the scenario shown in Appendix D) include:

- Continued O&M of the BIWF Project (5 WTGs) installed in state waters;
- Continued O&M of the CVOW pilot Project (2 WTGs) installed in OCS-A 0497;
- Ongoing construction of six offshore wind projects: the Vineyard Wind 1 Project (62 WTGs and 1 OSS) in OCS-A 0501, the SFWF Project (12 WTGs and 1 OSS) in OCS-A 0517, the Ocean Wind 1 Project (98 WTGs and 3 OSSs) in OCS-A 0498, the Revolution Wind Project (65 WTGs and 2 OSSs) in OCS-A 0486, the Empire Wind Project (147 WTGs and 2 OSSs), and the CVOW-C Project (202 WTGs and 3 OSSs).

Ongoing activities would affect commercial and for-hire recreational fisheries through the primary IPFs of anchoring, cable emplacement and maintenance, noise, port utilization, presence of structures, and traffic. Ongoing offshore wind activities would have the same type of impacts from these IPFs that are described in detail in under *Cumulative Impacts of Alternative A – No Action*, but the impacts would be of lower intensity.

Cumulative Impacts of Alternative A – No Action

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

In addition to ongoing activities, BOEM anticipates that the impacts of planned activities other than offshore wind development would result from installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, installation of new structures on the OCS, and fisheries use and management (see Appendix D, Section D.2 for a description of planned activities). Some of these activities may also result in bottom disturbance or habitat conversion and may alter the distribution of fishery-targeted species and increase individual mortality. Fishery management measures that are likely to be implemented in the future include measures to reduce the risk of interactions between fishing gear and NARW by 60 percent (McCreary and Brooks 2019). This measure would likely have an adverse impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area.

Offshore wind activities include planned offshore wind projects on the Atlantic OCS that have been determined by BOEM to be reasonably foreseeable, excluding the Proposed Action (see Appendix D for a description of planned offshore wind activities). BOEM expects planned offshore wind development activities to affect commercial and for-hire recreational fisheries through the following primary IPFs.

Anchoring: Ongoing and planned offshore wind activities may result in increased anchoring from vessels involved in installation and maintenance. Increased anchoring would pose a temporary (hours to days) navigational hazard to fishing vessels operating within a few hundred meters of anchored vessels. However, the extent of impacts on commercial and for-hire recreational fisheries would depend on the locations and duration of activities. In the maximum-case scenario, which assumes maximum build-out of offshore wind projects within the geographic analysis area, BOEM expects that anchoring from offshore wind projects other than the Proposed Action between 2023 and 2030 would disturb 7,020 acres (2,840 hectares) of the seafloor within the geographic analysis area out of the over 200 million acres (81 million hectares) within the geographic analysis area (Appendix D, Tables D.A2-1 and D.A2-2). However, the extent of anchoring disturbance could be less if planned projects use dynamic positioning vessels. In addition, there could be increased anchoring associated with the installation of meteorological towers or buoys. BOEM expects that anchoring associated with planned offshore wind activities would result in short-term, localized, minor impacts on commercial and for-hire recreational fisheries.

Cable emplacement and maintenance: Ongoing and planned offshore wind activities would involve the placement and maintenance of export and interarray cables in the geographic analysis area. New cables and cable maintenance could cause localized impacts on commercial fisheries by disrupting fishing activities during periods of active installation and maintenance and during periods when cables are exposed prior to burial. Fishing vessels unable to access affected areas may experience reduced revenue or increased conflict over other fishing areas. BOEM expects that offshore export and interarray cable emplacement in the geographic analysis area from offshore wind projects other than the Proposed Action could cause temporary displacement of fishing vessels and disruption of fishing activities over an estimated area of disturbance of 63,933 acres (25,873 hectares) between 2023 and 2030 within the geographic analysis area (Appendix D, Tables D.A2-1 and D.A2-2); this area represents approximately 0.03 percent of the over 200 million acres (81 million hectares) within the geographic analysis area. Cable laying for some of these projects may occur concurrently, which would disrupt fishing activities over a larger area but for a shorter time than sequential cable laying. However, BOEM does not expect that the decision to lay cables concurrently or sequentially would influence the extent of impacts on fisheries. The season in which cable laying occurs is likely to have a greater influence on the impacts on fisheries resources. Most construction activity is likely to occur in the summer when weather conditions are more favorable, such that fisheries that are most active in the summer (e.g., longfin squid) are more likely to be affected than those that are most active in the winter. BOEM expects that cable emplacement and maintenance for planned offshore wind activities would result in short-term, localized, moderate impacts on commercial and for-hire recreational fisheries.

Noise: Planned offshore wind activities that would generate noise include G&G surveys, pile driving, cable laying, vessels, and WTG operations. These noise sources have the potential to temporarily affect fish and shellfish, which may indirectly affect commercial and for-hire recreational fisheries. The potential impacts associated with each noise source are discussed separately in the following paragraphs.

G&G surveys would be conducted for site assessment and characterization activities associated with offshore wind facilities and are expected to occur intermittently over a 2- to 10-year period at locations throughout the geographic analysis area. Site characterization surveys for offshore wind farms typically use sub-bottom profiler technologies that generate sound waves that are similar to common deep-water echosounders. These survey methods produce less-intense sound waves compared to seismic surveys used in oil and gas exploration. Noise from G&G surveys may cause localized and temporary behavioral changes in some fish species, which could affect the catch efficiency of some fishing gears (e.g., hook and line). However, as described in Section 3.5.5.3, because noise from HRF survey equipment would not exceed the threshold for injury to finfish and invertebrates, it is not expected to result in declines in productivity of fish and shellfish stocks that would cause fishery-level impacts. Although schedules for many planned offshore wind activities are still being developed, noise impacts on fish and shellfish might be minimized by sequentially scheduling site assessment and characterization surveys to avoid overlapping noise from different surveys.

Ongoing and planned offshore wind activities would generate impulsive pile-driving noise during foundation installation. Pile driving is expected to occur for 7 to 9 hours per foundation as 2,940 WTGs and 41 OSSs/ESPs and met towers are anticipated to be constructed between 2023 and 2030 within the geographic analysis area (Appendix D, Tables D.A2-1 and D.A2-2) for offshore wind projects other than the Proposed Action. One or more projects may install more than one foundation per day, either concurrently or sequentially over the construction period. Noise transmitted through water and the seabed can cause injury to or mortality of fish over a small area around each pile and can cause temporary stress and behavioral changes over a larger area. Because of the relatively small footprint of injurious sound and the ability for most fish to swim away from noise sources, injurious noise from pile driving is not expected to cause stock-level changes that would adversely affect fisheries. High-intensity pile-driving noise may influence fish behavior by causing auditory masking and alteration of foraging patterns, social behavior, and metabolism (Wahlberg and Westerberg 2005; Madsen et al. 2006; Slabbekoorn et al. 2010; Siddagangaiah et al. 2021). It is expected that behavioral responses to noise may cause some displacement of fish, thereby temporarily reducing the quality of fishing in affected areas and causing fishers to seek alternative fishing areas (Skalski et al. 1992). As described in Section 3.6.1.5, *Impacts of Alternative B – Proposed Action on Commercial Fisheries and For-Hire Recreation Fishing,* behavioral responses from pile driving may occur at distances of 6.9 miles (11.2 kilometers) or greater (see Table 3.6.1-36). Most finfish species are expected to avoid the noise-affected areas while invertebrates may exhibit stress and behavioral changes such as discontinuation of feeding activities. For example, noise has been shown to affect bivalves based on reactions where bivalves close their valves and burrow deeper when subjected to noise and vibration stimuli (Roberts and Elliott 2017). Displacement of fishing activity may result in increased conflict among fishers, increased operating costs for vessels, and lower revenue. Furthermore, pile-driving noise may cause changes in spawning behavior. To the extent that changes in spawning behavior result in reduced reproductive success and subsequent recruitment, this could potentially result in long-term effects on populations and associated declines in harvest levels. There is a risk of reduced recruitment from pile-driving noise for some species because elevated noise levels would overlap the spawning period of certain species and would occur over a period of 7 to 10 years for regional wind projects. Offshore wind developers would implement measures to minimize potential impacts of pile-driving noise, including avoiding sensitive seasons (e.g., fishing, migration, or spawning seasons), using ramp-up or soft start pile-driving procedures to allow mobile fish and invertebrates to vacate the area, and using a noise abatement system to decrease the propagation of potentially harmful noise.

Several activities associated with cable laying would produce noise, including route identification surveys, trenching, jet plowing, backfilling, and installation of cable protection. Modeling based on noise data collected during cable laying for European wind farms has estimated that underwater noise levels from 174 to 180 dB occurred 3 to 4.6 feet (10 to 15 meters) from the source (Bald et al. 2015); these noise levels would exceed the 150-dB threshold for behavioral responses in fish (Mueller-Blenkle et al. 2010; Purser and Radford 2011; Wysocki et al. 2007). As with pile-driving noise, fish that are exposed to cable-laying noise may experience temporary stress and behavioral changes, which could indirectly cause displacement of fishing activity. However, because the cable-laying vessel and equipment would be continually moving and the ensonified area would move with it, a given area would not be ensonified for more than a few hours. Therefore, any behavioral responses to cable-laying noise are expected to be temporary and localized and are not expected to result in fishery-level impacts.

As described in Section 3.5.5.3, vessels generate low-frequency, non-impulsive noise that could cause temporary stress or behavioral responses in fish. Vessel activity from planned offshore wind activities is expected to peak in 2026. This increase in vessel activity could cause repeated, intermittent behavioral responses in fish, which could indirectly cause displacement of fishing activity. Because behavioral responses to vessel noise would be localized and temporary, dissipating once the vessel leaves the area, vessel noise is not expected to result in fishery-level impacts.

Operating WTGs generate non-impulsive underwater noise that is audible to some fish. The response of fishes to sustained anthropogenic noise is species-specific and may include disruption in social interactions, hearing loss, and a rise in noise-induced stress (Barton 2002; Popper and Hastings 2009; Siddagangaiah et al. 2021). Noise levels generated by operating WTGs are expected to reach ambient levels within a short distance of 10 MW turbines (Stöber and Thomsen 2021). Elliot et al. (2019) compared observed particle motion effects at 164 feet (50 meters) from an operational WTG at the BIWF to current research on particle motion sensitivity in fish. They concluded that particle motion effects could occasionally exceed the lower limit of observed behavioral responses in Atlantic cod and flatfish within these limits. Because behavioral impacts would be localized to the immediate area of WTGs, noise from operating WTGs is not expected to result in fishery-level impacts.

BOEM expects that underwater noise associated with planned offshore wind activities would cause long-term, localized, moderate impacts on commercial and for-hire recreational fisheries, depending on the timing and overlap of construction activities. Impacts are expected to primarily result from pile-driving noise during the installation of foundations for WTGs and OSS.

Port utilization: Port expansion would likely be needed to accommodate the increased vessel traffic and increased vessel sizes associated with planned offshore wind activities. At least two proposed offshore wind projects are considering port expansion, and other ports along the Atlantic coast may be expanded as well. Major fishing ports in the geographic analysis area (see Table 3.6.1-3, above) that have been identified as potential ports to support offshore wind energy construction and operations include Atlantic City, Hampton Roads, Montauk, and New Bedford (BOEM 2021). Port expansions would likely occur over the next 6 to 10 years and would result in increased vessel traffic, which would peak during construction. Increased vessel traffic may cause delays or restrictions in access to ports for commercial and for-hire fishing vessels. Furthermore, maintenance dredging of shipping channels may be required to support port expansion, which could cause additional delays or restrictions in access to port for fishing vessels, as well as increased vessel noise and increased suspended sediment concentrations, two factors that may cause temporary and localized displacement of fish. Port expansions could also increase competition for dockside services, which could affect fishing vessels. Port expansion is expected to have impacts on commercial and for-hire fishing vessels that are widespread across ports used for both fishing and offshore wind projects and are long term, with impacts primarily occurring during the construction period of multiple projects. BOEM expects that increased port utilization associated with planned offshore wind activities would cause long-term to permanent, widespread, moderate impacts on commercial and for-hire recreational fisheries resulting from increased vessel traffic at ports and increased competition for dockside services.

Presence of structures: As described above, an estimated 2,940 WTGs and 41 OSSs/ESPs and met towers are expected to be built within the geographic analysis area for ongoing and planned offshore wind activities other than the Proposed Action between 2023 and 2030. Approximately 4,727 acres (1,913 hectares) of hard scour protection would be installed around the foundations, and an additional 2,700 acres (1,093 hectares) of hard protection would be installed around the export and interarray cables (Appendix D, Table D.A2-2). The presence of these structures may have impacts on commercial and for-hire recreational fisheries through entanglement or gear loss or damage, space-use conflicts, navigational hazards, fish aggregation, habitat conversion, and migration disturbances. These impacts may arise from the presence of buoys, meteorological towers, turbine and substation foundations, scour/cable protection, and transmission-cable infrastructure.

The presence of the scour protection for the WTG foundations and transmission cables would result in a widespread, permanent increase in the risk of gear loss or damage for fishing vessels that operate within the offshore wind lease areas, which would exist over the operational period of each offshore wind project. Although interarray and export cables would be buried below the seabed approximately 5 to 6.6 feet (1.5 to 2 meters), BOEM estimates burial to this depth would not be possible for as much as 10 percent of the cables; these cables would require cable protection in the form of rock placement, concrete mattresses, or half-shell. Mobile gear could become snagged on these structures, resulting in damage to or loss of the gear and increased costs for fishers. The increased risk of damage or loss of fishing gear could affect mobile and fixed-gear fisheries, but the risk would be greatest for commercial mobile gear (e.g., trawl, dredge), which is pulled over the seafloor. Periodic damage to or loss of fishing gear would result in a long-term increase in expenses to fishers resulting from the costs of repairing or replacing the gear and lost fishing revenue that occurs while the gear is being repaired or replaced. Fishers may avoid areas where scour and cable protection are present, thereby leading to displacement of fishing activity and increased conflicts with other fishers. Further, lost gear that is carried by currents can disturb habitats and cause injury to aquatic organisms, potentially causing localized, short-term impacts on fish and invertebrates that are targeted in fisheries.

The presence of WTGs would result in a widespread, permanent navigational risk to commercial and for-hire recreational fishing vessels transiting through and fishing near offshore wind farms. Maneuverability within wind farms depends on several factors including vessel size, fishing gear used, and weather conditions. Trawl and dredge vessel operators have commented that less than 1 nautical mile (1.9 kilometers) 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. Clam industry representatives (Atlantic surfclam and ocean quahog fisheries) have stated that their operations require a minimum distance of 2 nautical miles (3.7 kilometers) between WTGs, in alignment with the bottom contours, for safe operations. For-hire recreational fishing vessels, which are generally smaller than commercial vessels and do not have large, externally deployed fishing gear, are expected to have less difficulty navigating near offshore wind farms. An exception to this would be recreational fishing vessels that troll for migratory species (e.g., bluefin tuna, swordfish), which often deploy many feet of lines and hooks behind the vessel that may create navigational challenges around wind farms. 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). Fishermen have expressed concerns that low visibility, wind, or crew exhaustion could lead to vessels alliding with WTGs (Brink and Dalton 2018). Mechanical problems, such as loss of steerage, could also result in an allision with a WTG as the vessel drifts during repair. The presence of WTGs could cause long-term changes in transit routes of fishing vessels that actively avoid transiting through the offshore wind lease areas, which could result in increased travel time and trip costs. Collectively, the reduced area available for fishing and the navigational hazards to fishing vessels posed by the presence of structures associated with planned offshore wind projects are expected to have long-term, adverse impacts on commercial and for-hire fisheries.

Some fishermen who 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 (Murray et al. 2010; O’Farrell et al. 2019). These behaviors are like those of fishermen experiencing reduced access to fisheries resulting from fishing regulations (Murray et al. 2010) and/or 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 fishermen. For example, O’Farrell et al (2019) observed that some fishermen have low vessel mobility, less explorative behavior, are risk averse, and take shorter trips, whereas other fishermen have high mobility, 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. Fishermen who are 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. Fishermen who 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 fishermen to land their catch in different ports (Papaioannou et al. 2021), which could increase operational costs depending on the port location.

Fishing vessel operators who are displaced from fishing grounds within offshore wind areas and are unable to find alternative fishing grounds would experience long-term revenue losses. The amount of revenue at risk would increase as proposed offshore wind energy projects are constructed and come online and would continue during the O&M phases of the offshore wind energy projects. The most revenue at risk would occur during the construction phase, but revenue exposure would occur during the O&M phase as well.

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

In addition to the economic impacts discussed above, the loss of historical fishing grounds and fishing transit areas may have social and cultural impacts on fishing communities. Discussions of these impacts are provided in Section 3.6.2, *Cultural Resources*, and Section 3.6.4, *Environmental Justice*.

The presence of the WTG foundations and associated scour protection, as well as cable 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). Habitat conversion would also result in the loss of soft-bottom benthic features that occur throughout the geographic analysis area, including sand waves, sand ridges, and shoal formations. These features provide habitat complexity that is used by benthic and finfish communities for refuge, spawning, and foraging, and are often identified as prime fishing areas by commercial and recreational fishermen. The offshore wind structures would also create uncommon relief in a mostly sandy seascape, attracting structure-oriented species and species that prefer hard-bottom habitat to these locations (Claisse et al. 2014; Smith et al. 2016). The presence of structures may increase the catchability of numerous species that are targeted in fisheries, including American lobster, Atlantic cod, black sea bass, and striped bass (Kirkpatrick et al. 2017), thereby resulting in increased opportunities for for-hire recreational fisheries. Conversely, commercial fishing vessels that deploy mobile fishing gear may be unable to fish near these structures because of the risk of snagging, and commercial fishers in general may encounter increased competition with recreational fishers in these areas. Planned offshore wind structures may also provide forage and refuge for some migratory finfish and shellfish that are valued in fisheries, such as black sea bass, lobster, monkfish, and summer flounder. These behavioral effects may affect the migrations of individual fish, but they are not expected to have broad impacts on the migration of fish populations. Other oceanographic conditions such as temperature and salinity are expected to remain the primary determinants of seasonal migration (Fabrizio et al. 2014; Moser and Shepherd 2009; Secor et al. 2018). The impact of structures on fish aggregation and migratory patterns would be localized to the immediate area surrounding the structures and would be long term, existing as long as the structures are in place, but is not expected to cause stock-level changes that would result in fishery-level impacts.

BOEM expects that the presence of structures associated with planned offshore wind activities would cause long-term, widespread, moderate to major impacts on commercial and for-hire recreational fisheries, depending on the mitigation measures that are implemented by offshore wind developers. Impacts are expected to primarily result from the risk of fishing gear damage or loss and reduced access to traditional fishing grounds.

Regulated fishing effort: Planned offshore wind development could influence fishery management by affecting fisheries' independent surveys used to inform management measures and by changing patterns of fishing activity. Fisheries managers may need to revise the sampling design of fisheries surveys to include sampling within WTAs to account for uncertainty in stock assessments that may accompany offshore wind development. Increased uncertainty in stock assessments could lead to more conservative quotas and resulting revenue losses in the fishing industry. Changes in fishing behavior from offshore wind development may necessitate new management measures, which would in turn have short-term or long-term impacts on commercial and for-hire recreational fisheries. BOEM expects that changes in regulated fishing effort in response to planned offshore wind activities would cause long-term, widespread, moderate impacts on commercial and for-hire recreational fisheries as management adapts to changing fishing patterns, data availability, and management options.

Traffic: Planned offshore wind activities would result in increased vessel traffic during construction, O&M, and decommissioning of planned offshore wind facilities. This increase in vessel traffic is expected to have begun in 2023, as several offshore wind projects began construction, and is expected to peak in 2026 and 2027, when as many as 21 offshore wind projects may be undergoing construction in the Greater Atlantic region (Appendix D, Table D.A2-1). Most offshore wind projects in the region are expected to complete construction by 2030. Increased vessel traffic could increase congestion, delays at ports, and the risk for collisions with fishing vessels. The presence of construction vessels could restrict fishing operations in offshore wind lease areas and along cable routes during installation and maintenance activities. Impacts from vessel traffic are expected to occur primarily during the construction period. BOEM expects that increased vessel traffic associated with Planned offshore wind activities would cause long-term, widespread, moderate impacts on commercial and for-hire recreational fisheries.

Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, ongoing activities would have continuing impacts on commercial and for-hire recreational fishing, primarily through port use, vessel activity, other offshore development, climate change, and fisheries use and management. BOEM anticipates that the commercial and for-hire recreational fisheries impacts from ongoing activities associated with the No Action Alternative would be permanent and **moderate to major**. The major impact rating for some fisheries and fishing operations is primarily driven by regulated fishing effort and climate change associated with ongoing activities.

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

BOEM anticipates that cumulative impacts of the No Action Alternative would have permanent **major adverse** impacts on commercial fisheries and for-hire recreational fishing. These impacts would primarily result from future fisheries use and management and the increased presence of offshore structures (i.e., foundations, scour protection, and cable protection), primarily those associated with planned offshore wind projects. The extent of adverse impacts would vary by fishery and fishing operation because of differences in target species, gear type, and predominant location of fishing activity. The impacts could also include **minor beneficial** impacts on some for-hire recreational fishing operations resulting from the artificial reef effect.

3.6.1.4 Relevant Design Parameters and Potential Variances in Impacts

This Final EIS analyzes the maximum-case scenario; any potential variances in the proposed 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 commercial and for-hire recreational fisheries:

- The number, size, and type of WTG and OSS foundations;
- The route of the interarray cables and offshore export cable, including the ability to reach target burial depth and the cable protection measures used when target burial depth is not achieved;
- The time of the year during which construction occurs; and
- The number of simultaneous vessels, number of trips, and size of vessels.

Variability of the Atlantic Shores South design exists as described in Appendix C. Below is a summary of potential variances in impacts:

- The number of WTG foundations: A larger number of WTG foundations would result in greater impacts on commercial and for-hire recreational fisheries associated with the presence of structures, including the risk of gear loss or damage, navigational hazards, space-use conflicts, and fish aggregation.
- The size of the OSS: Size would influence the number of structures located outside of the uniform grid pattern.
- The time of the year during which construction occurs: Construction that occurs during periods of peak activity may limit access to fishing areas and may cause displacement of fish from affected areas, thereby reducing catch and revenue.

Although variation is expected in the design parameters, the impact assessments for commercial and for-hire recreational fisheries in Section 3.6.1.5 through Section 3.6.1.8 evaluate impacts associated with the maximum-case scenario identified in Appendix C.

3.6.1.5 Impacts of Alternative B – Proposed Action on Commercial Fisheries and For-Hire Recreational Fishing

As described in Section 2.1.2, *Alternative B – Proposed Action*, the Proposed Action includes the construction of up to 200 WTGs, 10 OSSs, and 1 met tower and the installation of up to 547 miles (880 kilometers) of interarray cables, 37 miles (60 kilometers) of interlink cables, and 441 miles (710 kilometers) of export cables between 2025 and 2027. The Proposed Action also includes 30 years of O&M over a 30-year commercial lifespan and decommissioning activities at the end of commercial life.

The Proposed Action would include both onshore and offshore activities. Anticipated onshore activities include interconnection cable installation and onshore substation and/or converter station construction, remote monitoring of offshore structures, maintenance of onshore substations and/or converter stations, and maintenance of interconnection cables. Anticipated offshore activities include submarine export cable installation, OSS installation and commissioning, WTG foundation installation, interarray and interlink cable installation, WTG installation and commissioning, inspection and maintenance of WTGs, structural inspection and maintenance of OSSs, foundation and scour protection inspection and maintenance, and submarine cable surveys and maintenance. The effects of IPFs associated with these activities on commercial and for-hire recreational fisheries are discussed in the following paragraphs.

Anchoring: The Proposed Action would result in increased anchoring from vessels during survey activities and during the construction and installation, O&M, and decommissioning of offshore components. Anchored vessels would disturb approximately 714 acres (289 hectares) of seafloor and would pose a navigational hazard to fishing vessels (Appendix D, Table D.A2-2). All impacts from anchoring would be localized and potential navigational hazards would be temporary (hours to days). Atlantic Shores would implement measures to avoid interactions between anchored Atlantic Shores

South vessels and fishing vessels, including development of a website that contains real-time vessel tracking charts and vessel schedules (COM-16, Appendix G, Table G-1) and employment of a Marine Coordinator to monitor daily vessel movements, implement communication protocols with external vessels to avoid conflicts, and monitor safety zones (COM-20, Appendix G, Table G-1).

BOEM expects that anchoring associated with the Proposed Action would result in short-term, localized, minor impacts on commercial and for-hire recreational fisheries.

Cable emplacement and maintenance: The Proposed Action would involve the placement of 1,025 miles (1,650 kilometers) of export, interlink, and interarray cables, resulting in a 294-acre (119-hectare) area of seabed disturbance for the emplacement of export cables and a 282-acre (114-hectare) area of seabed disturbance for the emplacement of interarray and interlink cables.

Seabed preparation may be required in certain areas of the export and interarray cable corridors prior to cable installation. Seabed preparation may include sand bedform clearing, relocation of boulders, and a pre-lay grapnel run. Sand bedform clearing would involve the removal of the tops of some mobile sand bedforms to ensure cables can be installed within stable seabed. Boulder relocation may be required in limited areas along the ECCs. Boulder removal would likely be performed using subsea grab, a method with minimal seabed impact. Boulders would be relocated as close as practical to their original location and are anticipated to remain within the surveyed ECC. The movement of boulders from known locations may result in an increased likelihood of gear entanglement for vessels deploying bottom-oriented mobile gear. A pre-lay grapnel run would be completed approximately 2 months prior to cable installation to clear final cable alignments of human-made obstructions (e.g., discarded fishing gear). To complete the pre-lay grapnel run, a vessel would tow an approximately 3.3-foot-wide (1-meter-wide) grapnel train consisting of a series of hooks designed to snag debris. Seabed preparation impacts would contribute to the estimated 576 acres (233 hectares) of seabed disturbance associated with cable installation.

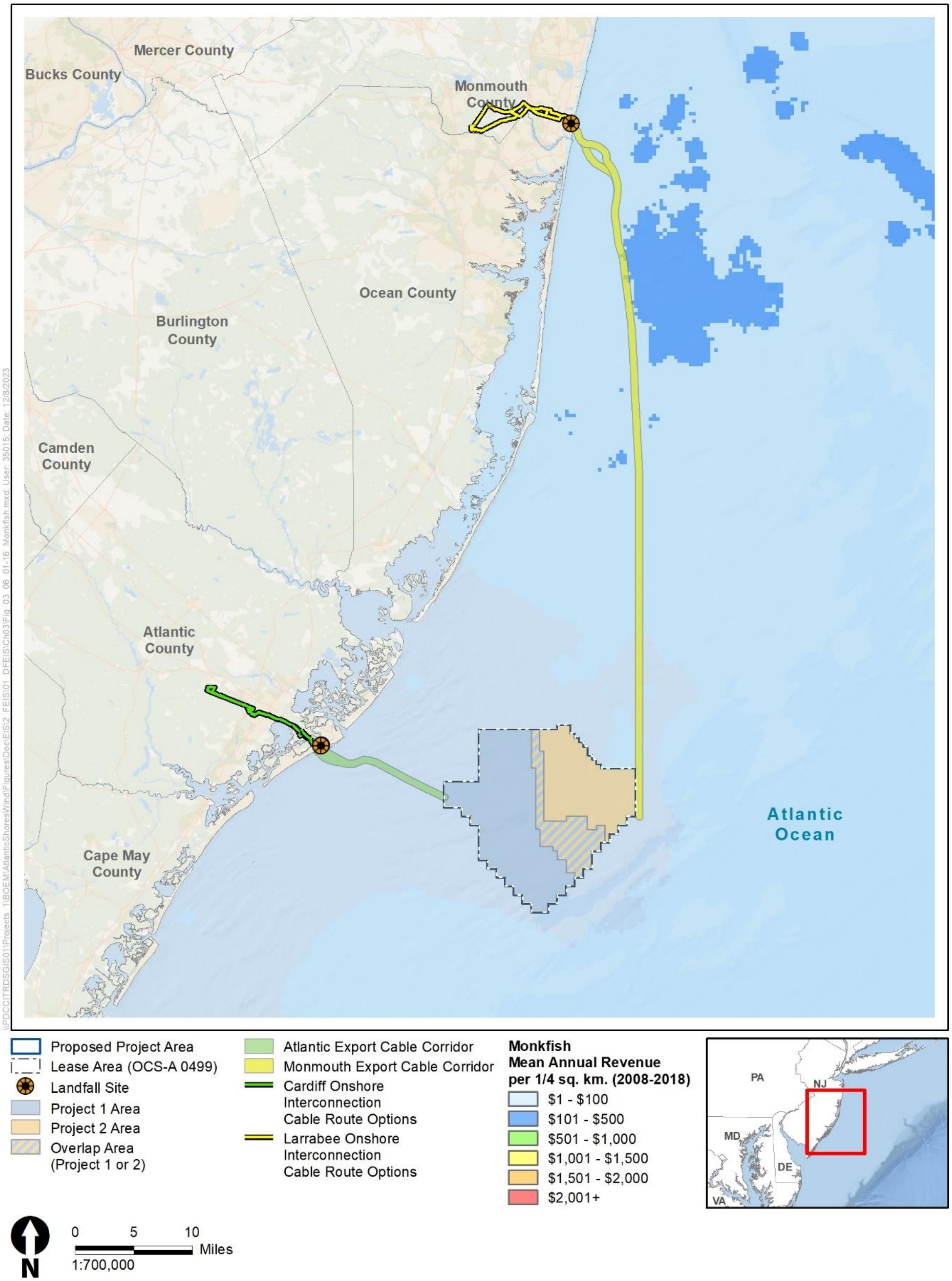
Cable emplacement could prevent deployment of fixed and mobile fishing gear in limited parts of the Project area from 1 day up to several months (if simultaneous lay and burial techniques are not used). During construction and installation activities, it may not be possible to deploy fixed fishing gear in parts of the Project area, which may result in the loss of revenue to fisheries. As provided in Table 3.6.1-21, from 2008 through 2022, the average annual commercial fishing revenue from fixed gear (i.e., gillnet and pots) in the combined Project 1 and Project 2 WTAs was approximately $17,435, which represented 2.2 percent of the average annual commercial fishing revenue of $779,581 in the WTAs. In addition, temporary limitations to fishing activities for all gear types could occur along the offshore export cable corridor while the site is being prepared and cables laid. Commercial fishing vessels operating in the offshore portion of the export cable corridor are expected to target similar species and use similar gear types compared to vessels operating in the WTAs. However, the target species and gears used are expected to differ along the inshore portion of the cable corridor. Fishing vessels that temporarily do not have access to areas along the export cable corridor could experience reduced revenue if alternative fishing locations are not available or there is increased conflict over other fishing grounds. Based on commercial revenue data collected in the Project area from 2008–2018 (Kirkpatrick et al. 2017), there is limited fishing activity along the Atlantic ECC, but there are several fisheries that are active along the Monmouth ECC and are likely to be impacted by cable emplacement, including the Monkfish FMP (Figure 3.6.1-15); Sea Scallop FMP (Figure 3.6.1-16); Summer Flounder, Scup, Black Sea Bass FMP (Figure 3.6.1.-17); and Surfclam, Ocean Quahog FMP (Figure 3.6.1-18). Fishing vessels targeting surfclam are likely to be impacted by cable emplacement because there is a band of intensive clam fishing activity spanning much of the central and southern portions of the Monmouth ECC.

The Manasquan Inlet and Axel Carlson Reefs are located near the northern end of the Monmouth ECC (Figure 3.6.1-12). However, because the reefs are outside of the area of the ECC where impacts from seabed preparation and sedimentation/turbidity associated with cable emplacement are expected, cable emplacement is not expected to impact recreational fishing activity around the reefs.

The presence of slow-moving (or stationary) cable installation vessels would increase the risk of collisions with fishing vessels. Fishing vessels would need to take additional care when crossing cable routes or would need to avoid installation or maintenance areas entirely during installation and maintenance activities. Navigational impacts from the presence of cable installation vessels are expected to be on the scale of hours and are not expected to occur over large areas.

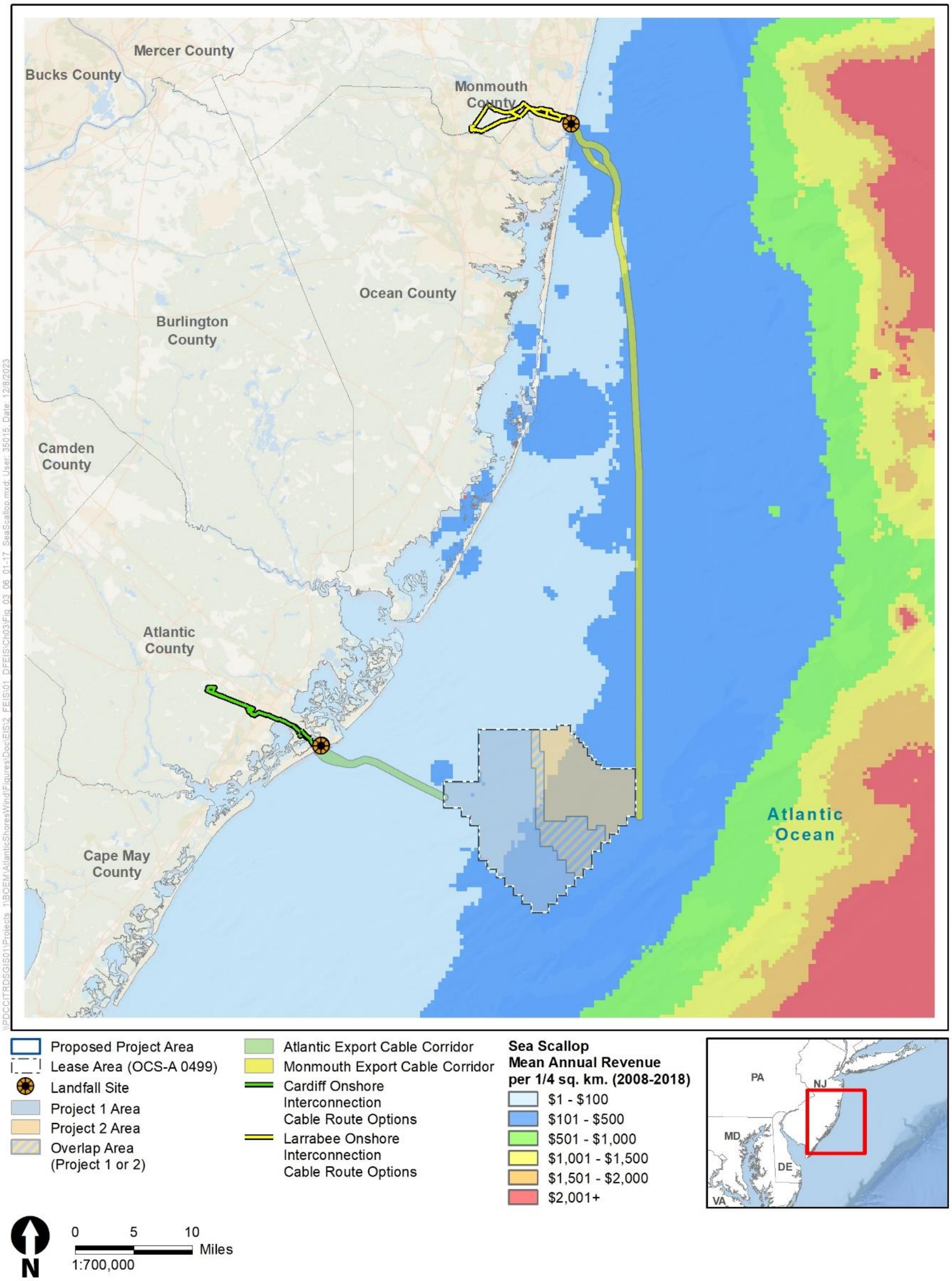
Once installed and in operation, the submarine export cables would be monitored through either a distributed temperature sensing system, a distributed acoustic sensing system, or online partial discharge monitoring. Regular cable surveys would be performed to identify potential issues with scour or burial depth. In the unlikely event of cable exposure, the cable would be reburied or cable protection would be applied. Should unplanned repairs be required, the damaged portion of the cable would be spliced and replaced with a new, working segment. This would require the use of various cable installation equipment, as described for construction activities.

BOEM expects that cable emplacement and maintenance for the Proposed Action would result in short-term, localized, moderate impacts on commercial and for-hire recreational fisheries.



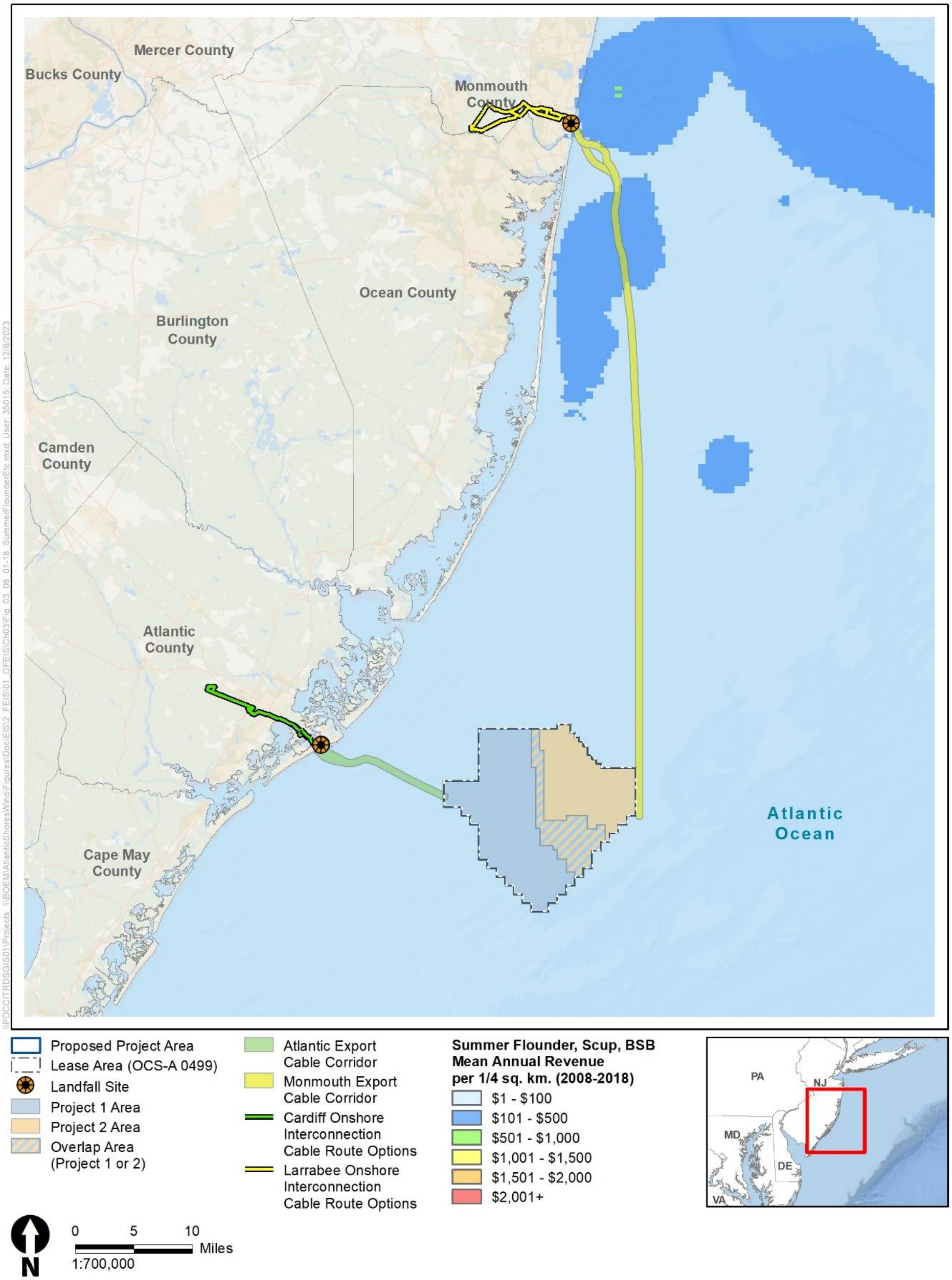
Source: Atlantic Shores 2023; AKRF 2023.

Figure 3.6.1-15. Annual revenue exposure of the Monkfish FMP in the Project area, 2008–2018



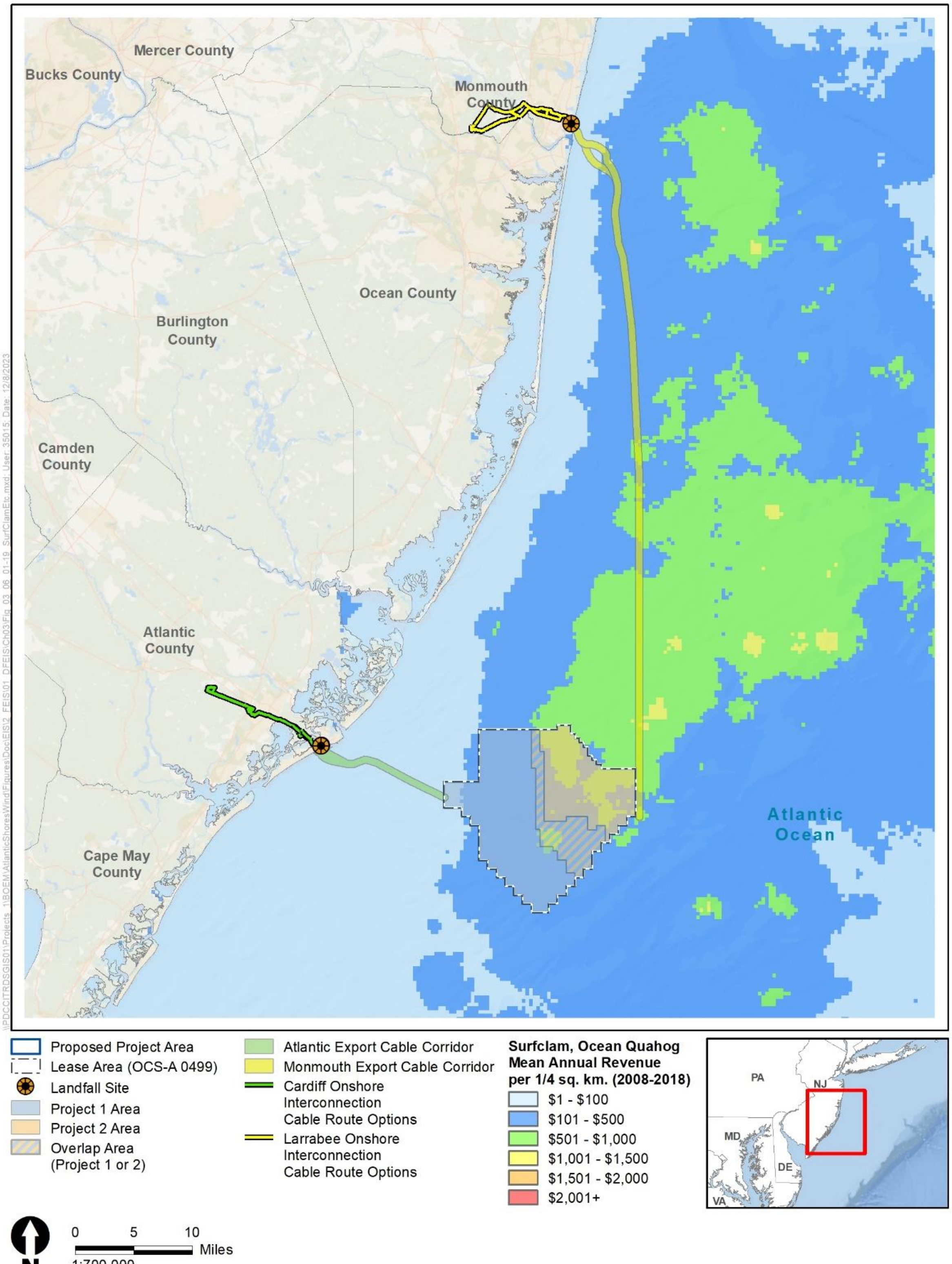
Source: Atlantic Shores 2023; AKRF 2023.

Figure 3.6.1-16. Annual revenue exposure of the Sea Scallop FMP in the Project area, 2008–2018



Source: Atlantic Shores 2023; AKRF 2023.

Figure 3.6.1-17. Annual revenue exposure of the Summer Flounder, Scup, Black Sea Bass FMP in the Project area, 2008–2018



Source: Atlantic Shores 2023; AKRF 2023.

Figure 3.6.1-18. Annual revenue exposure of the Surfclam, Ocean Quahog FMP in the Project area, 2008–2018

Noise: The Proposed Action would generate underwater noise during G&G surveys, pile driving, cable emplacement, vessel operation, and WTG operation. As described in Section 3.5.5.5, these noise sources have the potential to temporarily affect fish and shellfish, which may indirectly affect commercial and for-hire recreational fisheries. The potential impacts associated with each noise source are discussed separately in the following paragraphs.

HRG surveys, a type of G&G survey, would be conducted prior to construction to support final engineering design and after cable emplacement to confirm burial of submarine export and interarray cables. G&G survey noise could temporarily affect commercial and for-hire recreational fisheries indirectly by causing behavioral changes in commercial and recreational fish species within the ensonified area, which may affect the catch efficiency for some types of gear (e.g., hook and line). However, because HRG survey equipment produces less-intense noise, operates in smaller areas, and is deployed by faster-moving vessels compared to other types of G&G survey equipment (e.g., seismic air guns), it is not expected to cause injuries to fish, and any behavioral impacts are expected to occur over a small area.

Impact pile driving during the installation of WTGs and OSS foundations would generate intermittent noise during the construction period. A total of 211 foundations are expected to be installed under the Proposed Action, each requiring a maximum of 7 to 9 hours of pile driving (if piled foundations are used), which would occur over a maximum-case scenario of a total of 420 days (2 days per foundation assuming no daylight restrictions) over 3 years. As described in Section 3.6.1.3, *Impacts of Alternative A – No Action on Commercial Fisheries and For-Hire Recreational Fishing,* noise generated by pile driving can cause injury or mortality to fish over a small area around each pile and can cause temporary stress and behavioral changes over a larger area. For instance, vibratory noise within the range of noise levels measured near anthropogenic activities (e.g., pile driving, blasting) may cause bivalves to close their valves, retract their siphons, and burrow for long periods, potentially reducing respiration and feeding (Roberts et al. 2015). These impacts are particularly noteworthy, given that two bivalve species, scallops and surfclam, are among the most intensively fished species in the Project area. If this behavior is prolonged, it could lead to mortality or reduced spawning for these species resulting in reductions in fishery availability. As summarized in Table 3.6.1-36, pile driving of 15-meter monopiles with a 4,400-kilojoule hammer under the Proposed Action was estimated to have a maximum radius of behavioral impacts on all fish of as far as 6.9 miles (11.2 kilometers) at a deep location and 6.4 miles (10.2 kilometers) at a shallow site influenced by bathymetry (COP Volume II, Appendix II-L; Atlantic Shores 2024). The radius for behavioral impacts of pile driving would extent out to the Atlantic City Reef (Figure 3.6.1-13), potentially displacing fish and invertebrates from the area and resulting in reduced fishing opportunity for recreational fishing vessels targeting the area. However, impacts of pile driving noise on the Atlantic City Reef are expected to be short term, as displaced fish and invertebrates are expected to return following the completion of pile driving. Because of the relatively small footprint of injurious sound and the ability for most fish to swim away from noise sources, injurious noise from pile driving is not expected to cause fishery-level impacts on fish stocks. Invertebrates are generally less sensitive to sound than fish, such that injurious sound is expected to occur only close to pile driving and is not expected to cause fishery-level impacts on shellfish stocks.

Table 3.6.1-36. Acoustic radial distances ($R_{95\%}$ in kilometers) to thresholds for fish for 15-meter monopiles using a 4,400-kilojoule hammer energy with 0-dB attenuation

Threshold Type	Fish Type	Threshold Level	Acoustic Radial Distance at Deep Location (km)	Acoustic Radial Distance at Shallow Location (km)
Behavioral, peak	All fish	150 dB re 1 µPa SPL_{RMS}[1]	11.16	10.24
Injury, peak	All fish	206 dB re 1 µPa SPL_{peak}[1]	0.43	0.50
	No swim bladder	213 dB re 1 µPa SPL_{peak}[2]	0.21	0.18
	Swim bladder	207 dB re 1 µPa SPL_{peak}[2]	0.41	0.46
Injury, cumulative	Over 2 grams	187 dB re 1 µPa^2 SEL_{cum}[3]	9.46	8.57
	Under 2 grams	183 dB re 1 µPa^2 SEL_{cum}[3]	11.05	9.98
	No swim bladder	216 dB re 1 µPa SPL_{peak}[2]	1.45	1.34
	Swim bladder	203 dB re 1 µPa SPL_{peak}[2]	4.34	3.90

Sources:
[1] Andersson et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011; Wysocki et al. 2007.
[2] Popper et al. 2014.
[3] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
km = kilometers; µPa = micropascal; SELcum = cumulative sound exposure level; SPLpeak = peak sound pressure level.

As described in Section 3.6.1.3, noise-producing activities associated with cable laying may include trenching, jet plowing, backfilling, and installation of cable protection. Cable-laying activities associated with the Proposed Action would generate noise along 1,025 miles (1,650 kilometers) of interarray, interlink, and export cables. Fish that are exposed to cable-laying noise may experience temporary stress and behavioral changes, which could indirectly cause displacement of fishing activity and associated losses in revenue. However, because the cable-laying vessel and equipment would be continually moving and the ensonified area would move with it, a given area would not be ensonified for more than a few hours. The noise impacts of cable-laying activities associated with the Proposed Action are expected to be temporary and localized and are not expected to result in fishery-level impacts.

As described in Section 3.6.1.3, vessel operations during construction of the Proposed Action would generate low-frequency, non-impulsive noise, which could cause repeated, intermittent behavioral responses in fish and resulting displacement of fishing activity. However, because behavioral responses to vessel noise would be localized and temporary, ceasing once the vessel leaves the area, they are not expected to result in fishery-level impacts.

As discussed in Section 3.6.1.3, operating WTGs generate non-impulsive underwater noise that is audible to some fish species. The response of fishes to sustained anthropogenic noise is species-specific and may include disruption in social interactions, hearing loss, and a rise in noise-induced stress (Barton 2002; Popper and Hastings 2009; Siddagangaiah et al. 2021). Noise levels generated by operating WTGs are expected to reach ambient levels within a short distance of 10 MW turbines (Stöber and Thomsen 2021), such that impacts would be localized to the immediate area of WTGs. Therefore, noise from operating WTGs is not expected to result in fishery-level impacts.

BOEM expects that underwater noise associated with the Proposed Action would cause short-term to long-term, localized, minor to moderate impacts on commercial and for-hire recreational fisheries.

Moderate impacts are expected to result from pile-driving noise during installation of foundations for WTGs and OSSs, whereas minor impacts are expected to result from other noise sources.

Port utilization: No port expansion would be required to specifically accommodate the Proposed Action, but an increase in port utilization is expected during its construction and installation and O&M. Atlantic Shores has identified five port facilities in the Mid-Atlantic and New England that may be used for major construction staging activities for the Proposed Action: New Jersey Wind Port, Paulsboro Marine Terminal, and Repauno Port and Rail Terminal in New Jersey; Portsmouth Marine Terminal in Virginia; and Port of Corpus Christi in Texas. All port facilities being considered to support construction activities are located within industrial waterfront areas with existing marine industrial infrastructure or where such infrastructure is proposed for development within the required timeframe of Atlantic Shores South. While there is no port expansion included as part of the Project, for the O&M phase, Atlantic Shores would operate out of a new onshore O&M facility in Atlantic City, New Jersey, sited on a retired marine terminal. Several of the ports under consideration to support construction and installation and O&M are located within or near areas that have a medium or high level of fisheries engagement (e.g., Atlantic City, New Jersey; New Bedford, Massachusetts; North Kingstown, Rhode Island; Wilmington, Delaware) (NMFS 2023c). Use of these ports by vessels associated with the Proposed Action would result in increased vessel traffic, which may cause delays or restrictions for commercial and for-hire fishing vessels. Impacts from port utilization associated with the Proposed Action are expected to be localized and long term, occurring primarily during the construction period, and are not expected to result in fishery-level impacts.

BOEM expects that increased port utilization associated with the Proposed Action would cause long-term to permanent, localized, moderate impacts on commercial and for-hire recreational fisheries resulting from an increase in vessel traffic.

Presence of structures: The Proposed Action would include the installation of up to 200 WTGs, 10 OSSs, 1 permanent meteorological tower, up to 268 acres (108 hectares) of hard scour protection around the WTG and OSS foundations, and up to 595 acres (241 hectares) of hard cable protection around the export, interlink, and interarray cables. As described in Section 3.6.1.3, the presence of these structures during the operational phase of the Proposed Action could have several impacts on commercial and for-hire recreational fisheries, including through gear loss or damage, navigational hazards, habitat conversion and fish aggregation, migration disturbances, and space-use conflicts. The potential impacts associated with the presence of these structures are discussed separately in the following paragraphs.

The presence of structures, particularly the export and interarray cables and associated scour protection, would pose an increased risk of damage or loss of fishing gear. The most significant threat of cable interaction among the regional fishing industry comes from the surf clam fishery, which uses hydraulic dredges that generate trenches penetrating 0.66 to 1 foot (0.2 to 0.3 meters) into the seabed (NEFMC 2009; Stevenson et al. 2004). Consistent with this, New Jersey Administrative Code §7:7-12.21 recommends burial of submerged cables to a depth of at least 4 feet (1.2 meters) in areas where marine fish and invertebrates are commercially harvested using mobile bottom-tending gear. Although interarray and export cables would be buried at a target depth of 5 to 6.6 feet (1.5 to 2 meters) below the seabed, burial to this depth would not be possible in certain areas. Based on the CBRA developed for the Proposed Action (Atlantic Shores 2024, Appendix II-A5), the entirety of the Atlantic ECC would be suitable for jet trenching, whereas 11 out of 28 segments of the Monmouth ECC contained localized regions that would not be suitable for jet trenching. These results suggest that a greater percentage of the Monmouth ECC would require cable protection compared to the Atlantic ECC but do not provide a basis for estimating the amount of cable protection that would be required along each ECC. BOEM estimates that burial to the target depth of 5 to 6.6 feet (1.5 to 2 meters) would not be possible for as much as 10 percent of the area along the cable corridor; these cables would require an estimated 595 acres (241 hectares) of cable protection in the form of rock placement, concrete mattresses, or half-shell. Mobile gear could become snagged on these cable protection structures, resulting in damage to or loss of the gear, increased costs to fishers associated with repairing or replacing the gear, and revenue loss while the gear is being repaired or replaced. The increased risk of damage or loss of fishing gear would affect mobile and fixed-gear commercial fisheries and for-hire recreational fisheries, but the risk would be greatest for bottom-oriented commercial fisheries that use mobile gear (e.g., trawl, dredge), which is actively pulled over the seafloor. Although the Project area is generally classified as mostly sandy, areas where the seabed requires cable protection often contain natural snags that would provide suboptimal conditions for trawling or dredging and would therefore be avoided by those fisheries. Bottom-oriented mobile gear is the predominant type of gear used in the Lease Area. From 2008 through 2022, bottom-oriented mobile gear harvested an average annual revenue of $735,648 from the combined Project 1 and Project 2 WTAs (Table 3.6.1-21) which represented approximately 94 percent of the total revenue generated there. Atlantic Shores would implement measures to avoid, minimize, and mitigate impacts from the risk of interactions between fishing gear and submarine cables, including limiting the amount of cable protection and designing cable protection that minimize effects on fishing gear to the maximum extent practicable (COM-07, Appendix G, Table G-1); burying cables at a sufficient depth of 5 to 6.6 feet (1.5 to 2 meters) (GEO-07, Appendix G, Table G-1); developing a Gear Loss Avoidance Program to identify gear located within the Project area and to work with fishermen to avoid, remove, or relocate fishing gear in the Project area (COM-15, Appendix G, Table G-1); and establishing a Gear Loss and Damage Compensation program (COM-21, Appendix G, Table G-1). Collectively, the risk of damage or loss of fishing gear posed by the Proposed Action is expected to have long-term, adverse impacts, primarily on commercial fisheries.

Structures installed under the Proposed Action would pose a long-term navigational hazard and risk of allisions to commercial and for-hire recreational fishing vessels transiting through and fishing near the Lease Area. Depending on the location and width of transit corridors, commercial and for-hire recreational fishing vessels may have difficulty safely navigating within the Lease Area, as there may be less space for maneuverability and greater risk of allision or collision if there is a loss of steerage. Vessels that choose not to navigate through the WTAs and use alternative transit routes may experience increases in travel times and fuel costs. As described in Section 3.6.1.3, commercial fishing vessels, which are generally larger than for-hire recreational fishing vessels and often have large, externally deployed fishing gear, are expected to have more difficulty navigating within the Lease Area. Fishing industry representatives have stated that their operations require a minimum distance greater than 1 nautical mile (1.9 kilometers) between WTGs, in alignment with the prevailing tidal currents for safe operations (NYSERDA 2022). Fishing vessels navigating through the Lease Area could also have difficulty using navigational radar when WTGs present many radar targets that may obscure smaller vessels and where radar returns may be duplicated under certain meteorological conditions, such as heavy fog. To provide additional navigational flexibility during inclement weather, Atlantic Shores proposed that the WTGs be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart (Atlantic Shores 2024). The up to 10 OSSs that would be installed under the Proposed Action would be sited along the same east-northeast/west-southwest rows as the WTGs, but off-grid, sited within the narrower north/south corridors (see Figure 2.1-6). The met tower and the 4 temporary metocean buoys would be sited off-grid as well, not within the east-northeast/west-southwest rows or the north/south columns (see Figure 2.1-6). The presence of the OSSs, met tower, and metocean buoys at off-grid locations would increase the difficulties of navigating and fishing within the Lease Area, particularly for vessels using the north-south columns. Vessels following an east-west or northeast-southwest bearing would be able to use most of the dominant rows to safely navigate within the Lease Area. As described in Section 3.6.1.1 and summarized on Figure 3.6.1-4, VMS-enabled vessels in the Lease Area generally move along an east-west or slightly northeast-southwest bearing when fishing and a north-south or northwest-southeast bearing when transiting. However, as Figure 3.6.1-5 through Figure 3.6.1-11 demonstrate, the orientation of vessels varies by fishery. For instance, scallop vessels, which account for a high percentage of fishing activity in the Lease Area, generally follow either a north or northwest bearing when fishing that is not in alignment with the dominant row direction for WTGs or the off-grid OSSs and may therefore experience greater difficulties with navigation. Atlantic Shores would implement measures to avoid, minimize, and mitigate impacts of navigational hazards on commercial and for-hire recreational fisheries, including marking all offshore structures with marine navigation lighting in accordance with USCG and BOEM guidance (COM-08, Appendix G, Table G-1); installing sound signals on select foundations in accordance with a Marking and Lighting Plan that would be developed in consultation with USCG (COM-09, Appendix G, Table G-1); equipping each WTG and OSS with access ladders to allow distressed mariners access to an open refuge area above the splash zone (COM-11, Appendix G, Table G-1); equipping each WTG, OSS, and met tower position with AIS to indicate positions to mariners (COM-12, Appendix G, Table G-1); communicating with offshore fishermen while they are at sea (COM-17, Appendix G, Table G-1); and establishing a Navigational Safety Adaptation Fund (COM-21, Appendix G, Table G-1). Collectively, the navigational hazards and risk of allisions to fishing vessels posed by the Proposed Action are expected to have long-term, adverse impacts on commercial and for-hire recreational fisheries.

As described in Section 3.6.1.3, the presence of gear entanglement hazards and navigational hazards associated with structures in the WTAs may cause some fishermen to seek alternative fishing grounds, switch the species they target or the gear they use, or leave the fishery altogether. Each of these scenarios requires adaptive behavior and risk tolerance, traits that are not universally shared by all fishermen (O'Farrell et al 2019). Fishermen who are willing to seek alternate fishing grounds may experience increased operating costs and/or lower revenue. Fishermen who switch target species or gear types used may lose revenue from targeting a less-valuable species and increased costs from switching gear type. Switching species could also cause fishermen to land their catch in different ports

(Papaioannou et al. 2021), which could increase operational costs depending on where the port is located. Fisheries adaptation may require a long period of time and may require fishery management changes.

Fishing vessel operators who are displaced from fishing grounds within offshore wind areas and are unable to find alternative fishing locations would experience long-term revenue losses if they were unable to find alternative fishing grounds. The amount of revenue that would be at risk in the Lease Area during the construction, installation, and O&M of the Proposed Action can be approximated by historical revenue from the Lease Area from 2008 through 2022, which is summarized by species in Table 3.6.1-11 and by fishing port in Table 3.6.1-15, above. Further, revenue losses may be compounded if displacement of fishing effort causes fishing vessels to become concentrated into smaller areas, potentially leading to reduced catches at the individual level. The most revenue at risk would occur during the construction and installation of the Proposed Action, but revenue exposure would occur during the O&M phase as well. The average annual commercial fishing revenue exposure is estimated to be $779,581 across all fisheries and ports. The most affected fisheries in terms of exposed revenue per year would include the Atlantic surfclam ($502,320) and Atlantic sea scallop ($202,110) fisheries. The most affected fishing ports in terms of exposed revenue would include Atlantic City, NJ ($518,395), followed by Cape May ($79,052), Newport News, VA ($48,243), and New Bedford, MA ($41,578). Several commercial fishing vessels fish heavily in the Lease Area; the highest percentage of total annual revenue attributed to catch within the Lease Area for an individual commercial permit holder was 59 percent in 2013. Three quarters of the vessels fishing in the area derived less than 0.21 percent of their total revenue from the area in 2008 through 2022.

Changes in fishing activity resulting from the presence of offshore wind structures would likely result in impacts on shoreside support services (e.g., seafood processing, fuel, ice). Fishing communities that derive a high percentage of revenue from the Lease Area and have a high reliance on the commercial fishing industry are expected to experience the greatest impacts from reduced demand for shoreside support services. As summarized in Table 3.6.1-24, Atlantic City derived the highest percentage of its fishing revenue from the Lease Area (1.98 percent) but has a low reliance on the commercial fishing industry. Fishing communities that generate a relatively large percentage of their revenue from the Lease Area and have a high reliance on the commercial fishing industry include Barnegat and Cape May in New Jersey.

The presence of structures in the Lease Area could cause fishing vessel route detours, leading to direct and indirect impacts on fishermen, fishing ports, seafood processing facilities, and other shoreside support industries. Fishing vessels transiting between ports in different states may be particularly impacted if they decided to make vessel route detours that avoid the Lease Area. For instance, NYSERDA, New York State Department of Environmental Conservation, and RODA collected information on transit patterns of commercial fishermen from January 2019 through January 2020 and determined that vessels frequently transit between ports in New Jersey, Cape May in particular, and ports in New York State (NYSERDA 2020). A key driver of these transit patterns stems from New York ports having insufficient docking and unloading facilities, seafood processing capacity, or land-based transportation networks to efficiently get the seafood to market. This has resulted in some New York fishing vessels landing their catch in other states, like surfclam fishermen landing in New Jersey because New York does not have an appropriate processing facility. Where a fisherman chooses to land their catch also depends on market price, proximity to fishing grounds, permit requirements, and other factors. Because of these existing challenges, infringement on vessel transit lanes by offshore wind structures could make it more challenging or costly for fishermen to land their catch in New Jersey, which may have adverse effects on shoreside support industries.

Atlantic Shores would mitigate impacts of fisheries displacement by establishing a compensation and mitigation fund to compensate commercial fishermen for loss of income resulting from the Project and to compensate shoreside businesses for losses indirectly related to the Project (Table 3.6.1-37). Atlantic Shores would manage future mitigation funds through a regional fund administrator or other method of administration as directed by the State of New Jersey (COM-21, Appendix G, Table G-1). Considering the revenue risk across ports, together with the number of vessels and fishing activity that would be affected by the Atlantic Shores South Project, the impacts of fisheries displacement associated with the presence of structures on other fishing industry sectors, including seafood processors and distributors and shoreside support services, would be long term and moderate to major, depending on the fishery in question.

Revenue exposure of for-hire recreational fishing in the WTAs was summarized for the period of 2008 through 2022 in Section 3.6.1.1. During this period, more than 88 percent of the for-hire angler trips and 96 percent of for-hire vessel trips made to the combined Project 1 and Project 2 WTAs originated from ports in New Jersey (see Table 3.6.1-29). From 2008 through 2017, an annual average of approximately $19 thousand was generated from for-hire recreational fishing trips to the combined Project 1 and Project 2 WTAs, which represented approximately 0.03 percent of the revenue generated by the for-hire recreational fishery in the state of New Jersey (see Table 3.6.1-32). Several for-hire recreational fishing vessels fish heavily in the Lease Area. One quarter of recreational permit holders fishing in the area made more than 9 percent of their angler trips to the Lease Area from 2008 through 2022, and there was one permit holder that made 100 percent of its angler trips to the Lease Area in 2022.

The scour protection and cable protection would convert soft-bottom habitat to hard-bottom habitat. It is estimated that installation of these structures under the Proposed Action would provide 873 acres (353 hectares) of hard-bottom habitat. The introduction of hard-bottom habitat may result in adverse, beneficial, or mixed impacts, depending on the species and location. Habitat conversion from the Proposed Action would result in the displacement of soft-bottom species, such as squid and winter flounder, in the area immediately surrounding the structures. Further, habitat conversion would result in the loss of soft-bottom benthic features that occur throughout the Offshore Project area, including sand waves, sand ridges, and shoal formations. These features provide habitat complexity that is used by benthic and finfish communities for refuge, spawning, and foraging, and are often identified as prime fishing areas by commercial and recreational fishermen. The introduction of hard-bottom, structured habitat may also attract structure-oriented species that are targeted in recreational fisheries, such as American lobster, Atlantic cod, black sea bass, scup, and striped bass (Guida et al. 2017). Highly migratory pelagic predators that are targeted in recreational fisheries (e.g., tuna, billfish, sharks) may also be attracted to the prey that aggregate around the WTG foundations. These impacts could provide enhanced opportunities to for-hire recreational fisheries but could also cause space-use conflicts with commercial fisheries. Although local distributions of squid and finfish may respond to the presence of foundations, no stock-level effects are expected. Collectively, habitat conversion caused by the Proposed Action is expected to have localized, long-term impacts that would be adverse for commercial fisheries and beneficial to for-hire recreational fisheries.

The hard-bottom habitat created by the Proposed Action may provide forage and refuge for some migratory finfish and shellfish that are valued in fisheries, such as black sea bass, lobster, monkfish, and summer flounder. Highly migratory pelagic predators are also likely to encounter the WTG foundations and may be attracted by the prey that aggregate around the vertical structures for shelter, foraging, or other reasons. Highly migratory species may use offshore structures as navigational landmarks (Taormina et al. 2018). These behavioral effects may affect the migrations of individual fish, but they are not expected to have broad impacts on migration. Other oceanographic conditions such as temperature and salinity are expected to remain the primary determinants of seasonal migrations (Fabrizio et al. 2014; Moser and Shepherd 2009; Secor et al. 2018). Collectively, the impact on migratory patterns from structures introduced by the Proposed Action is expected to be negligible on commercial and for-hire recreational fisheries.

The previously described impacts from the presence of structures under the Proposed Action, including navigational hazards and increased risk of damage or loss of fishing gear, are likely to cause some displacement of fishing activity from traditional fishing grounds. Commercial fishing vessels have well-established and mutually recognized traditional fishing locations, and the displacement of fishing activity outside of the Project area may result in space-use conflicts among fishermen as other areas are encroached upon. BOEM expects that space-use conflicts would be higher in fisheries that target less-mobile species, such as crab, lobster, scallop, and surfclam, and in fisheries where regulations constrain where vessels can fish. Fisheries that target less-mobile species are among the most valuable in the Lease Area: from 2008 through 2022, the average annual revenue generated by the Surfclam, Ocean Quahog FMP and Sea Scallop FMP fisheries in the Lease Area was $704,430, or approximately 90 percent of the total revenue generated in the Lease Area. Because of constraints on these fisheries, economic losses caused by displacement from traditional fishing grounds would not necessarily be compensated for by revenue earned on alternative fishing grounds. Finally, as described above, fish aggregation around the vertical habitat provided by the WTGs and resulting increases in recreational fishing effort around the WTGs could contribute to space-use conflicts with the commercial fisheries within the Lease Area. Collectively, space-use conflicts that would result from the Proposed Action are expected to have long-term, adverse impacts on commercial and for-hire recreational fisheries. BOEM expects that the presence of structures associated with the Proposed Action would cause long-term, localized, moderate to major impacts on commercial fisheries and minor to moderate impacts on for-hire recreational fisheries. Impacts are expected to primarily result from reduced access to traditional fishing grounds and increased risk of fishing gear damage or loss. As described above, variation in the capacity of fishermen to adapt to change associated with offshore wind development would cause variation in the magnitude of impacts across the fishing industry.

Traffic: The Proposed Action would result in increased vessel traffic due to vessels transiting to and from the Project area during construction, O&M, and decommissioning. Construction support vessels, including vessels carrying assembled WTGs or WTG components, would be present in the waterways between the Lease Area and the ports used during construction. Atlantic Shores expects up to 51 vessels to be used during construction, though a maximum of 16 vessels are expected to operate at one time for a given construction activity. Construction vessels would make an estimated 1,745 trips to the Project area, including trips from the future New Jersey Wind Port, Paulsboro Marine Terminal, and Repauno Port and Rail Terminal in New Jersey; Portsmouth Marine Terminal in Virginia; and the Port of Corpus Christi in Texas (see Section 3.6.6, *Navigation and Vessel Traffic)*. Impacts associated with vessel traffic during the O&M phase would be lower because of lower vessel activity; Atlantic Shores generally expects 5 to 11 maintenance vessels to operate at a given time, though up to 22 vessels may be required in some repair scenarios. Maintenance vessels would make an estimated 1,861 trips to the Project area, the majority of which would originate from the O&M facility in Atlantic City, with a smaller number originating from the New Jersey Wind Port. As described in Section 3.6.1.3, increased vessel traffic could increase congestion, delays at ports, and the risk for collisions with fishing vessels. Furthermore, the presence of construction vessels would temporarily restrict fishing operations in the Lease Area and the offshore export cable corridors. Fishing vessels transiting between ports and the Project area would be able to avoid Atlantic Shores South vessels and restricted safety zones though adjustments to navigation. Atlantic Shores would implement measures to avoid interactions between Atlantic Shores South vessels and fishing vessels, including development of a website that contains real-time vessel tracking charts and vessel schedules (COM-16, Appendix G, Table G-1) and employment of a Marine Coordinator to monitor daily vessel movements, implement communication protocols with external vessels both in port and offshore to avoid conflicts, and monitor safety zones (COM-20, Appendix G, Table G-1). Any impacts on commercial and for-hire recreational fisheries from vessel traffic would be localized and temporary, occurring primarily in the Project area during the construction phase.

BOEM expects that increased vessel traffic associated with the Proposed Action would cause long-term, localized, moderate impacts on commercial and for-hire recreational fisheries.

Impacts of the Connected Action

As described in Chapter 2, *Alternatives,* improvements to the existing marine infrastructure within an approximate 20.6-acre (8.3-hectare) site at the Atlantic City, New Jersey, Inlet Marina area are planned in connection with construction of the O&M facility of the Proposed Action. The connected action includes construction of a new 541-foot (165-meter) bulkhead composed of corrugated steel sheet pile to be sited externally of the existing and deteriorating 250-foot (76-meter) bulkhead. The proposed design for new shoreline structures consisting of three floating docks, 9.0 feet (2.7 meters) wide and extending 92.7 feet (28.3 meters) from the shoreline. Each floating dock will be equipped with a 37.0-foot (11.3-meter) gangway and stabilized by two 4.0-foot (1.2-meter) diameter steel piles. This dock area will also include 16 dolphin structures each with seven 1.0-foot (0.3-meter) timber clusters. The final design and scope of proposed activities, including dimensions, areas, volumes, construction methodologies, mitigation measures, and other details are subject to change following ongoing design work and permit review and approval. Final details will be included in the respective approved permits.

Additionally, the connected action will include maintenance dredging at the site to be accomplished via hydraulic cutterhead dredge with pipeline or mechanical dredge. Atlantic Shores is proposing to implement the construction of the new bulkhead and the City of Atlantic City would complete the maintenance dredging at the site.

BOEM expects the connected action to affect commercial fisheries and for-hire recreational fishing through the following primary IPFs.

Noise: Installation of sheet piles for construction of the new bulkhead may include impact or vibratory pile driving and vessel operation, which would generate intermittent noise during the construction period. The potential impacts associated with each noise source are discussed separately in the following paragraphs.

The connected action would include installation of twenty-two 4.2-foot (1.3-meter) corrugated steel sheet piles, six 4-foot (1.2-meter) steel piles, and one hundred twelve 1-foot (0.3-meter) timber piles. The final design and scope of proposed activities for the connected action, including dimensions and construction methodologies, mitigation measures, and other details, is subject to change following ongoing design work and permit review and approval. Final details will be included in the respective approved permits. As described in Section 3.6.1.3, noise generated by pile driving can cause injury or mortality to fish over a small area around each pile and can cause temporary stress and behavioral changes over a larger area. The radius for injurious impacts from driving of 4.2-foot (1.3-meter) steel sheet piles and 4-foot (1.2-meter) steel piles would be much smaller than that of 49-foot (15-meter) monopiles. Because of the relatively small footprint of injurious sound and the ability for most fish to swim away from noise sources, injurious noise from pile driving is not expected to cause fishery-level impacts on fish stocks. Invertebrates are generally less sensitive to sound than fish, such that injurious sound is expected to occur only close to pile driving and is not expected to cause fishery-level impacts on shellfish stocks. Because there is minimal fishing activity near the marina where the connected action would be sited, displacement of fish and invertebrates associated with behavioral impacts of noise is not expected to result in measurable revenue loss for commercial or recreational fisheries.

Construction vessel activity would also generate noise during connected action activities. Vessels associated with the connected action would generate low-frequency, non-impulsive noise that could elicit behavioral or stress responses in finfish and invertebrates. However, because behavioral responses to vessel noise would be localized and temporary, ceasing once the vessel leaves the area, they are not expected to result in fishery-level impacts.

Port utilization: The connected action would aid in the conversion of a retired marine terminal to an active O&M facility that would support the offshore wind industry, thereby resulting in an increase in port utilization. The connected action would be sited in Atlantic City, which generates approximately $19 million in annual revenue from commercial fisheries (see Table 3.6.1-3) and is classified as having a high level of commercial fisheries engagement (see Table 3.6.1-24). Commercial and for-hire recreational fishing vessels traveling to and from Atlantic City may experience delays from increased vessel traffic associated with the connected action. Impacts from port utilization associated with the

Proposed Action are expected to be localized and long term, occurring during the construction and installation and O&M periods.

As described in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, dredging and dredge material management from the connected action may affected finfish and invertebrates that are targeted in commercial and for-hire recreational fisheries through organism mortality, direct disturbance and modification of bottom habitat, and sediment suspension and deposition. Demersal and pelagic fish and invertebrates would likely avoid the dredge, but benthic invertebrates and fish with benthic life stages (e.g., eggs, larvae) may be captured by the dredge, possibly resulting in mortality. The potential loss of individual fish and invertebrates from mortality associated with dredging is not expected to cause fishery-level effects for any species. Because there is minimal fishing activity near the marina where the connected action would be sited, displacement of fish and invertebrates associated with dredging is not expected to result in measurable revenue loss for commercial or recreational fisheries.

Cumulative Impacts of Alternative B – Proposed Action

The cumulative impact analysis of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, including offshore wind activities, and the connected action. Ongoing and planned activities include undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredge material disposal; military use; marine transportation; fisheries use and management; oil and gas activities; regulated fishing effort; global climate change; and planned offshore wind development. Ongoing and planned offshore wind activities in the geographic analysis area include the construction and installation, O&M, and decommissioning of 33 planned offshore wind projects. Impacts on commercial and for-hire recreational fishing from the Proposed Action and other ongoing and planned activities include anchoring, cable emplacement, noise, port utilization, presence of structures, and vessel traffic.

Anchoring: The incremental contributions of the Proposed Action to the cumulative anchoring effects of ongoing and planned activities would be appreciable, given the relatively large area that would be affected by the Proposed Action. The 714 acres (289 hectares) of seafloor disturbed by anchoring under the Proposed Action would represent 9 percent of the estimated 7,764 acres (3,142 hectares) of seafloor that would be disturbed on the OCS by existing and planned offshore wind development activities, including the Proposed Action.

Cable emplacement and maintenance: The incremental contributions of the Proposed Action to the cumulative cable emplacement impacts of ongoing and planned activities would be noticeable. The 576 acres (233 hectares) of seabed disturbance associated with the Proposed Action represents approximately 1 percent of the 64,509 acres (26,106 hectares) of seabed expected to be disturbed on the OCS from existing and planned offshore wind development activities, including the Proposed Action (Appendix D, Table D.A2-2).

Noise: The incremental contributions of construction and installation of the Proposed Action to the cumulative noise impacts associated with ongoing and planned activities would be noticeable. The loudest sources of noise are expected to be pile driving, assuming piled foundations are selected, followed by vessels. The 211 structures for the Proposed Action represent 7 percent of the 3,192 offshore wind structures that would be installed on the OCS for existing and planned offshore wind development activities, including the Proposed Action (Appendix D, Table D.A2-2).

Port utilization: The incremental contributions of the Proposed Action to the cumulative port utilization impacts associated with ongoing and planned activities would be noticeable. There are several major fishing ports in the geographic analysis area (see Table 3.6.1-3) that have been identified as potential ports to support offshore wind energy construction or operations, including Atlantic City, Hampton Roads, Montauk, and New Bedford (BOEM 2021). None of the major fishing ports in the geographic analysis area are being slated for expansion for the Proposed Action.

Presence of structures: The incremental contributions of the Proposed Action to the cumulative impacts from the presence of structures associated with ongoing and planned activities would be noticeable. The 211 structures for the Proposed Action represent 7 percent of the 3,192 offshore wind structures anticipated on the OCS for existing and planned offshore WTAs, including the Proposed Action (Appendix D, Table D.A2-2). The 863 acres (349 hectares) of scour and cable protection installed under the Proposed Action would represent approximately 10 percent of the 8,290 acres (3,355 hectares) of scour and cable protection anticipated on the OCS for planned offshore wind farms, including the Proposed Action (Appendix D, Table D.A2-2).

Traffic: The incremental contributions of the Proposed Action to the cumulative impacts of vessel traffic associated with ongoing and planned activities would be noticeable given the large volume of existing vessel traffic in the geographic analysis area.

Conclusions

Impacts of Alternative B – Proposed Action. Project construction and installation, O&M, and decommissioning could affect port and fishing access, as well as transit and harvesting activities, fishing gear interactions, and target species catch. BOEM anticipates that the adverse impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing would vary by fishery and fishing operation because of differences in target species abundance in the Project Area, gear type, and predominant location of fishing activity. Some of the fishing vessels that generate a large percentage of their total revenue in the WTAs may choose to avoid this area once the Project becomes operational. If these fishing vessels are unable to find suitable alternative fishing locations, they could experience long-term, major disruptions. However, it is expected that most fishing vessels would only have to adjust somewhat in response to impacts of the Proposed Action. Therefore, BOEM expects that the impacts resulting from the Proposed Action would range from **moderate to major** on commercial fisheries and for-hire recreational fisheries, depending on the fishery and fishing vessel. This impact rating is driven mostly by ongoing impacts from fisheries use and management and long-term impacts from the presence of structures (e.g., cable protection measures and foundations), including navigational hazards, gear loss and damage, and space use conflicts, which are expected to result in revenue loss for some commercial and recreational fishermen. Additionally, the impacts of the Proposed Action could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations because of the artificial reef effect.

BOEM expects that the connected action alone would have long-term **minor** to **moderate** impacts on commercial and recreational fishing vessels operating out of the Port of Atlantic City.

Cumulative Impacts of Alternative B – Proposed Action. The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities and other planned offshore wind activities. BOEM anticipates that the cumulative impacts of these activities would result in **major** impacts on commercial and for-hire recreational fisheries in the geographic analysis area. This impact rating is driven mostly by permanent impacts from the presence of structures associated with planned offshore wind projects. Additionally, the cumulative impacts could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations because of the artificial reef effect. The Proposed Action would contribute to the overall impact rating primarily through permanent impacts associated with the presence of structures, including navigational hazards, gear loss and damage, and space-use conflicts. The overall impacts of the Proposed Action on commercial and for-hire recreational fisheries would be **major** because the fishing industry would experience unavoidable disruptions beyond what is normally acceptable, but mitigation, including financial compensation and uniform spacing and layout across adjacent projects, could reduce impacts if adopted for planned offshore wind projects.

3.6.1.6 Impacts of Alternatives C, D, and E on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternatives C, D, and E. Alternatives C (Habitat Impact Minimization/Fisheries Habitat Impact Minimization), D (No Surface Occupancy at Select Locations to Reduce Visual Impacts), and E (Wind Turbine Layout Modification to Establish a Setback Between Atlantic Shores South and Ocean Wind 1) would include micrositing or a reduction of the number of WTGs compared to the Proposed Action. As detailed in Section 2.1.3, under Alternative C, up to 29 WTGs, 1 OSS, and the associated interarray cables would be removed to avoid and minimize impacts on sensitive habitats. As detailed in Section 2.1.4, under Alternative D, up to 31 WTGs sited closest to shore would be removed in order to reduce visual impacts. As detailed in Section 2.1.5, under Alternative E, modifications would be made to the wind turbine array layout to create a setback between WTGs in the lease areas of Atlantic Shores South (OCS-A 0499) and Ocean Wind 1 (OCS-A 0498) to reduce impacts on existing ocean uses, including commercial and recreational fishing. Alternative E would allow for a setback of 0.81 nautical mile (1,500 meters) to 1.08 nautical mile (2,000 meters) by removing or micrositing up to 4 to 5 WTG positions from the southern boundary of Project 1.

Offshore construction and installation activities associated with Alternatives C, D, and E would not differ from the Proposed Action, but the number of WTGs that are installed would potentially be reduced by as few as 4 WTGs under Alternative E to as many as 31 WTGs under Alternative D. Any reduction in the number of WTGs may also reduce the length of the interarray cables. A reduction in the number of WTGs and the length of the interarray cables would result in a reduction in impacts associated with construction and installation, including anchoring, cable emplacement, noise, and vessel traffic.

Impacts of offshore O&M activities of Alternatives C, D, and E on commercial and for-hire recreational fisheries would be slightly reduced relative to the Proposed Action. The removal of 4 to 5 WTGs from the southern boundary of Project 1 under Alternative E would allow for a setback area that would enable fishing vessels to transit between the Ocean Wind 1 and Atlantic Shores South lease areas more safely and efficiently, thereby minimizing navigational hazards and reducing transit costs incurred by fishers relative to the Proposed Action. The 2- to 15-percent reduction in the number of WTGs that would be installed under Alternatives C, D, and E would reduce the number of structures in the Lease Area, which would primarily affect commercial fisheries by reducing the navigation hazards and risk of gear loss or damage associated with transiting through or fishing in the Lease Area. However, the contiguous structure-free area that would be added to the Lease Area by the removal of WTGs under these alternatives would be small, and any additional revenue realized by the commercial fishery would be dependent on the targeted species that may be in that area and whether commercial fishermen are willing to fish that part of the Lease Area. The reduction in the number of WTGs in the Lease Area would also reduce the artificial reef effect, slightly decreasing benefits from this effect for for-hire recreational fishing but also decreasing potential vessel conflicts with commercial fishing vessels that transit or fish within the Lease Area. Alternative C1 would avoid and minimize the potential impacts on Lobster Hole, a designated recreational fishing area, by removing up to 16 WTGs, 1 OSS, and associated interarray cables (see Figure 2.1-7), thereby producing a benefit to for-hire recreational fisheries relative to the Proposed Action. Given that the presence of WTGs in the water is expected to have adverse impacts on commercial fisheries that outweigh the beneficial impacts on for-hire recreational fisheries, the reduction in WTGs under Alternatives C, D, and E is expected to result in slightly reduced overall impacts on commercial and for-hire recreational fisheries compared to the Proposed Action.

Cumulative Impacts of Alternatives C, D, and E. The contribution of Alternatives C, D, or E to the impacts of individual IPFs from ongoing and planned activities would be slightly reduced relative to the Proposed Action. The cumulative impacts on commercial and for-hire recreational fisheries of ongoing and planned activities in combination with Alternatives C, D, or E would be the same level as described under the Proposed Action.

Conclusions

Impacts of Alternatives C, D, and E. The anticipated minor to major impacts of individual IPFs associated with Alternatives C, D, and E would be slightly reduced relative to those of the Proposed Action. However, any additional revenue realized by commercial fisheries would likely be minimal, and benefits of the artificial reef effect for for-hire recreational fishing would be reduced. When considering all of the IPFs, the adverse impact would still be **moderate to major** for commercial fisheries and for-hire recreational fisheries and could include **minor beneficial** impacts on for-hire recreational fisheries.

Cumulative Impacts of Alternatives C, D, and E. BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including Alternatives C, D, or E, would result in **major** impacts on commercial and for-hire recreational fisheries and could include **minor beneficial** impacts on for-hire recreational fisheries, as described in Section 3.6.1.5. The overall impacts of Alternatives C, D, or E on commercial and for-hire recreational fisheries would be **major** because the fishing industry would experience unavoidable disruptions beyond what is normally acceptable, but mitigation, including financial compensation and uniform spacing and layout across adjacent projects, could reduce impacts if adopted for planned offshore wind projects.

3.6.1.7 Impacts of Alternative F on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternative F. As detailed in Section 2.1.6, Alternative F (Foundation Structures) allows for an evaluation of impacts associated with specific foundation types, whereas the Proposed Action evaluated a variety of foundation types. Under Alternative F1, monopile or piled jacked foundations would be used for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs (monopile or piled jacket), up to 5 medium OSSs (piled jacket), or up to 4 large OSSs (piled jacket) for Project 1 and Project 2. Under Alternative F2, mono-bucket, suction bucket jacket, or suction bucket tetrahedron base foundations would be used for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs (mono-bucket or suction bucket jacket), up to 5 medium OSSs (suction bucket jacket), or up to 4 large OSSs (suction bucket jacket), for Project 1 and Project 2. Under Alternative F3, gravity-pad tetrahedron or GBS foundations would be used for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs, up to 5 medium OSSs, or up to 4 large OSSs, with GBS for Project 1 and Project 2.

Though all potential offshore activities under Alternative F were evaluated under the Proposed Action, some sub-alternatives of Alternative F may exclude some activities evaluated under the Proposed Action. Offshore construction and installation activities would not differ between the Proposed Action and Alternative F1. However, in contrast to the Proposed Action, impact pile driving would not be conducted during offshore construction and installation of Alternative F2 (suction bucket foundations) and Alternative F3 (gravity-based foundations). The avoidance of pile-driving noise impacts would slightly reduce the overall construction and installation impacts on commercial and for-hire recreational fisheries under Alternatives F2 and F3 compared to the Proposed Action.

Though offshore O&M activities would not differ between Alternative F and the Proposed Action, some sub-alternatives may result in reduced habitat conversion compared to the Proposed Action. Alternative F2 (suction bucket foundations) would result in the greatest area of habitat conversion from scour protection and was evaluated under the Proposed Action. Alternative F1 (piled foundations) and Alternative F3 (gravity-based foundations) would result in a reduction in scour protection, compared to the Proposed Action and Alternative F2. Such reductions would reduce O&M impacts from the presence of structures on commercial and for-hire recreational fisheries. Less scour protection would result in a lower risk of gear entanglement within the Lease Area for commercial fisheries that deploy mobile, bottom-oriented gear (i.e., dredges and trawls) compared to the Proposed Action and Alternative F2. However, less scour protection would also result in a reduced artificial reef area, thereby reducing benefits to for-hire recreational fisheries compared to the Proposed Action and Alternative F2. Given that the presence of structures is expected to have adverse impacts on commercial fisheries that outweigh the beneficial impacts on for-hire recreational fisheries, the reduction in scour protection under Alternatives F1 and F3 is expected to result in slightly reduced overall impacts on commercial and for-hire recreational fisheries compared to the Proposed Action and Alternative F2.

Cumulative Impacts of Alternative F. The contribution of Alternatives F1 or F3 to the impacts of individual IPFs from ongoing and planned would be slightly reduced relative to the Proposed Action. Alternative F2 would result in the greatest area of habitat conversion from scour protection and was evaluated under the Proposed Action. The cumulative impacts on commercial and for-hire recreational fisheries of ongoing and planned activities in combination with Alternatives F1, F2, or F3 would be the same level as described under the Proposed Action.

Conclusions

Impacts of Alternative F. Impacts of Alternative F2 would not be measurably different from the Proposed Action, whereas impacts of Alternatives F1 and F3 would be slightly reduced compared to the Proposed Action because of a reduction in the amount of scour protection in the Lease Area. When considering all of the IPFs, the adverse impact of Alternatives F1, F2, and F3 would still be **moderate to major** for commercial fisheries and for-hire recreational fisheries and could include **minor beneficial** impacts on for-hire recreational fisheries.

Cumulative Impacts of Alternative F. BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including Alternatives F1, F2, and F3, would result in **major** impacts on commercial and for-hire recreational fisheries and could include **minor beneficial** impacts on for-hire recreational fisheries, as described in Section 3.6.1.5. The overall impacts of Alternative F on commercial and for-hire recreational fisheries would be **major** because the fishing industry would experience unavoidable disruptions beyond what is normally acceptable, but mitigation, including financial compensation and uniform spacing and layout across adjacent projects, could reduce impacts if adopted for planned offshore wind projects.

3.6.1.8 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-3 and G-4 and summarized and assessed in Table 3.6.1-37. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts on commercial fisheries and for-hire recreational fishing could be further reduced.

Table 3.6.1-37. Proposed mitigation measures – commercial fisheries and for-hire recreational fishing

Mitigation Measure	Description	Effect
Artificial reef buffer for turbines	The Lessee must remove a single turbine approximately 150–200 feet (46–61 meters)	This measure would reduce long-term impacts on for-hire recreational fishing operations

Mitigation Measure	Description	Effect
	from the observed Fish Haven (Atlantic City Artificial Reef Site).	that have historically relied on the Atlantic City Artificial Reef Site.
Cable Maintenance Plan	In conjunction with cable monitoring, the Lessee will develop and implement a Cable Maintenance Plan that requires prompt remedial burial of exposed and shallow-buried cable segments, review to address repeat exposures, and a process for identifying when cable burial depths reach unacceptable risk levels.	This measure would reduce the risk of interactions between fishing gear and shallow-buried cable segments.
Incident reporting	Provide written notification of incidents of property or equipment damage (e.g., gear interactions, anchor strikes, vessel allisions) that fall below the incident reporting threshold of $25,000 outlined in 30 CFR 585.831. Summaries could be provided to BOEM/BSEE and USACE during construction, operations, and decommissioning. The purpose is to increase awareness of the frequency and circumstances surrounding these incidents and assess whether any actions are needed to address them.	This measure would enable BOEM to determine whether changes to incident reporting thresholds are warranted.
Fisheries compensation/ mitigation fund	Prior to construction and determined in the COP approval, the Lessee will establish a compensation/mitigation fund (Fund) consistent with BOEM's draft[3] *Guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585* (Guidance) to compensate commercial and for-hire recreational fishermen for loss of income due to unrecovered economic activity resulting from displacement from fishing grounds due to project construction and operations and to shoreside businesses for losses indirectly related to the Project.	This measure would mitigate for economic impacts of the Proposed Action on commercial and recreational fisheries and associated shoreside support services.
Boulder Relocation Plan	The Lessee will develop and implement a boulder relocation plan to ensure potential impacts to essential fish habitat and commercial and recreational fisheries are adequately minimized. The Lessee must provide USCG, NOAA, and the local harbormaster with a comprehensive list and shapefile of positions and areas where boulders would be relocated (latitude, longitude) at least 60 days prior to boulder relocation activities.	This measure would reduce impacts to habitat of species targeted in fisheries and reduce the risk of gear damage and/or loss associated with relocated boulders.

[3] Draft Guidance shall be superseded by Final Guidance, if Final Guidance is published by the signing of the ROD for the Project.

Mitigation Measure	Description	Effect
Fisheries survey mitigation	Consistent with NMFS and BOEM survey mitigation strategy actions 1.3.1, 1.3.2, 2.1.1, and 2.1.2 in the *NOAA Fisheries and BOEM Federal Survey Mitigation Implementation Strategy - Northeast US Region* within 120 days of COP approval, the Lessee must submit to BOEM a survey mitigation agreement between NMFS and the Lessee. The survey mitigation agreement must describe how the Lessee will mitigate the Project impacts on the eleven NMFS surveys that overlap with the Project area. The Lessee must conduct activities in accordance with such agreement. If the Lessee and NMFS fail to reach a survey mitigation agreement, then the Lessee must submit a Survey Mitigation Plan to BOEM and NMFS that is consistent with the mitigation activities, actions, and procedures described below, within 1 year plus 180 days of COP approval. BOEM will review the Survey Mitigation Plan in consultation with NMFS NEFSC, and the Lessee must resolve comments to BOEM's satisfaction and must conduct activities in accordance with the plan.	This measure would mitigate for impacts of the Proposed Action on fisheries independent surveys.
Navigational safety	No permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, met tower, and WTGs would be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.	This measure would enable vessels to transit the Lease Area more safely and efficiently.
Fishing gear-friendly cable protection measures	The Lessee will use mobile fishing gear-friendly cable protection measures to better reflect pre-existing conditions along seafloor cable routes, consistent with N.J.A.C. 7:7-16.2, to the maximum extent practicable.	This measure will ensure that seafloor cable protection does not introduce new hangs for mobile fishing gear and will minimize potential impacts on benthic resources.
Cable protection locations	The Lessee will provide the maritime community with the physical locations of all cable protections installed during Project construction.	This measure will reduce the risk of adverse interactions with fishing gear or anchors.
Fish and Wildlife Coordination Act Conservation Recommendations	The Lessee must comply with the Fish and Wildlife Coordination Act Conservation Recommendations (see FWCA CR 1 through CR 4 in Table G-2), including mitigation of impacts	Implementation of Fish and Wildlife Coordination Act Conservation Recommendations would minimize known or

Mitigation Measure	Description	Effect
	on NMFS scientific surveys, avoidance of impacts on artificial reefs, and notification of locations of relocated boulders, created berms, scour protection, and cables requiring wet storage.	reasonably foreseeable adverse impacts on commercial fisheries and for-hire recreational fishing. Mitigation of impacts on NMFS scientific surveys would ensure the continuity of biological monitoring and stock assessments that are vital to developing fisheries management measures. Minimizing impacts on artificial reef sites would protect these habitats, which are known to be productive fishing grounds that are targeted by for-hire recreational fisheries. Disclosure of relocated boulders, placed structures on the sea floor, and cables requiring wet storage would inform fishing activities such that the risk of gear interaction and resulting gear damage or loss would be minimized. While adoption of these measures would decrease impacts on commercial fisheries and for-hire recreational fishing under the Proposed Action, it would not alter impact determinations for this resource.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.6.1-37 and Tables G-3 and G-4 in Appendix G are incorporated into the Preferred Alternative. These measures, if adopted, would have the effect of reducing navigational impacts, gear entanglement risks, and impacts on artificial reefs that support for-hire recreational fishing. Further, these measures would mitigate for lost commercial fishing revenue resulting from displacement of fishing activity in the Lease Area. While the impact determinations for commercial fisheries and for-hire recreational fishing described in Section 3.6.1.5 would not change, these measures would ensure the effectiveness of, and compliance with, EPMs already analyzed as part of the Proposed Action.

3.6.1.9 Comparison of Alternatives

Alternatives C, D, E, and F would have similar or slightly reduced adverse and beneficial impacts on commercial and for-hire recreational fisheries relative to the Proposed Action; however, the overall impact designations would not change under any of the alternatives. This section provides a comparison of the alternatives relative to the Proposed Action and in terms of which alternatives would provide the greatest reduction in adverse impacts on commercial and for-hire recreational fisheries.

Relative to the Proposed Action, Alternatives C, D, and E would result in the removal of WTGs from the Lease Area and are expected to provide a reduction in potential adverse impacts on commercial fisheries compared to other alternatives, including the Proposed Action. However, the removal of WTGs under these alternatives would also reduce benefits associated with enhanced recreational fishing around the WTGs. Alternative D would provide the greatest reduction in adverse impacts on commercial fisheries compared to other alternatives because it would potentially remove up to 31 WTGs, the most of any alternative, within a contiguous area, which would potentially provide a meaningful expansion of commercial fishing activity. However, Alternative D would also result in the greatest reduction in potential beneficial impacts on recreational fishing because it would remove WTGs that are closest to shore and therefore most accessible to recreational fishers. Alternative E would provide the next greatest reduction in adverse impacts on commercial fisheries compared to other alternatives because it would allow for a setback between the Atlantic Shores South and Ocean Wind 1 Lease Areas and would remove WTGs from a contiguous area within Atlantic Shores South. The setback is expected to produce a small reduction in adverse impacts because it may provide fishing vessels with an alternate route through the Lease Area, and the removal of WTGs from a contiguous area would potentially provide an expansion of area for commercial fishing. Under Alternative E, there would be a reduction in adverse impacts on commercial fisheries because it would allow the removal of up to 5 WTGs. Alternative C would also remove WTGs from a contiguous area within the Lease Area, which would potentially provide a meaningful expansion of commercial fishing activity, but over smaller areas. Therefore, Alternative C is expected to result in a smaller reduction in adverse impacts on commercial fisheries than Alternative D or E.

Sub-alternatives F1 and F3 would result in reductions in the area of scour protection compared to the Proposed Action. The reduction in scour protection would reduce the risk of gear entanglement to commercial fishing vessels that operate mobile, bottom-oriented gear within the Lease Area but would also reduce the area of artificial reef habitat that would be available to recreational fishers. These sub-alternatives are expected to result in a reduction in adverse impacts on commercial fisheries and an increase in adverse impacts on for-hire recreational fisheries compared to the Proposed Action. Sub-alternative F2 would result in the greatest area of scour protection, thereby resulting in the greatest reduction in fishable area for actively towed gears. This sub-alternative is expected to result in an increase in adverse impacts on commercial fisheries compared to the Proposed Action.

3.6.1.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of the Proposed Action and Alternatives C4, D3, and E, as well as two agency-proposed mitigation measures, as described in Section 2.1.7. Under the Preferred Alternative, 29 WTGs, 1 OSS, and their associated interarray cables would be microsited outside of the 1,000-foot (305-meter) buffer of the sand ridge and swale features within AOC 1 (Lobster Hole) and AOC 2 (NMFS-identified sand ridge complex); WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and a maximum blade tip height of 932 feet (284 meters); 2 WTGs would be removed and 1 WTG would be micrisited to establish a 0.81-nautical mile (1,500-meter) setback between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area; and no permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical miles (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. Additionally, one WTG sited approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site) would be removed. The Preferred Alternative would include up to 195 WTGs,[4] representing a decrease of 5 WTGs as compared to the Proposed Action. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

The Preferred Alternative is expected to result in a small reduction in adverse impacts on commercial fisheries and for-recreational fishing. The Preferred Alternative would microsite foundations within AOCs that have pronounced bottom features and produce habitat value, thereby reducing impacts on complex benthic habitat. AOC 1 is part of a designated recreational fishing area called “Lobster Hole”, and AOC 2 is part of a sand ridge (ridge and trough) complex that provides soft-bottom habitat structure for some species that are harvested in commercial fisheries (e.g., flounder, skates). Accordingly, micrositing foundations within AOC 1 may result in a small decrease in impacts on for-hire recreational fisheries, and micrositing foundations within AOC 2 may result in a small decrease in impacts on commercial fisheries. The Preferred Alternative would reduce the number of structures in Lease Area by at least five, thereby reducing the navigation hazards and risk of gear loss or damage associated with transiting through or fishing in the Lease Area. The Preferred Alternative would allow for a setback area that would enable fishing vessels to transit between the Ocean Wind 1 and Atlantic Shores South lease areas more safely and efficiently, thereby minimizing navigational hazards and reducing transit costs incurred by fishers. The mitigation measure related to the spacing and alignment of permanent structures in the Lease Area would ensure that there are consistent lines of orientation within the Lease Area, which will enable fishing vessels to navigate the area more safely and efficiently, thereby minimizing navigational hazards and reducing transit costs incurred by fishers. The mitigation measure to remove the WTG in proximity to the observed Fish Haven, an area that is valued by recreational fishers, would result in a decrease in impacts on for-hire recreational fishing.

Although the Preferred Alternative would reduce impacts on commercial fisheries and for-hire recreational fishing, BOEM anticipates that impacts on these resources under the Preferred Alternative would not be measurably different from those anticipated under the Proposed Action. Therefore, the adverse impacts of the Preferred Alternative are expected to range from **moderate to major** on commercial fisheries and for-hire recreational fisheries, depending on the fishery and fishing vessel.

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[4] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

Additionally, the Preferred Alternative would potentially have **minor beneficial** impacts on for-hire recreational fisheries.

BOEM anticipates that the cumulative impacts of ongoing and planned activities, including the Preferred Alternative and the connected action, would result in similar impacts as the Proposed Action: **major** adverse and **minor beneficial**.

3.6.2 Cultural Resources

This section discusses potential impacts on cultural resources from the proposed Project, alternatives, and ongoing and planned activities in the cultural resources geographic analysis area. The cultural resources geographic analysis area, as shown on 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 Part 800 (Protection of Historic Properties). See Appendix I, *Finding of Adverse Effect for the Atlantic Shores Offshore Wind South Project Construction and Operations Plan*, Section I.1.3, for a complete description of the delineated Project APE. 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 seabed potentially impacted by any bottom-disturbing activities, constituting the marine portion of the APE;
- The depth and breadth of terrestrial areas potentially impacted by any ground-disturbing activities, constituting the terrestrial portion of the APE;
- The viewshed from which renewable energy structures, whether located offshore or onshore, would be visible, constituting the visual portion of the APE; and
- Any temporary or permanent construction or staging areas, both onshore and offshore, which may fall into any of the above portions of the APE.

The phrase *cultural resource* refers to a physical resource valued by a group of people. A resource can date to the pre-Contact period (i.e., the time prior to the arrival of Europeans in North America), post-Contact period, or both. The range of common resource types includes archaeological sites, buildings, structures, objects, districts, and traditional cultural properties (TCPs) 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 NHPA, require a project to consider how it might have impacts on significant cultural resources. For a more detailed discussion of cultural resource types, see Section 3.6.2.1, *Description of the Affected Environment and Future Baseline Conditions*.

The phrase *historic property*, as defined in the NHPA (54 U.S.C. 300308), refers to any "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places [NRHP], including artifacts, records, and material remains related to such a property or resource." The term *historic property* also includes National Historic Landmarks (NHLs), as well as properties of traditional religious and cultural importance to Tribal Nations that meet NRHP criteria.

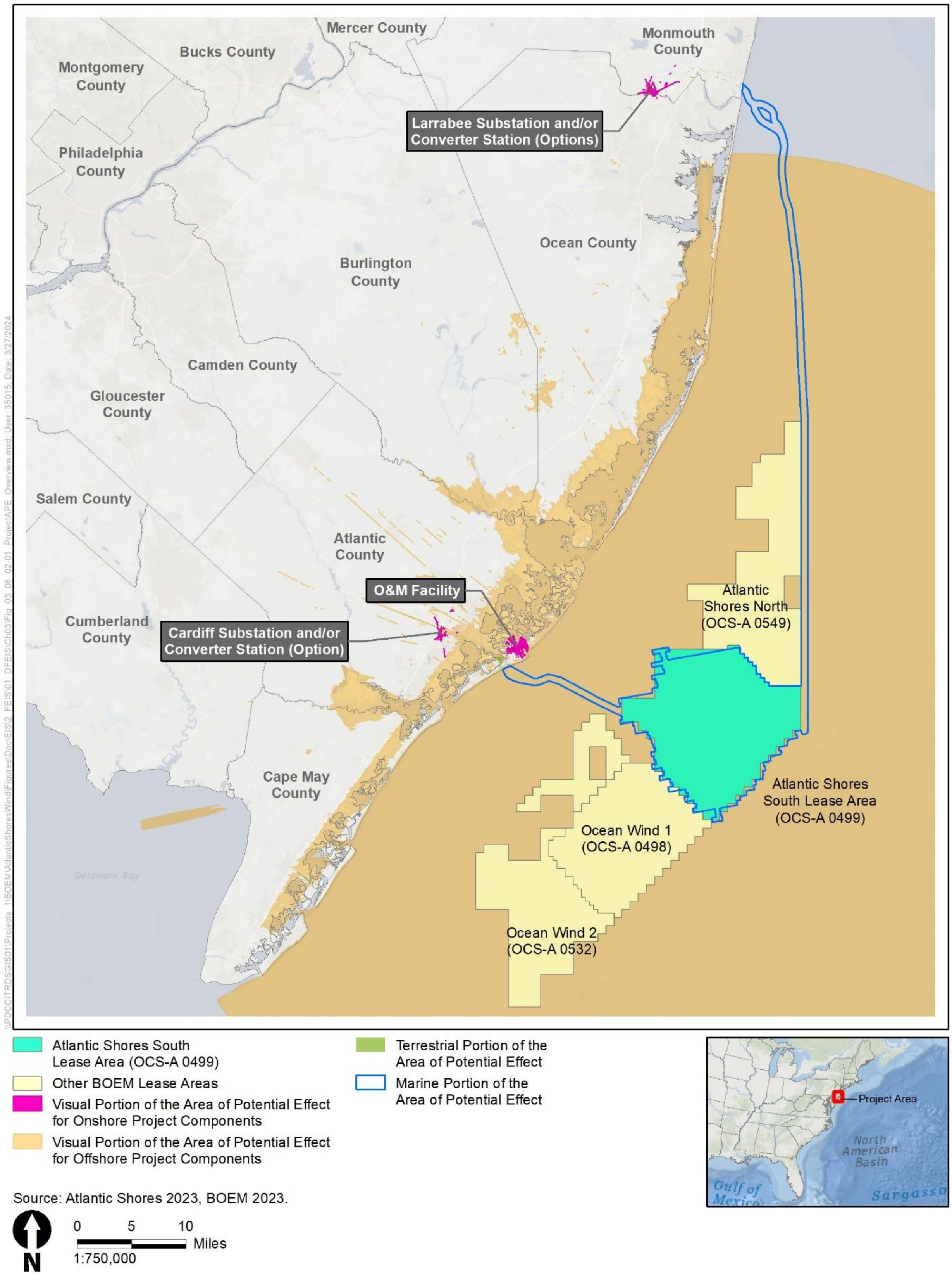

Figure 3.6.2-1. Cultural resources geographic analysis area

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, Section 6.0; Atlantic Shores 2024), supplemental COP cultural resources studies (COP Volume II, Appendices II-N, II-O, II-P, and II-Q; Atlantic Shores 2024), and Appendix I. Specifically, this includes marine and terrestrial areas potentially affected by the proposed Project's seabed- or ground-disturbing activities, areas where structures from the Proposed Action would be visible, and the area of intervisibility where structures from the Proposed Action and other offshore wind projects would be visible simultaneously.

Atlantic Shores has conducted onshore and offshore cultural resource investigations to identify known and previously undiscovered cultural resources in the marine, terrestrial, and visual portions of the APE. Information from additional investigations completed since the publication of the Draft EIS is considered in the analyses below. Table 3.6.2-1 presents a summary of the pre-Contact and post-Contact cultural context of the Project area in New Jersey based on the Project's Marine Archaeological Resources Assessment (MARA; COP Volume II, Appendix II-Q1; Atlantic Shores 2024) and Terrestrial Archaeological Resources Assessment (TARA; COP Volume II, Appendix II-P; Atlantic Shores 2024).

Table 3.6.2-1. Summary of cultural context of coastal New Jersey and the Project area

Period	Date	Description
Paleoindian	13,000–10,000 BP	Environment composed of spruce, boreal forest and low sea level causing coastline to be miles out to sea from its current location. Pleistocene megafauna present along coast. Mobile hunting and gathering. Use of fluted points. Coastline sites from this period now inundated in Atlantic Ocean.
Archaic	10,000–3,500 BP	Period subdivided into Early (10,000–8,000 BP), Middle (8,000–6,000 BP), and Late (6,000–3,500 BP) phases. Gradual establishment of modern environmental conditions. Warmer and wetter conditions relative to previous period. Sea level begins to rise. Introduction of a broad range of food. Decreasing hunting and gathering mobility. Diversifying stone toolkit over period. Increasing amounts of seasonal exploitation of resources, marine resources. Increasing population densities, and small seasonal settlements.
Archaic-Woodland Transitional	4,000–3,000 BP	Cooling trend. Mixed deciduous forests persist. Somewhat high residential mobility, likely on seasonal basis. Small-scale exploitation of marine resources. Orient Culture influences. Small shell middens. Use of cemeteries. Use of steatite vessels.
Woodland	3,000–400 BP	Period subdivided into Early (3,000–2,300 BP), Middle (2,300–1,000 BP), and Late (1,000–400 BP) phases. Cooler temperatures in Early Woodland, then warming and drying trend begins in Middle Woodland. Mixed deciduous forests persist. Terrestrial foraging and intensive exploitation of marine resources. Use of ceramics. Increasing sedentism with use of agriculture. Increasing projectile point varieties.
Post-Contact	17th Century AD	Cooler, wetter conditions. Native Americans settle in sedentary villages supported by agriculture and seasonal camps targeting large and small game, plants, riverine, and marine resources. Native Americans have similar technologies to Late Woodland but increasingly use European trade goods. Interactions occur among Native Americans and European colonists. Dutch, Finnish, Swedish colonies established. Colonial New Jersey organized into two

Period	Date	Description
		provinces: East Jersey and West Jersey. The English formed Monmouth County in 1683 in the East Jersey province.
Post-Contact	18th Century AD	New Jersey provinces combined into single province in 1702. During the American War for Independence, several engagements between British and Continental forces took place in New Jersey. City of Princeton served as seat of the U.S. government for brief period in 1783. New Jersey statehood granted in 1787.
Post-Contact	19th Century AD	Iron production an important aspect of economy in present-day Howell and Wall Townships. Growth of public roadways connecting farms and communities. The Raritan and Delaware Bay Railroad Company (later the New Jersey Southern Railroad) completed its north-south line from Port Monmouth on Raritan Bay to Lakewood by 1860, passing through Howell Township. Manasquan formed as distinct borough from Wall Township in 1887.
Post-Contact	20th Century AD	Wall and Howell Townships remained largely agricultural. Rail connections with larger urban areas and later improved roadways for automobiles led to growth of seaside communities in Monmouth County. Sea Girt formed as distinct borough in 1917.

Source: COP Volume II, Appendices II-Q1 and II-P; Atlantic Shores 2024.
AD = Anno Domini; BP = before present.

For the purposes of this analysis, cultural resources are divided into several types and subtypes: marine cultural resources (i.e., marine archaeological resources and ancient submerged landform features [ASLFs]), terrestrial archaeological resources, and historic aboveground resources. These broad categories may include archaeological or historic aboveground resources with cultural or religious significance to Native American tribes.

Archaeological resources are the physical remnants of past human activity that occurred at least 50 years ago. These remnants can include items left behind by past peoples (i.e., artifacts) and physical modifications to the landscape (i.e., features). This analysis divides archaeological resources into those that are submerged underwater (i.e., marine) and those that are not (i.e., terrestrial). ASLFs are landforms that have the potential to contain Native American archaeological resources inundated and buried as sea levels rose at the end of the last Ice Age; additionally, Native American tribes in the region may consider ASLFs to be TCPs or tribal resources representing places where their ancestors lived. *Historic aboveground resources* include standing buildings, bridges, dams, and other structures of historic or aesthetic significance. *TCPs* are places, landscape features, or locations associated with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community; they may have either or both archaeological and aboveground elements. *Historic districts* may be composed of a collection of any of the resources described above. The discussion of cultural resources in this section is divided by the marine, terrestrial, and visual portions of the APE and may be further discussed in relation to Onshore and Offshore Project components.

As a subcategory of marine cultural resources, marine archaeological resources in the region include pre-Contact and post-Contact archaeological resources that are submerged underwater. Based on known historic and recent maritime activity in the region, the marine portion of the APE (hereafter referred to as the *marine APE*) has a high probability for containing shipwrecks, downed aircraft, and related debris fields (BOEM 2012; COP Volume II, Appendix II-Q; Atlantic Shores 2024). Marine geophysical archaeological surveys performed for the Proposed Action identified 22 potential marine archaeological resources in the marine APE: nine within the WTA (i.e., six in the Project 1 area, two in the Project 2 area, and one in the Overlap Area); four within the Atlantic offshore ECC; and nine within the offshore Monmouth ECC (COP Volume II, Appendix II-Q; Atlantic Shores 2024). These resources include both known and potential shipwrecks and related debris fields from the post-Contact and recent (i.e., less than 50 years ago) eras. Because ages of these resources cannot be confirmed through the marine cultural investigations, these resources are all assumed to be archaeological and historic properties potentially eligible for listing in the NRHP.

Marine cultural resources also include ASLFs on the OCS (BOEM 2012). Marine geophysical archaeological surveys performed for the Proposed Action identified 59 ASLFs in the marine APE (COP Volume II, Appendix II-Q; Atlantic Shores 2024). The extent of marine cultural investigations performed for the Proposed Action does not enable conclusive determinations of eligibility for listing identified ASLFs in the NRHP; as such, all ASLFs are assumed eligible for listing in the NRHP and are therefore historic properties.

Cultural resources investigations performed for the Proposed Action in the terrestrial portion of the APE (hereafter referred to as the *terrestrial APE*) have identified one previously recorded terrestrial archaeological resource that may be eligible for listing in the NRHP and one historic aboveground resource eligible for listing in the NRHP (the West Jersey and Atlantic Railroad Historic District) (COP Volume II, Appendix II-P1; Atlantic Shores 2024). The terrestrial APE intersects the mapped West Jersey and Atlantic Railroad Historic District boundary; however, additional terrestrial archaeological investigations conducted in this intersecting area did not identify any intact archaeological elements contributing to the historic property's eligibility for listing in the NRHP that would be subject to impacts from the Proposed Action.

In consultation with BOEM and the New Jersey Historic Preservation Office (NJHPO; the New Jersey State Historic Preservation Office [SHPO]), Atlantic Shores will be using a process of phased identification and evaluation of historic properties as defined in 36 CFR 800.4(b)(2) for completing surveys in the remaining unsurveyed areas of the terrestrial APE (see Appendix I, Section I.5, *Phased Identification and Evaluation*, for additional information). Completion of the remaining archaeological surveys during the phased process may lead to the identification of archaeological resources in the terrestrial APE. BOEM will use the MOA to establish commitments for reviewing the sufficiency of any supplemental terrestrial archaeological investigations as phased identification; assessing effects on historic properties; consulting on the identification of historic properties and assessment of effects with federally recognized Tribes, NJHPO, and consulting parties; and resolving adverse effects, if any, by implementing avoidance, minimization, and mitigation measures in these areas prior to construction. See Appendix I, Section I.5, *Phased Identification and Evaluation*, for additional details on the phased process and Appendix I, Attachment A, for the draft of the MOA as of April 10, 2024.

The visual portion of the APE (hereafter referred to as the *visual APE*) includes sub-portions for Offshore Project components, Onshore Project components, and the O&M facility. A total of 112 aboveground historic properties were identified in the visual APE overall. Cultural resources review of the visual APE for Offshore Project components identified a total of 102 aboveground historic properties: 2 NHLs, 19 NRHP-listed historic districts and individual historic properties, 66 individual historic properties and historic districts determined eligible for the NRHP, and 15 individual properties and historic districts recommended as eligible for the NRHP as a result of field surveys (COP Volume II, Appendix II-O; Atlantic Shores 2024). A review of the visual APE for Onshore Project components identified 3 NRHP-eligible historic districts within the visual APE for the proposed onshore substations and/or converter stations in Cardiff and Larrabee (COP Volume II, Appendix II-N1; Atlantic Shores 2024). Lastly, 7 NRHP-eligible aboveground historic properties were identified within the portion of the visual APE for the proposed O&M facility in Atlantic City (COP Volume II, Appendix II-N2; Atlantic Shores 2024).

3.6.2.2 Impact Level Definitions for Cultural Resources

This Final EIS uses a four-level classification scheme to characterize potential impacts on cultural resources (including historic properties under Section 106) resulting from Project alternatives, including the Proposed Action, as shown in Table 3.6.2-2.

Table 3.6.2-2. Definitions of potential adverse impact levels for cultural resources by type

Impact Level	Historic Properties under Section 106 of the NHPA	Archaeological Resources and ASLFs	Historic Aboveground Resources and TCPs
Negligible	No historic properties affected, as defined at 36 CFR 800.4(d)(1).	A. No cultural resources subject to potential impacts from ground- or seabed-disturbing activities; or B. All disturbances to cultural resources are fully avoided, resulting in no damage to or loss of scientific or cultural value from the resources.	A. No measurable impacts; or B. No physical impacts and no change to the integrity of resources or visual disruptions to the historic or aesthetic settings from which resources derive their significance; or C. All physical impacts and disruptions are fully avoided.
Minor	No adverse effects on historic properties could occur, as defined at 36 CFR 800.5(b). This can include avoidance measures.	A. Some damage to cultural resources from ground- or seabed-disturbing activities, but there is no loss of scientific or cultural value from the resources; or B. Disturbances to cultural resources are avoided or limited to areas lacking scientific or cultural value.	A. No physical impacts (i.e., alteration or demolition of resources) and some limited visual disruptions to the historic or aesthetic settings from which resources derive their significance; or B. Disruptions to historic or aesthetic settings are short term and expected to return to an original or comparable condition (e.g., temporary vegetation clearing and construction vessel lighting).

Impact Level	Historic Properties under Section 106 of the NHPA	Archaeological Resources and ASLFs	Historic Aboveground Resources and TCPs
Moderate	Adverse effects on historic properties as defined at 36 CFR 800.5(a)(1) could occur. Characteristics of historic properties would be altered in a way that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association, but the adversely affected property would remain eligible for the NRHP.	As compared Minor Impacts: A. Greater extent of damage to cultural resources from ground- or seabed-disturbing activities, including some loss of scientific or cultural data; or B. Disturbances to cultural resources are minimized or mitigated to a lesser extent, resulting in some damage to and loss of scientific or cultural value from the resources.	As compared to Minor Impacts: A. No or limited physical impacts and greater extent of changes to the integrity of cultural resources or visual disruptions to the historic or aesthetic settings from which resources derive their significance; or B. Disruptions to settings are minimized or mitigated; or C. Historic or aesthetic settings may experience some long-term or permanent impacts.
Major	Adverse effects on historic properties as defined at 36 CFR 800.5(a)(1) could occur. Characteristics of historic properties would be affected in a way that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association to the extent that the property is no longer eligible for listing in the NRHP.	As compared to Moderate Impacts: A. Destruction of or greater extent of damage to cultural resources from ground- or seabed-disturbing activities; or B. Disturbances are minimized or mitigated but do not reduce or avoid the destruction or loss of scientific or cultural value from the cultural resources; or C. Disturbances are not minimized or mitigated resulting in the destruction or loss of scientific or cultural value from the resources.	As compared to Moderate Impacts: A. Physical impacts on cultural resources (for example, demolition of a cultural resource onshore); or B. Greater extent of changes to the integrity of cultural resources or visual disruptions to the historic or aesthetic settings from which resources derive their significance, including long-term and/or permanent impacts; or C. Disruptions to settings are not minimized or mitigated.

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 activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for cultural resources. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Ongoing and Planned Activities Scenario.*

Impacts of Alternative A – No Action

Under the No Action Alternative, baseline conditions for cultural resources described in Section 3.6.2.1, *Description of the Affected Environment and Future Baseline Conditions*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing activities within the geographic analysis area that contribute to impacts on cultural resources in onshore areas include ground-disturbing activities and the introduction of intrusive visual elements, while the primary sources of impacts on cultural resources in offshore areas include seabed-disturbing activities. Onshore and offshore construction activities and associated impacts are expected to continue at current trends, range in severity from minor to major, and have the potential to result in impacts on cultural resources. See Appendix D, Table D.A1-7 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for cultural resources.

There is one ongoing offshore wind activity within the geographic analysis area for cultural resources: Ocean Wind 1 in Lease Area OCS-A 0498.

Ongoing sea level rise, ocean acidification, increased storm severity/frequency, and increased sedimentation and erosion associated with climate change have the potential to result in long-term, permanent impacts on cultural resources. Sea level rise could lead to the inundation of terrestrial archaeological and historic aboveground resources. Increased storm severity and frequency would likely increase the severity and frequency of damage to coastal historic aboveground resources. Increased erosion along coastlines could lead to the complete destruction of coastal archaeological resources and the collapse of historic structures as erosion undermines their foundations. Ocean acidification could accelerate the rate of decomposition and corrosion of marine archaeological resources, such as shipwrecks and downed aircraft, on the seafloor.

Cumulative Impacts of Alternative A – No Action

The cumulative impact analysis for the No Action Alternative considered the impacts of the No Action Alternative, inclusive of ongoing activities, in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action). Planned non-offshore wind activities that may have impacts on cultural resources include new submarine cables and pipelines, oil and gas activities, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section D.2 in Appendix D for a description of planned activities). These activities may result in short-term, long-term, and permanent onshore and offshore impacts on cultural resources.

The following sections summarize the potential impacts of planned offshore wind activities on cultural resources during construction and installation, O&M, and decommissioning of the projects, excluding the Proposed Action. Planned offshore wind projects in the geographic analysis area that would contribute to impacts on cultural resources include Lease Areas OCS-A 0549 (Atlantic Shores North), OCS-A 0482 (Garden State Offshore Energy [GSOE] I), OCS-A 0532 (Ocean Wind 2), OCS-A 0519 (Skipjack Offshore Energy), OCS-A 0539 (Community Offshore Wind), OCS-A 0541 (Atlantic Shores Offshore Wind Bight), and OCS-A 0542 (Invenergy Wind Offshore), and ongoing offshore wind projects in the geographic analysis area include OCS-A 0498 (Ocean Wind 1). BOEM expects planned offshore wind activities to have impacts on cultural resources through the following primary IPFs.

Accidental releases: Accidental release of fuel, fluids, hazardous materials, 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 or substations offshore New Jersey. The potential for accidental releases, volume of released material, and associated need for cleanup activities from offshore wind projects aside from the Proposed Action in the geographic analysis area 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 impacts.

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 on marine and coastal cultural resources. 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 aboveground resources such as historic buildings, structures, objects, districts, significant landscapes, and TCPs; and damage to or removal of nearshore marine cultural resources during contaminated soil/sediment removal. In addition, the accidentally released materials in deep-water settings could settle on marine cultural resources. In the case of marine archaeological resources, such as shipwrecks, downed aircraft, and debris fields, this may accelerate their decomposition or cover them and make them inaccessible or unrecognizable to researchers, resulting in a significant loss of historic 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 has the potential to cause permanent, adverse impacts on marine cultural resources. These activities would increase during the construction and installation, O&M, and eventual decommissioning of planned 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 potentially disturb marine archaeological resources and ASLFs on or just below the seafloor surface. The damage or destruction of marine cultural resources from these activities would result in the permanent and irreversible loss of scientific or cultural value and would be considered major impacts.

The scale of impacts on cultural resources would depend on the number of marine archaeological resources and ASLFs in offshore wind lease areas and offshore export cable corridors. Impacts on marine archaeological resources can typically be avoided through project design. The number, extent, and dispersed character of the ASLFs make avoidance difficult, while the depth of these resources makes mitigative measures difficult and expensive. It is unlikely that offshore wind projects would be able to avoid all of these resources. 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 would be localized and permanent, and range from negligible to major on a case-by-case basis, depending on the ability of offshore wind projects to avoid, minimize, or mitigate impacts. More substantial impacts could occur if the final project designs cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Cable emplacement and maintenance: Construction and installation of offshore wind infrastructure would have permanent, geographically extensive, adverse impacts on cultural resources. Planned offshore wind projects would result in seabed disturbance from construction and installation of structure foundations and interarray and offshore export cables. The ongoing Ocean Wind 1 (OCS-A 0498) Project has a publicly available COP; however, other planned offshore wind activities in the geographic analysis area do not yet have publicly available COPs. This includes Atlantic Shores North (OCS-A 0549), Atlantic Shores Offshore Wind Bight (OCS-A 0541), Community Offshore Wind Holdings (OCS-A 0539), GSOE I (OCS-A 0482), Invenergy Wind Offshore (OCS-A 0542), Ocean Wind 2 (OCS-A 0532), and Skipjack Offshore Energy (OCS-A 0519). As such, the extent of cable route emplacement and maintenance in the geographic analysis area is largely unknown. There is the potential that these planned projects may propose cable routes that intersect the geographic analysis area. The 2012 BOEM study and the Proposed Action studies (BOEM 2012; COP Volume II, Appendix II-Q; Atlantic Shores 2024) suggest that the offshore wind lease areas and offshore export cable corridors of the offshore wind projects would likely contain a number of marine archaeological resources and ASLFs, which could be subject to impacts from offshore construction activities.

As part of compliance with the NHPA, BOEM and SHPOs will require planned offshore wind project developers to conduct extensive geophysical surveys of offshore wind lease areas and export cable corridors to identify marine cultural resources and avoid, minimize, or mitigate these resources when identified. Due to these federal and state requirements, the adverse impacts of offshore construction on marine cultural resources would be infrequent and isolated and in cases where conditions are imposed to avoid marine cultural resources, impacts would be negligible. However, if marine cultural resources 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 negligible to major.

If present in a project area, the number, extent, and dispersed character of ASLFs make avoidance impossible in many situations and make extensive archaeological investigations of formerly subaerial portions of the 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 ASLFs that 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 their permanent, irreversible nature.

Gear utilization: Construction and installation, O&M, and decommissioning of offshore wind activities may necessitate additional monitoring or geophysical surveys, from which gear utilization could cause entanglements with marine archaeological resources, resulting in adverse impacts. Other offshore wind activities in the geographic analysis area (i.e., Atlantic Shores North, GSOE I, Ocean Wind 1, Ocean Wind 2, and Skipjack) have the potential to conduct these additional surveys. The 2012 BOEM study and the Proposed Action studies (BOEM 2012; COP Volume II, Appendix II-Q; Atlantic Shores 2024) suggest that the offshore wind lease areas and offshore export cable corridors of the offshore wind projects would likely contain a number of marine archaeological resources that could be subject to impacts from gear utilization.

As part of compliance with the NHPA, BOEM and SHPOs will require planned offshore wind project developers to conduct extensive geophysical surveys of offshore wind lease areas and export cable corridors to identify marine cultural resources and avoid, minimize, or mitigate these resources when identified. Due to these federal and state requirements, the adverse impacts of offshore construction on marine cultural resources would be infrequent and isolated. However, the magnitude of these impacts would remain moderate to major in the case of an entanglement, due to the permanent, irreversible nature of the impacts, unless these marine cultural resources can be avoided.

Land disturbance: The construction and installation of onshore components associated with offshore wind projects, such as electrical export cables and onshore substations and/or converter stations, could result in physical adverse impacts on known and undiscovered cultural resources. Ground-disturbing construction activities, including vegetation removal, excavation, grading, and placement of fill material, could disturb or destroy undiscovered archaeological resources and TCPs, if present. The number of cultural resources subject to impacts, 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 subject to impacts. State and federal requirements to identify cultural resources, assess project impacts, and develop measures 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 planned 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 operation. Up to 809 WTGs, excluding those from the Proposed Action, with a maximum blade tip height of 1,049 feet (320 meters) AMSL would be added within the geographic analysis area for cumulative visual effects on historic properties (Appendix D, Tables DA.2-1 and DA.2-2).

Offshore wind projects could require nighttime construction lighting and would require nighttime hazard lighting during operations. Construction and decommissioning lighting would be most noticeable if construction activities occur at night. Up to eight ongoing and planned offshore wind projects (Ocean Wind 1 and 2, Atlantic Shores North, GSOE I, Skipjack, Community Offshore Wind, Atlantic Shores Offshore Wind Bight, and Invenergy Wind Offshore) could contribute to cumulative visual effects on historic properties. These could be constructed from 2023 through 2030 (with some of the projects potentially under construction simultaneously; see Appendix D, Table DA.2-1). 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 WTGs or OSSs 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. 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 historic aboveground resources on the coast of New Jersey for which a dark nighttime sky is a character-defining feature that contributes to historic significance and integrity. The intensity of lighting impacts would be limited by the distance between resources and the nearest lighting sources, as the majority of the proposed WTGs would be over 15 miles (24.1 kilometers) from the nearest shoreline (see Section 3.6.8, *Recreation and Tourism)*. 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 short-term, 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 an 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 (for a detailed explanation, see Section 3.6.9, *Scenic and Visual Resources*). For the Proposed Action, the reduced time of FAA hazard lighting resulting from an ADLS, if implemented, would reduce the duration of the potential impacts of nighttime aviation lighting by 99 percent from the normal operating time that would occur without using ADLS (COP, Appendix II-M4; Atlantic Shores 2024). The use of ADLS on offshore wind projects other than the Proposed Action would likely 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 range from minor to major.

Onshore structure lighting would be required for offshore wind projects and could impact cultural resources. The magnitude of impact would depend on the height of the buildings or towers and the intensity of the lighting fixtures. The impacts on cultural resources from these lights would be minimized by the distance between the facilities and cultural resources, and the presence of vegetation, buildings, or other visual buffers that may diffuse or obscure the light. Therefore, the lighting associated with onshore components from offshore wind activities could have long-term, continuous, negligible to minor impacts on cultural resources.

Noise: The development of offshore wind projects would introduce noise from onshore and offshore construction and installation, O&M, and decommissioning. Airborne noise could result in a change to the integrity of the historic setting of historic aboveground resources by introducing modern sounds into historic contexts both onshore and offshore. Historic properties set in urban contexts may not be affected by an increase in airborne noise, while in other contexts such noise may lead to the disruption of the historic setting by which a historic aboveground resource derives its significance. Onshore noise may be generated from substation and converter station construction, underground installation of onshore interconnection cables, HDD, and electrical and mechanical components of the substations or converter stations or POI sites, such as electric generators and transformers. These noise impacts may be reduced by designing onshore substations and converter sites to comply with applicable state residential or commercial sound level limits, mitigation elements (e.g., certified enclosures, natural barriers, and landscaping around the onshore component sites), and adherence to municipal noise ordinances and seasonal construction restrictions. Offshore noise associated with these activities, such as vessel noise or the construction and O&M of WTGs and OSSs, is either expected to be temporary or not audible from the nearest shorelines. Overall, noise from offshore wind activities would have localized, short-term, negligible to minor impacts on cultural resources.

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 have impacts on cultural resources within or near port facilities. Channel deepening by dredging that may be required to accommodate larger vessels necessary to carry WTG and OSS components and increased vessel traffic and economic activity associated with offshore wind projects could have impacts on 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 negligible to major.

Presence of structures: 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 New Jersey. Excluding the Proposed Action, up to 809 WTGs and additional OSSs and met towers would be added within the geographic analysis area for cumulative visual effects on historic properties, assuming WTGs with a maximum blade tip height of 1,049 feet (320 meters) AMSL (Appendix D, Tables D-3, DA.2-1 and DA.2-2).

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 aboveground resources (e.g., buildings, structures, objects, districts, 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 historic aboveground resources for which a maritime view, free of modern visual elements, is an integral part of their historic integrity and contributes to their significance and eligibility for listing in the NRHP. Due to the distance between the reasonably foreseeable wind development projects and the nearest historic aboveground resources, in most instances exceeding 15 miles (24.1 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 (for a detailed explanation, see 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, negligible to major impacts on cultural resources.

Additionally, the presence of onshore components associated with offshore wind projects, including substations, converter or switching stations, transmission lines, O&M facilities, and other components, would introduce new, modern, and intrusive visual elements to the viewsheds of cultural resources located within sight of these components in New Jersey. The magnitude of impacts from the presence of structures would be greatest for historic aboveground resources for which a setting free of modern visual elements is an integral part of their historic integrity and contributes to their eligibility for listing in the NRHP. Factors such as distance and visual buffers, including vegetation and buildings, would also affect the intensity of these impacts. While these factors would limit the intensity of impacts, the presence of onshore components associated with offshore wind activities would have long-term, continuous, negligible to major impacts on cultural resources.

Traffic: The development of offshore wind projects could introduce new onshore and offshore traffic along the coast of New Jersey during construction and installation, O&M, and decommissioning. An increase in traffic associated with these projects could result in a change to the integrity of the historic setting of historic aboveground resources by creating an increase in the flow of aircraft, marine vessels, or land-based vehicles that could disrupt onshore or offshore historic contexts of these cultural resources. However, given the existing degree of vehicle traffic in the geographic analysis area and relative existing frequency of seagoing vessels on the horizon along the New Jersey coast, it is unlikely that traffic related to the offshore wind activities would result in any measurable impacts on cultural resources. As a result, impacts from traffic from offshore wind activities would have localized, short-term, negligible to minor impacts on cultural resources.

Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, cultural resources would continue to be subject to impacts from existing environmental trends and ongoing activities in the geographic analysis area. Ongoing activities are expected to have continued short-term, long-term, and permanent impacts (e.g., via disturbance, damage, disruption, destruction) on cultural resources. These impacts would be primarily driven by offshore construction impacts and the presence of structures and, to a lesser extent, onshore construction impacts. The primary sources of onshore impacts from ongoing activities include ground-disturbing activities and the introduction of intrusive visual elements, while the primary source of offshore impacts includes activities that disturb the seafloor. Given the extent of known cultural resources in the region and extent of planned development on the OCS, ongoing offshore wind activities would noticeably contribute to impacts on cultural resources. While long-term and permanent impacts may occur as a result of offshore wind development, impacts would be reduced through the NHPA Section 106 consultation process to resolve adverse effects on historic properties. The No Action Alternative would result in **moderate adverse** impacts on cultural resources.

Cumulative Impacts of Alternative A – No Action. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and cultural resources would continue to be subject to impacts from natural and human-caused IPFs. BOEM anticipates that the cumulative impacts of the No Action Alternative would likely be **major** because the IPFs of anchoring, cable emplacement and maintenance, gear utilization, land disturbance, and presence of structures of planned activities would result in long-term or permanent disturbance, damage, disruption, and destruction of cultural resources and historic properties located onshore and offshore.

3.6.2.4 Relevant Design Parameters and Potential Variances in Impacts

This Final EIS analyzes the maximum-case scenario; any potential variances in the proposed 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 cultural resources:

- Physical impacts on marine cultural resources (i.e., archaeological resources and ASLFs), depending on the location of offshore bottom-disturbing activities, including the locations where Atlantic Shores would embed the WTGs and OSSs into the seafloor in the Lease Area, and the location of the cables in the offshore ECCs;
- Physical impacts on terrestrial cultural resources (i.e., archaeological resources and historic aboveground resources), depending on the location of onshore ground-disturbing activities; and
- Visual impacts on cultural resources (e.g., historic aboveground resources), depending on the design, height, number, and distance of WTGs, OSSs, and Onshore Project components (e.g., onshore cables, substations, converter stations) visible from these resources.

Variability of the proposed Project design exists as outlined in Appendix C. The following summarizes the potential variances in impacts:

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

- Size of scour protection around foundations: If marine cultural resources cannot be avoided, a smaller size of scour protection around foundations can minimize disturbance or destruction of marine cultural resources.

- Offshore cable (interarray, substation interconnector) burial location, length, depth of burial, and burial method: If marine cultural resources cannot be avoided entirely, specific location, length, and depth of burial could minimize disturbance or destruction of marine cultural resources.

- Landfall for offshore export cable installation method: Selection of trenchless installation over open-cut installation could have decreased potential for unanticipated disturbance of terrestrial archaeological resources.

- Onshore export cable corridor width and burial depth: Reduced width and burial depth to reduce overall volume of excavation in the export cable construction corridors could decrease potential for unanticipated disturbance of terrestrial archaeological resources. Additionally, the installation of aboveground onshore export cables and associated towers would have lesser adverse impacts on terrestrial archaeology than the installation of underground onshore export cables.

Atlantic Shores has committed to several EPMs to avoid, minimize, or mitigate impacts on cultural resources (CUL-01 through CUL-19, Appendix G, Table G-1). Additionally, the NHPA Section 106 consultation process will culminate in an MOA detailing avoidance, minimization, mitigation, and monitoring measures to avoid and resolve adverse effects on historic properties, including cumulative visual adverse effects to which the Project would be additive. See Section 3.6.2.10, *Proposed Mitigation Measures*, for additional information and Appendix I, Attachment A.

3.6.2.5 Impacts of Alternative B – Proposed Action on Cultural Resources

Under the Proposed Action, Atlantic Shores would install up to 200 WTGs, 10 OSSs and 1 permanent met tower, and related onshore and offshore facilities, which would have negligible to minor impacts on most cultural resources but would potentially have moderate to major impacts on presently undiscovered but potential marine archaeological resources, ASLFs, known and presently undiscovered but potential terrestrial archaeological resources, and historic aboveground resources.

Specifically, the Proposed Action may have negligible impacts on 22 marine archaeological resources, negligible to major physical impacts on 59 ASLFs, negligible to minor physical impacts on 1 terrestrial archaeological resource, and negligible to minor physical impacts on 1 historic aboveground resource (i.e., West Jersey and Atlantic Railroad Historic District) (COP Volume II, Appendices II-P1, and II-Q; Atlantic Shores 2024). The proposed Project may also have minor to moderate visual impacts on up to 29 aboveground historic properties—including 2 NHLs (i.e., Atlantic City Convention Hall [Jim Whelan Boardwalk Hall] and Lucy, The Margate Elephant)—of the 102 total historic aboveground resources identified in the visual APE for Offshore Project components (COP Volume II, Appendix II-O; Atlantic Shores 2024). Negligible impacts are anticipated on the 3 aboveground historic properties in the visual APE for Onshore Project components and 7 aboveground historic properties in the visual APE for the

O&M facility (COP Volume II, Appendices II-N1 and II-N2; Atlantic Shores 2024). See Appendix I for a complete list of historic properties in the marine, terrestrial, and visual APEs for the Project.

Accidental releases: Accidental release of fuel, fluids, hazardous materials, trash, or debris, if any, could have impacts on cultural resources. The WTGs and OSSs associated with the Proposed Action alone would include storage for a variety of potential chemicals such as diesel fuel, hydraulic fluid, and lubricating oil (COP Volume I, Chapter 7.0; Atlantic Shores 2024). Construction and installation, O&M, and decommissioning of the onshore and offshore portions of the Project would require use of several types of vehicles, ocean-going vessels, and aircraft from which there may be unanticipated release or spills of substances onto land or into receiving waters (COP Volume I, Section 4.10; Atlantic Shores 2024). Overall, the potential for accidental releases, volume of released material, and associated need for cleanup activities from the Proposed Action 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.

The majority of impacts associated with accidental releases would be incidental due to cleanup activities that require the removal of contaminated soils, trash, or debris. As such, the majority of potential individual accidental releases from the Proposed Action would not be expected to result in measurable impacts on cultural resources and would be considered negligible impacts. 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 on marine and coastal cultural resources. A large-scale release would require extensive cleanup activities to remove contaminated materials, resulting in damage to or complete destruction 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 aboveground resources such as buildings, structures, objects, districts, significant landscapes, and TCPs; and damage to or destruction of nearshore marine cultural resources during contaminated soil/sediment removal. In addition, the accidentally released materials in deep-water settings could settle on marine cultural resources. In the case of marine archaeological resources, such as shipwrecks, downed aircraft, and debris fields, this may accelerate their decomposition or cover them and make them inaccessible or unrecognizable to researchers, resulting in a significant loss of historic 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. Overall, the impacts on cultural resources from accidental releases from the Proposed Action would be localized, short term, and negligible to major depending on the number and scales of accidental releases.

Anchoring: Anchoring associated with offshore activities of the Proposed Action could have impacts on marine cultural resources. Atlantic Shores' marine geophysical archaeological surveys identified 22 marine archaeological resources in the marine APE: 9 within the WTA (i.e., 6 in the Project 1 area, 2 in the Project 2 area, and 1 in the Overlap Area); 4 within the Atlantic offshore ECC; and 9 within the Monmouth offshore ECC (COP Volume II, Appendix II-Q; Atlantic Shores 2024). Atlantic Shores has committed to avoidance of these marine archaeological resources (CUL-17, Appendix G, Table G-1). Additionally, 59 ASLFs were identified in the marine APE. The severity of effects of this IPF would depend on the horizontal and vertical extent of disturbance relative to the size of the ASLF subject to impacts. As Atlantic Shores has not committed to avoidance of these ASLFs, all 59 ASLFs are anticipated to be subject to physical adverse impacts from the Proposed Action. Mitigation measures for resolving adverse effects on these ASLFs per NHPA Section 106 were developed through BOEM's consultations with consulting parties, Native American Tribes, and NJHPO and will be stipulated in the MOA (Appendix I, Attachment A).

Based on this information, impacts of the Proposed Action on marine archaeological resources are expected to be negligible due to Atlantic Shores' commitment to avoidance of these resources and their protective buffers. However, impacts on ASLFs would be localized, permanent, and range from negligible to major depending on the ability of Atlantic Shores to avoid, minimize, or mitigate impacts. More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Cable emplacement and maintenance: The installation of interlink cables and offshore export cables would include site preparation activities (e.g., dredging, trenching), cable installation via jet trenching, plowing/jet plowing, or mechanical trenching, which could have impacts on marine cultural resources. The specific cultural resources subject to potential impacts, AMM measures, and potential range of severity and extent of impacts on cultural resources under this IPF are the same as those described under the *Anchoring* IPF for the Proposed Action. Overall, impacts of the Proposed Action on marine archaeological resources are expected to be negligible due to Atlantic Shores' commitment to avoidance of these resources and their protective buffers. However, impacts on ASLFs would be localized, permanent, and range from negligible to major depending on the ability of Atlantic Shores to avoid, minimize, or mitigate impacts. More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Gear utilization: Construction and installation, O&M, and decommissioning of the Proposed Action may necessitate additional monitoring or geophysical surveys, from which gear utilization could cause entanglements with marine archaeological resources, resulting in adverse impacts. The specific marine archaeological resources subject to potential impacts, EPMs, and potential range of severity and extent of impacts on marine archaeological resources under this IPF are the same as those described under the *Anchoring* IPF for the Proposed Action. Overall, impacts of the Proposed Action on marine archaeological resources are expected to be negligible due to Atlantic Shores' commitment to avoidance of these resources. More substantial impacts could occur if previously undiscovered resources are discovered during construction.

Land disturbance: Land disturbance associated with the construction and installation of Onshore Project components could have impacts on cultural resources. Construction activities may include site clearing, grading, excavation, and filling during the construction and installation phase of the landfall sites, interconnection cable routes, and substations and/or converter stations (COP Volume II, Section 6.2; Atlantic Shores 2024). The onshore interconnection cables would be buried beneath or adjacent to existing ROWs (COP Volume II, Appendix II-N1; Atlantic Shores 2024). Overall, visual impacts of land disturbance related to the construction of Onshore Project components would have negligible impacts on historic aboveground resources identified in the visual APE.

Ground-disturbing activities associated with construction (e.g., site clearing, grading, excavation, and filling) could have impacts on terrestrial archaeological resources. The number of resources subject to impacts would depend on the location of specific Project components relative to known and undiscovered cultural resources, and the severity of impacts would depend on the horizontal and vertical extent of disturbance relative to the size of the resources subject to impacts. Onshore cultural resource investigations conducted for the Proposed Action identified one terrestrial archaeological resource and one historic aboveground resource (i.e., West Jersey and Atlantic Railroad Historic District) in the terrestrial APE (COP Volume II, Section 6.2, and Appendix II P; Atlantic Shores 2024). Terrestrial archaeological investigations indicated the Proposed Action would have negligible to minor physical impacts on these resources.

Archaeological investigations have been completed for the Proposed Action in the terrestrial APE; however, due to logistical limitations related to Project developments and landowner permissions, not all of the terrestrial APE has been fully investigated. As such, currently undiscovered but potential terrestrial archaeological resources may exist in the terrestrial APE. In consultation with BOEM and NJHPO, Atlantic Shores will be using a process of phased identification and evaluation of historic properties as defined in 36 CFR 800.4(b)(2) for the unsurveyed areas of the terrestrial APE. Completion of the remaining archaeological surveys during the phased process may lead to the identification of archaeological resources in the terrestrial APE. BOEM will use the MOA to establish commitments for reviewing the sufficiency of any supplemental terrestrial archaeological investigations as phased identification; assessing effects on historic properties; consulting on the identification of historic properties and assessment of effects with federally recognized Tribes, NJHPO, and consulting parties; and resolving adverse effects, if any, by implementing measures to avoid, minimize, or mitigate effects in these areas prior to construction. See Appendix I, Section I.5, *Phased Identification and Evaluation*, for additional details on the phased process and Appendix I, Attachment A, for a draft of the MOA. Furthermore, Atlantic Shores has proposed to implement several EPMs to reduce the risk of impacts on terrestrial archaeological resources (CUL-01 through CUL-19; Appendix G, *Mitigation and Monitoring*), including siting Onshore Project components within previously disturbed and developed areas (e.g., roadways, ROWs, previously developed industrial/commercial areas) to the maximum extent practicable (CUL-12, Appendix G, Table G-1) in areas where no terrestrial archaeological resources are known to exist, thereby avoiding, and minimizing impacts on, known terrestrial archaeological resources (CUL-12 and CUL-14, Appendix G, Table G-1).

Based on this information, the impacts of land disturbance from the Proposed Action on cultural resources are expected to be localized, range from short term to permanent, and range from negligible to minor. If terrestrial archaeological resources are identified through the phased identification process, Atlantic Shores will implement measures to avoid, minimize, or mitigate impacts on cultural resources as aligned with NJHPO and NHPA requirements and per the MOA (Appendix I, Attachment A). More substantial impacts could occur if previously undiscovered resources are found during construction.

Lighting: Anthropogenic light from activities associated with the Proposed Action could result in a change to the integrity of the historic setting of historic aboveground resources by introducing new sources of light into settings or contexts, both onshore and offshore (COP Volume II, Section 6.1.2.2; Atlantic Shores 2024). Depending on the existing conditions in which a historic aboveground resource is located, the introduction of an additional light source may be disruptive, or not noticeable at all.

Construction and installation, O&M, and conceptual decommissioning of the Proposed Action may require nighttime vessel and construction area lighting. The lighting impacts would be short term, and the intensity of this nighttime lighting from the Proposed Action would be limited to active construction areas 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 New Jersey 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.

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. Nighttime lighting impacts would be restricted to cultural resources for which a dark nighttime sky is a character-defining feature that contributes to their historic significance and integrity. Onshore construction lighting may result in temporary intrusions to the visual setting of historic aboveground resources but are not anticipated to affect or diminish the integrity of historic properties. Due to the developed nature of the visual APE for Onshore Project components, lighting associated with the construction and conceptual decommissioning of the Proposed Action would be temporary and is not expected to contribute significantly to the sky glow resulting from existing light sources present in each of the respective areas (COP Volume II, Section 6.1.2.2; Atlantic Shores 2024). As a result, construction lighting in the visual APE for Onshore Project components would result in negligible impacts on cultural resources.

The Proposed Action would also include offshore construction lighting and nighttime and daytime use of aviation and vessel hazard avoidance lighting on WTGs and OSSs during operation. Impacts from lighting would be reduced by the distance between the nearest construction area and the closest line of WTGs and the nearest cultural resources on the New Jersey 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. As previously stated, these impacts would be limited to cultural resources for which a dark nighttime sky is a character-defining feature that contributes to their historic significance and integrity. If implemented, an ADLS would reduce operational phase nighttime lighting impacts (COP Volume I; Atlantic Shores 2024). ADLS would only activate the required FAA aviation obstruction lights on WTGs and OSSs when aircraft enter a predefined airspace and turn off when the aircraft were no longer in proximity to the WTA. Based on recent studies (COP Volume II, Appendix II-M4; Atlantic Shores 2024), activation of the Atlantic Shores ADLS would be anticipated to occur for less than 9 hours per year, compared to standard continuous FAA hazard lighting. Overall, the impacts on cultural resources from construction and operational lighting on WTGs and OSSs associated with the Proposed Action would result in negligible to minor impacts on cultural resources.

Use of lighting on Onshore Project facilities for O&M of the Proposed Action could result in a change to the integrity of the historic setting of historic aboveground resources by introducing new sources of light into historic contexts, both onshore and offshore. Operational lighting would be required for the O&M of the onshore substations, converter stations, and POIs. However, the lights associated with these facilities would have minimal visibility from historic aboveground resources, and due to the developed nature of the visual APE for Onshore Project components, the lights are not expected to contribute significantly to the sky glow resulting from existing light sources present in their respective areas. Plantings to create screening would be installed at the onshore substation and converter station sites to the maximum extent practicable to reduce potential visibility and thereby avoid impacts from lighting from onshore facilities during O&M (COP Volume II, Section 6.1.2.2; Atlantic Shores 2024). Additional lighting mitigation may include keeping lighting to a minimum, turning lights on only as needed, directing lights downward, and utilizing full cut-off fixtures to minimize offsite light trespass (COP Volume II, Appendices II-M2 and II-M3; Atlantic Shores 2024). As a result, lighting would likely result in negligible impacts on the three aboveground historic properties in the visual APE for Onshore Project components and seven aboveground historic properties in the visual APE for the O&M facility.

During decommissioning, WTGs and OSSs would be disassembled, resulting in the removal of lighting components (COP Volume I, Sections 6.2.1 and 6.2.2; Atlantic Shores 2024). Onshore facilities (such as onshore substations, converter stations, POIs, and buried duct banks) would either be retired in place or reused for other purposes (COP Volume I, Section 6.2.6; Atlantic Shores 2024). Overall, lighting associated with the Proposed Action is anticipated to have negligible impacts on cultural resources during the construction and installation, O&M, and conceptual decommissioning phases.

Noise: Airborne noise produced by the Project could result in a change to the integrity of the setting of historic aboveground resources by introducing modern sounds into historic contexts both on- and offshore. Historic aboveground resources set in urban contexts may not be subject to impacts by an increase in airborne noise, while in other contexts airborne noise may lead to the disruption of the historic setting by which a cultural resource derives its significance. Based on an assessment of operational noise of the Project (COP Volume II, Appendix II-U; Atlantic Shores 2024), noise generated by Offshore Project components, including the WTGs, is not expected to be audible at the nearest shorelines. Therefore, operational noise associated with the Offshore Project components is anticipated to have negligible impacts on cultural resources.

The onshore interconnection facilities and substations/converter stations may generate noise at levels that would vary based on the type of facility constructed. The design of onshore facilities would depend on whether HVAC, HVDC, or a combination of both HVAC and HVDC onshore interconnection cables are constructed. It is anticipated that the HVDC design would have generally lesser sound impacts on the surrounding community than HVAC technology. Therefore, only the HVAC onshore substation design was evaluated to provide the most conservative assessment of potential noise impacts. Modeled sound levels around the onshore substation and converter station sites showed all nearby land uses would comply with their respective residential or commercial A-weighted sound limits with some sound level mitigation (COP Volume II, Section 6.1.2.3; Atlantic Shores 2024). Noise from the O&M of onshore substations and cables is anticipated to be consistent with background noise already in the area, including automobile and marine traffic, and would be mitigated by the incorporation of noise-reducing design features, such as strategically placed noise barriers on equipment and other features required to comply with local noise ordinances (COP Volume II, Appendix II-U; Atlantic Shores 2024).

The onshore interconnection cables would not generate noise during operations because the cable would be buried beneath existing roads or within other public and utility ROWs. Noise levels generated by the proposed onshore facilities would vary based on the type of facilities (HVAC, HVDC, or both HVAC and HVDC) that are constructed, but it is anticipated that the HVDC design would have generally lesser sound impacts on the surrounding community than HVAC technology. If necessary, screening would be implemented at the onshore substation and/or converter station sites to the extent feasible to reduce potential noise effects on aboveground historic properties (CUL-08; Appendix G, Table G-1). The proposed O&M facility is not anticipated to produce noise that would be out of character with the surrounding environment, including noise associated with marine and automobile traffic (COP Volume II, Appendix II-N2; Atlantic Shores 2024). To minimize potential impacts, the onshore substations/converter stations would be designed to comply with NJDEP sound level limits. Screening would be implemented at the onshore substation and converter station sites to the maximum extent practicable, to reduce potential noise impacts from onshore facilities. The anticipated levels of noise generated by onshore facilities are described in greater detail in the Onshore Noise Report (COP Volume II, Appendix II-U; Atlantic Shores 2024). It is anticipated that any noise from the facilities during O&M would be eliminated once the facilities are decommissioned. Therefore, noise associated with the Onshore Project components is anticipated to have negligible impacts on historic aboveground resources.

Overall, impacts of noise from onshore and offshore components of the Proposed Action are anticipated to have negligible impacts on cultural resources.

Port utilization: Construction and O&M vessels would travel between the Offshore Project area and a third-party port facility where equipment and materials would be staged. Atlantic Shores anticipates using ports in Salem County and Gloucester County, New Jersey; Portsmouth City, Virginia; and Nueces County and San Patricio Counties, Texas, to support construction. The proposed O&M facility would be located at Atlantic City Harbor, Atlantic County, New Jersey. The areas of the Project APE and potential impacts from the Proposed Action associated with the O&M facility are discussed under the *Land disturbance* and *Presence of structures* IPFs. Potential impacts from activities under the connected action at the O&M facility are discussed in the next section. Overall, the Proposed Action would not directly require any upgrades to port infrastructure at these locations and therefore would have no measurable impacts on cultural resources that may be present at or near those port locations.

Presence of structures: The visibility of Project components could have impacts on cultural resources. Atlantic Shores' investigations identified three aboveground historic properties in the visual APE for Onshore Project components with potential visibility of these components as determined through viewshed analysis (COP Volume II, Appendix II-N1; Atlantic Shores 2024). The onshore interconnection cables would be buried beneath or adjacent to existing ROWs. The onshore substation and/or converter stations may include equipment and facilities such as transformers, static synchronous compensators, shunt reactors, harmonic filter banks, a valve hall, an AC yard and a DC area, a reactor yard, valve cooling towers, AC filters, and substation control, service, and storage buildings, depending on the type of transmission cables used. The nature and degree of visual impacts would be minimal due to the density of existing modern development and infrastructure (COP Volume II, Appendix II-N1; Atlantic Shores 2024). Impacts would be further minimized on historic aboveground resources due to the distance from the site, the overall setting that already features overhead utilities and buildings, and by the likelihood that drivers along these parkways would be primarily focused on navigating traffic along a busy section of roadway and, thus, less likely to notice the visual changes (COP Volume II, Appendices II-M2 and II-M3; Atlantic Shores 2024). Therefore, the new transmission lines and substations/converter stations that would be operated as a part of the Proposed Action are expected to have negligible impacts on the three aboveground historic properties within the visual APE for Onshore Project components (COP Volume II, Appendix II-N1; Atlantic Shores 2024).

Atlantic Shores' investigations identified seven aboveground historic properties in the visual APE for the O&M facility with potential visibility of this component as determined through viewshed analysis (COP Volume II, Appendix II-N2; Atlantic Shores 2024). The O&M facility includes a three-story operations building, potentially associated parking structure, access road around the building perimeter, and three floating pontoons used to moor work vessels. The facility would be up to 50 feet (15 meters) tall, and the tallest component would be a communications tower, which would be up to 120 feet (36.6 meters) tall. The O&M facility would likely not appear out of place in the context of modern buildings and infrastructure surrounding it. Therefore, the proposed O&M facility would have negligible impacts on the seven aboveground historic properties identified in this portion of the visual APE for Onshore Project components (COP Volume II, Appendix II-N2; Atlantic Shores 2024).

The presence of structures in the WTA, including WTGs, OSSs, and the met tower could have impacts on cultural resources. Atlantic Shores' Historic Resources Visual Effects Assessment (HRVEA) for Offshore Project components also determined that the Proposed Action could adversely affect up to 29 aboveground historic properties, including historic districts, individual historic aboveground resources, and two NHLs, in the visual APE for Offshore Project components (see Appendix I for a complete list of historic properties) (COP, Appendix II-O; Atlantic Shores 2024). The study determined that views and vistas of the Atlantic Ocean, free of modern visual elements, are a contributing element to the NRHP eligibility of the historic homes and structures, recreational properties, lighthouses and navigational aids, and maritime defense facilities. A location near the water or a historic functional relationship with the sea is also an element of the latter three aboveground property types. Although the operational life of the Project is 30 years, and the WTGs and OSSs would be decommissioned after that period, the presence of visible WTGs from the Proposed Action alone would have long-term, continuous, widespread, minor to 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, offshore components of the Proposed Action alone would only affect seaward views from these resources. To further minimize and mitigate the Proposed Action's effects, Atlantic Shores has voluntarily committed to several EPMs (Appendix G, Table G-1). These measures include painting the WTGs no lighter than Pure White (RAL 9010) and no darker than Light Grey (RAL 7035) and implementation of an ADLS to limit nighttime lighting impacts (VIS-03 and VIS-05, Appendix G, Table G-1).

The final resolution of adverse effects on historic properties will be determined through BOEM's NHPA Section 106 consultation process and included as conditions of COP approval as established in the MOA.

Traffic: An increase in traffic associated with the Project could result in a change to the integrity of the historic setting of historic aboveground resources by creating an increase in the flow of aircraft, vessels, or land-based vehicles that could disrupt the historic contexts of cultural resources. Marine vessels used to complete construction and decommissioning activities would likely include jack-up vessels, heavy-lift vessels, and support vessels such as tugboats and crew transfer vessels for Offshore Project components (COP Volume I, Section 6.2; Atlantic Shores 2024). Given the relative frequency of seagoing vessels on the horizon in the APE, it is unlikely that marine traffic related to the construction and installation, O&M, and decommissioning of the Project would be a noticeable change (COP Volume II, Section 6.1.2.4; Atlantic Shores 2024).

The proposed Onshore Project areas are within or adjacent to busy roadways, where vehicle traffic is already a part of the setting. While O&M of the onshore substations and converter stations and POIs would occur regularly based on manufacturer recommended schedules, these facilities would be unmanned during routine operations and would likely cause no noticeable increase in existing traffic patterns. If any unforeseen maintenance is required, impacts on traffic from potential detours might occur (COP Volume II, Section 6.1.2.4; Atlantic Shores 2024). Additionally, Onshore Project components may require truck-mounted winches, cable reels, and cable reel transport trucks during decommissioning (COP Volume I, Section 6.2; Atlantic Shores 2024). Traffic is not anticipated to have an impact on the integrity of the historic setting of identified historic aboveground resources for the duration of the Project's activity. The O&M facility operation may result in a slight increase in traffic as automobiles and marine vessels arrive and depart during working hours. However, it is not anticipated that this slight increase would result in adverse impacts on identified historic aboveground resources due to the existing conditions near the O&M facility site, as it would be located immediately adjacent to a state marina and a major highway onramp (COP Volume II, Appendix II-N2; Atlantic Shores 2024). Overall, onshore and offshore traffic caused by the Proposed Action is anticipated to have negligible impacts on cultural resources.

Impacts of the Connected Action

As described in Chapter 2, *Alternatives,* bulkhead repair and/or replacement and maintenance dredging activities have been proposed as a connected action under NEPA, per 40 CFR 1501.9(e)(1). These activities are proposed to include the repair and/or replacement of an existing bulkhead to be conducted by Atlantic Shores via a USACE Nationwide Permit 13 and implementation of a maintenance dredging program to be conducted by Atlantic Shores in coordination with the City of Atlantic City via USACE DA Permit (CENAP-OPR-2021-00573-95; USACE 2021) and a NJDEP Dredge Permit (No.

0102.20.0001.1 LUP 210001). See Chapter 2, Section 2.1.2.4, *Connected Action*, for additional details. The area subject to impacts from the connected action largely coincides with a portion of the Project APE associated with the O&M facility under the Proposed Action (see Appendix I, Figure I-2). However, activities associated with the connected action are distinct from and will occur independently of other activities Atlantic Shores has proposed at the O&M facility under the Proposed Action.

Subsequently, activities under the connected action have undergone or will undergo Section 106 review, with USACE serving as the lead federal agency. In its issuance of City of Atlantic City's DA Permit (CENAP-OPR-2021-00573-95; USACE 2021), USACE fulfilled its Section 106 obligations and determined the proposed activities would have no effect on historic properties. Atlantic Shores is in the process of preparing their USACE Nationwide Permit 13 for the proposed bulkhead repair and/or replacement activities, and as such, USACE's Section 106 review has not yet commenced for this portion of activities under the connected action. BOEM will participate in Section 106 consultation for this portion of activities under the connected action. If findings from the Section 106 review change BOEM's final determinations and finding of effects for the Proposed Action, BOEM will ensure consulting parties may review and consult on final determinations and findings associated with this portion of activities under the connected action.

City of Atlantic City's approved USACE DA Permit (CENAP-OPR-2021-00573-95; USACE 2021) indicates USACE found that the dredging activities proposed under the connected action would have no effect on historic properties. BOEM has determined Atlantic Shores' proposed bulkhead repair or replacement under the connected action has the potential to subject cultural resources to adverse impacts. Based on relevant cultural resource background information provided in Atlantic Shores' COP (COP Volume II, Appendices II-N2 and II-P2; Atlantic Shores 2024), no previously recorded marine cultural resources, terrestrial archaeological resources, or historic aboveground resources are located in the area subject to physical effects from seabed- or ground-disturbing activities of the connected action. However, seven aboveground historic properties are located in the Proposed Action's visual APE for the O&M facility and may be subject to effects from the connected action. Presently unknown but potential cultural resources may exist in this area and may be subject to adverse impacts.

Impacts on cultural resources from the connected action are expected through the following primary IPFs.

Accidental releases: Accidental releases of fuel, fluids, or hazardous materials could occur during activities associated with the connected action. However, the volume of materials released in an accidental spill or leak is unlikely to require cleanup operations that would permanently have impacts on cultural resources. As a result, the impacts of accidental releases from the connected action alone on cultural resources would be negligible to minor. More substantial impacts could occur in the unlikely event of a large-scale release and if previously undiscovered cultural resources are discovered during the performance of these activities.

Land disturbance: Bulkhead repair activities of the connected action may involve ground disturbance, which could have impacts on cultural resources. No previously recorded terrestrial archaeological resources or historic aboveground resources are located in the area subject to ground-disturbing activities of the connected action (COP Volume II, Appendices II-N2 and II-P2; Atlantic Shores 2024). Cultural resource and historic property investigations are being conducted under Section 106 review for the portion of the connected action related to bulkhead repair and/or replacement, with USACE serving as Lead Federal Agency, and may lead to the identification of cultural resources subject to impacts from land disturbance. However, activities under the connected action are proposed for an area likely significantly disturbed by land reclamation and construction throughout the twentieth century, and therefore there is low potential for intact or potentially significant terrestrial archaeological resources in this area (COP Volume II, Appendix II-P2; Atlantic Shores 2024). Cultural resource investigations completed for the Proposed Action have found that the bulkhead subject to repair or replacement under the connected action is not itself a historic property eligible for listing in the NRHP and subject to adverse effects. As such, BOEM expects that land disturbance associated with the connected action would have negligible to major impacts on cultural resources, with more substantial moderate to major impacts occurring if previously undiscovered archaeological resources are discovered during the performance of these activities.

Lighting: Should any of these activities occur at night, nighttime lighting may be utilized, which could have impacts on cultural resources. Impacts on cultural resources could occur on any of those historic properties with visibility of the lighting and for which a dark nighttime sky is a character-defining feature that contributes to historic significance and integrity. However, these impacts would be short term. As a result, BOEM anticipates lighting associated with the connected action would have negligible impacts on cultural resources.

Port utilization: Under the connected action, Atlantic Shores would conduct bulkhead repair and/or replacement activities and, in coordination with the City of Atlantic City, would conduct maintenance dredging at Atlantic City's Inlet Marina. These activities have been or are being separately reviewed and authorized by USACE and state and local agencies. City of Atlantic City's approved USACE DA Permit (CENAP-OPR-2021-00573-95; USACE 2021) indicates USACE found the dredging activities proposed under the connected action would have no effect on historic properties; as such, BOEM does not anticipate activities that affect or sweep the seafloor would have impacts on any marine cultural resources. Any activities associated with the bulkhead repair and/or replacement that involve ground disturbance could potentially have physical impacts on presently undiscovered but potential terrestrial archaeological resources or historic aboveground resources. Based on relevant cultural resource background information provided in Atlantic Shores' COP (COP Volume II, Appendices II-N2 and II-P2; Atlantic Shores 2024), no previously recorded cultural resources are located in the area subject to physical impacts from the connected action. Activities under the connected action are proposed for an area subject to prior dredging, land reclamation, and construction disturbances, and therefore the area bears low potential for intact or potentially significant marine cultural resources or terrestrial archaeological resources (COP Volume II, Appendix II-P2; Atlantic Shores 2024). However, cultural resource and historic property investigations are being conducted under Section 106 review for the portion of the connected action related to bulkhead repair and/or replacement, with USACE serving as Lead Federal Agency and may lead to the identification of cultural resources subject to impacts. Cultural resource investigations completed for the Proposed Action have found that the bulkhead subject to repair or replacement under the connected action is not itself a historic property eligible for listing in the NRHP and subject to physical adverse effects. Additionally, investigations completed for the connected action may identify historic aboveground resources that are historic properties subject to visual adverse effects. As such, port utilization associated with the connected action would have negligible to major impacts on cultural resources depending on the identification of cultural resources in the area subject to impacts. More substantial moderate to major impacts could occur if previously undiscovered archaeological resources are discovered during the performance of these activities or if historic properties subject to visual effects are identified in the area subject to impacts.

Presence of structures: Repair of the existing bulkhead may not introduce elements that diminish the location, feeling, and association of potential historic aboveground resources with visibility of the bulkhead, because the visual alterations could be consistent with and sustain the current setting of the marina. The replacement of the bulkhead could introduce visual alterations that diminish such characteristics of these potential historic aboveground resources, depending on the appearance of the replacement. Cultural resource and historic property investigations are being conducted under Section 106 review for the portion of the connected action related to repair and/or replacement of the bulkhead, with USACE serving as the Lead Federal Agency, and may lead to the identification of cultural resources subject to impacts. As a result, presence of structures associated with the connected action would have negligible to major impacts on cultural resources depending on the identification of cultural resources in the area subject to impacts. More substantial moderate to major impacts could occur if historic properties subject to visual effects are identified in the area subject to impacts.

Cumulative Impacts of Alternative B – Proposed Action

The cumulative impact analysis of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, including offshore wind activities, and the connected action.

Accidental releases: Impacts from accidental releases on cultural resources from offshore wind projects would be similar to those of the Proposed Action and be negligible in most cases, except that rare cases of large-scale accidental release may represent major impacts on cultural resources. The cumulative impacts on marine cultural resources from accidental releases would range from localized, short-term, and negligible to geographically extensive, permanent, and major depending on the number and scales of accidental releases, if any.

Anchoring: The Proposed Action, combined with impacts from ongoing and planned activities, could have impacts on marine cultural resources through anchoring. BOEM anticipates that lead federal agencies and relevant SHPOs would require the applicants 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 marine cultural resources as part of NEPA and NHPA Section 106 compliance activities. BOEM would also continue to require developers to avoid, minimize, or mitigate impacts on any identified marine cultural resources that are historic properties during construction and installation, O&M, and decommissioning. BOEM has committed to working with Tribes, NJHPO, applicants, and consulting parties to develop specific mitigation measures to address effects on marine cultural resources that cannot be avoided by proposed offshore wind development projects. Development and implementation of Project-specific mitigation measures, agreed to by Tribes and consulting parties, would likely reduce the magnitude of otherwise unmitigated impacts on marine cultural resources; however, the magnitude of these impacts would remain moderate to major, due to the permanent, irreversible nature of the impacts, unless these marine cultural resources can be avoided. As a result, the cumulative impacts on marine cultural resources from anchoring from the Proposed Action, combined with impacts from ongoing and planned activities, would be localized and permanent, and range from negligible to major depending on the ability of offshore wind projects to avoid, minimize, or mitigate impacts. More substantial impacts could occur if the final project designs cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Cable emplacement and maintenance: The Proposed Action, combined with impacts from ongoing and planned activities, could have impacts on marine cultural resources through cable emplacement and maintenance. The potential range of severity and extent of impacts on marine cultural resources under this IPF are the same as those described under the *Anchoring* IPF for the cumulative impacts of the Proposed Action. The cumulative impacts on marine cultural resources from cable emplacement and maintenance from the Proposed Action, combined with impacts from ongoing and planned activities, would be localized and permanent, and range from negligible to major depending on the ability of offshore wind projects to avoid, minimize, or mitigate impacts. More substantial impacts could occur if the final project designs cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Gear utilization: The Proposed Action, combined with impacts from ongoing and planned activities, could have impacts on marine cultural resources through gear utilization. The potential range of severity and extent of impacts on marine cultural resources under this IPF are the same as those described under the *Anchoring* IPF for the cumulative impacts of the Proposed Action. The cumulative impacts on marine cultural resources from gear utilization from the Proposed Action, combined with impacts from ongoing and planned activities, would be localized and permanent, and range from negligible to major depending on the ability of offshore wind projects to avoid, minimize, or mitigate impacts. More substantial impacts could occur if the final project designs cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Land disturbance: Land disturbance (e.g., ground-disturbing construction activities) from offshore wind developments could result in impacts on known and undiscovered cultural resources (if present). BOEM anticipates that federal (i.e., NEPA and NHPA Section 106) 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 wind developments. The cumulative impacts from land disturbance from the Proposed Action, combined with ongoing and planned activities, would result in localized, short-term to permanent, and negligible to major impacts on cultural resources depending on the developers' abilities to avoid, minimize, or mitigate impacts of ground-disturbing activities. More substantial impacts could occur if the final project designs cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Lighting: Lighting from the offshore wind developments could result in impacts on cultural resources. Nighttime lighting impacts would be restricted to cultural resources for which a dark nighttime sky is a character-defining feature contributing to the historic significance and integrity of the resource. Permanent aviation and vessel warning lighting would be required on all WTGs and OSSs built by offshore wind projects. The Proposed Action would account for approximately 19.6 percent of the WTGs and OSSs in the geographic analysis area that could potentially have cumulative visual impacts on historic properties. If ADLS were used by offshore wind developments, nighttime hazard lighting impacts on cultural resources from ongoing and planned activities, including offshore wind and the Proposed Action, would be negligible. If offshore wind projects do not commit to using ADLS, operational lighting from the Proposed Action combined with ongoing and planned activities including offshore wind would have negligible to moderate impacts on cultural resources. Therefore, cumulative impacts from lighting from the Proposed Action combined with ongoing and planned activities would result in negligible to moderate impacts on cultural resources.

Noise: Impacts of noise from offshore wind projects would be similar to those of the Proposed Action: noise generated by offshore wind project components would be unlikely to be audible from the nearest shorelines. Noise could also occur in localized locations associated with onshore project components throughout the larger geographic analysis area. Noise from the O&M of onshore substations and cables could be consistent with background noise already in the area of these components, including automobile and marine traffic. Therefore, the cumulative impacts on cultural resources from noise from the Proposed Action combined with impacts from ongoing and planned activities would be localized and short term, and would range from negligible to minor.

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 have impacts on cultural resources within or near port facilities. 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 from the Proposed Action, combined with ongoing and planned activities, would range from negligible to major.

Presence of Structures: BOEM conducted a Cumulative Historic Resources Visual Effects Assessment (CHRVEA) to evaluate visual impacts on the 29 aboveground historic properties in the visual APE determined to be adversely affected (BOEM 2024). The planned activities scenario assessment determined the maximum number of WTGs from the Proposed Action and ongoing and planned offshore wind projects that could be theoretically visible (based on distance, topography, vegetation, and intervening structures) from each of the 29 aboveground historic properties affected by the Proposed Action. The study assessed these values using known project specifications of each project within the geographic analysis area to simulate the maximum number of WTGs that could theoretically be visible from the Proposed Action and offshore wind projects. Other offshore wind projects included in the cumulative WTG count from historic properties are Atlantic Shores North, GSOE I, Ocean Wind 1, Ocean Wind 2, Skipjack Offshore Energy, Community Offshore Wind Holdings, Atlantic Shores Offshore Wind Bight, and Invenergy Wind Offshore that have intervisibility with the 29 aboveground historic properties (BOEM 2024). See Appendix I, Table I-8 for a list of these historic properties.

The CHRVEA demonstrated that portions of WTGs would be theoretically visible from each of the 29 aboveground historic properties. Fewer WTGs would be visible from lower elevations, locations without clear east-facing seaward views, and from historic properties located farther from the lease areas. Historic properties with unobstructed views toward the ocean would be subject to the largest scale impacts due to theoretical visibility of portions of the up to 1,021 WTGs within the geographic analysis area (BOEM 2024).[1] WTGs associated with the Project would represent 22.6 to 39.1 percent of the total WTGs theoretically visible from each property, with the closest Project WTG approximately 9.9 miles (15.9 kilometers) away from the closest historic property. WTGs associated with other offshore wind energy development activities would represent 60.9 to 77.4 percent of the total WTGs theoretically visible from each property, with the closest WTGs approximately 8.6 miles (13.8 kilometers) away from the closest historic property. As such, the proposed Project is a large-scaled development when compared to other developments planned nearby (BOEM 2024).

In addition to the limited geographic extent of impacts, the intensity of visual impacts on these historic properties would be limited by distance and environmental and atmospheric factors. As discussed in Section 3.6.8, *Recreation and Tourism,* 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 the Proposed Action, would have long-term, continuous, minor to moderate impacts on these 29 aboveground historic properties. The Proposed Action would contribute a noticeable increment to these impacts.

Traffic: Impacts of traffic from offshore wind projects would be similar to those of the Proposed Action due to the anticipated increase in the flow of aircraft, vessels, or land-based vehicles. Increased traffic would occur in localized locations throughout the larger geographic analysis area. The cumulative impacts on cultural resources from traffic from the Proposed Action combined with impacts from ongoing and planned activities would be localized and short term, and would range from negligible to minor.

[1] The CHRVEA analyzes the intervisibility of other regional projects based on known WTG location and height information as of October 2023 and as provided to Atlantic Shores by BOEM to produce the cumulative photosimulations. The information regarding WTG totals for each project was based on the best available information about commercially available WTGs at that time and differs from the totals presented in Appendix D of this Final EIS.

Conclusions

Impacts of Alternative B – Proposed Action. The Proposed Action alone would have negligible to major impacts on individual cultural resources. Impacts would be reduced through the NHPA Section 106 process, including the implementation of measures to avoid, minimize, and/or mitigate adverse effects on historic properties. Similarly, the analysis of impacts is based on a maximum-case scenario; impacts would be reduced by implementation of a less-impactful construction or infrastructure development scenario in the PDE. Greater impacts, ranging from moderate to major, would otherwise occur without the preconstruction NHPA requirements to identify historic properties, assess potential effects, and develop avoidance, minimization, or mitigation measures to resolve adverse effects. These NHPA-required, "good-faith" efforts to identify historic properties and address impacts resulted in or contributed to Atlantic Shores making a number of commitments to reduce the magnitude of impacts on cultural resources (CUL-01 through CUL-19; Appendix G, Table G-1). Avoidance, minimization, and mitigation measures have also been stipulated in the MOA (Appendix I, Attachment A).

BOEM expects the connected action alone would have negligible to major impacts on cultural resources depending on the identification of cultural resources in the area subject to impacts from activities proposed under the connected action. More substantial moderate to major impacts could occur if previously undiscovered archaeological resources are discovered during the performance of these activities or if historic properties subject to visual effects are identified in the area subject to impacts.

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. However, mitigation of both physical and visual adverse effects on historic properties would still be needed under the Proposed Action. Therefore, the overall impacts on historic properties from the Proposed Action would likely qualify as **major** because a notable and measurable impact requiring mitigation is anticipated.

Cumulative Impacts of Alternative B – Proposed Action. Impacts of individual IPFs resulting from the Proposed Action in combination with other ongoing and planned activities and the connected action would be appreciable. Considering all the IPFs together, BOEM anticipates that the impacts on cultural resources associated with the Proposed Action and other ongoing and planned activities would be **major** because the IPFs of anchoring, cable emplacement and maintenance, gear utilization, land disturbance, and presence of structures of planned activities would result in long-term or permanent and irreversible impacts on archaeological resources and ASLFs, and long-term impacts on historic aboveground resources, including the 29 aboveground historic properties identified in Appendix I, Table I-8.

3.6.2.6 Impacts of Alternative C on Cultural Resources

Impacts of Alternative C. Alternative C (Habitat Impact Minimization/Fisheries Habitat Impact Minimization) includes four sub-alternatives (C1, C2, C3, and C4) that involve the adjustment of layout or maximum number of WTGs and OSSs to avoid and minimize potential impacts on important fisheries habitats and AOCs identified by NMFS. NMFS identified two AOCs within the Lease Area that have pronounced bottom features and produce habitat value: AOC 1 is part of a designated recreational fishing area called “Lobster Hole,” and AOC 2 is part of a sand ridge (ridge and trough) complex. Due to Atlantic Shores’ commitment to avoidance of marine archaeological resources (CUL-17, Appendix G, Table G-1), impacts on marine archaeological resources under this alternative are anticipated to be the same as the Proposed Action. Proposed activities under Alternative C would not involve changes to any Onshore Project components; therefore, impacts on historic aboveground resources in the visual APE for Onshore Project components and terrestrial archaeological resources under Alternative C would be the same as those under the Proposed Action. Given the size, locations, and number of WTGs unaffected by removal under this alternative, impacts on historic aboveground resources in the visual APE for Offshore Project components would not substantially reduce the overall visual impact of the Project on this type of cultural resource. As such, impacts on historic aboveground resources under this alternative are anticipated to be the same or similar to those under the Proposed Action.

Removal of the number of WTGs, OSSs, and associated interlink cables may change the degrees of impact on ASLFs depending on the locations of the removed components in relation to the locations of ASLFs. ASLFs located within the area from which Offshore Project components would be removed would experience no or fewer impacts from the Project. Details on each of the Alternative C sub-alternatives and their specific impacts on ASLFs are provided below.

Alternative C1 would involve the removal of up to 16 WTGs, 1 OSS, and associated interlink cables within the Lobster Hole designated area as identified by NMFS. Implementation of Alternative C1 would result in a reduction of impact severity on one ASLF that has been identified within the area from which Offshore Project components would be removed under this alternative. Alternative C2 would involve the removal of up to 13 WTGs and associated interlink cables within the NMFS-identified sand ridge complex. Implementation of Alternative C2 would result in a reduction of impact severity on two ASLFs that have been identified within the area from which Offshore Project components would be removed under this alternative. Alternative C3 would involve the removal of up to six WTGs and associated interlink cables within the sand ridge complex area identified by NMFS but further demarcated through the use of NOAA’s Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores. Implementation of Alternative C3 would result in a reduction of impact severity on one ASLF that has been identified within the area from which Offshore Project components would be removed under this alternative. In addition to the potential to minimize adverse effects on the aforementioned ASLFs, the ability to fully avoid adverse effects on other ASLFs in the larger vicinity of the removed Offshore Project components under Alternative C could be possible depending on the adjusted interlink cable layout and Atlantic Shores’ implementation of avoidance buffers around the defined resource boundaries. Alternative C4 would involve micrositing 29 WTGs, one OSS, and associated interlink cables outside of 1,000-foot (305-meter) buffers of ridges and swales within AOCs 1 and 2. This alternative is not anticipated to reduce or increase impacts on ASLFs compared to those anticipated for the Proposed Action. As such, impacts on ASLFs under Alternative C4 are anticipated to be similar to those under the Proposed Action.

Removal of Offshore Project components from the Proposed Action, as proposed under any or all of these sub-alternatives, would reduce potential impacts on presently undiscovered marine archaeological resources in these areas. As a result, impacts on individual ASLFs under Alternative C may be reduced or similar compared to those under the Proposed Action depending on the specific locations of removed Offshore Project components and ASLFs. Overall, the majority of ASLFs are located in other areas of the marine APE that are unchanged under Alternative C. As a result, this alternative and its sub-alternatives would not substantially change the impacts on ASLFs overall; therefore, impacts on ASLFs under Alternative C would be similar to those of the Proposed Action.

Cumulative Impacts of Alternative C. The incremental impacts contributed by Alternative C to the cumulative impacts on cultural resources would be the same or similar to those described for the Proposed Action. BOEM anticipates that the cumulative impacts on cultural resources associated with Alternative C and other ongoing and planned activities would be major.

Conclusions

Impacts of Alternative C. The impacts resulting from individual IPFs associated with Alternative C alone on cultural resources may be reduced or similar compared to the Proposed Action depending on the specific locations of removed Offshore Project components. The degree of impacts on specific cultural resources may be reduced from the removal of Offshore Project components under this alternative. As a result, Alternative C would have similar **major** impacts on cultural resources compared to the Proposed Action that may be avoided, minimized, or mitigated depending on Atlantic Shores' implementation of mitigation measures developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative C. The incremental impacts contributed by Alternative C to the cumulative impacts on cultural resources would be appreciable—the same or similar as for the Proposed Action. BOEM anticipates that the cumulative impacts on cultural resources associated with Alternative C when combined with the impacts from ongoing and planned activities including offshore wind would be **major** because the IPFs of anchoring, cable emplacement and maintenance, gear utilization, land disturbance, and presence of structures would result in long-term or permanent disturbance, damage, disruption, and destruction of cultural resources and historic properties located onshore and offshore.

3.6.2.7 Impacts of Alternative D on Cultural Resources

Impacts of Alternative D. Alternative D (No Surface Occupancy at Select Locations to Reduce Visual Impacts) includes three sub-alternatives (D1, D2, and D3) that involve adjustments to the layout and maximum number of WTGs to reduce visual impacts. Due to Atlantic Shores commitment to avoidance of marine archaeological resources (CUL-17, Appendix G, Table G-1), impacts on marine archaeological resources under this alternative are anticipated to be the same as the Proposed Action. However, removal of Offshore Project components under this alternative would reduce potential impacts on presently undiscovered marine archaeological resources areas of removal. Proposed activities under Alternative D would not involve changes to any Onshore Project components; therefore, impacts on historic aboveground resources in the visual APE for Onshore Project components and terrestrial archaeological resources under Alternative D would be the same as those under the Proposed Action.

Impacts on ASLFs as well as historic aboveground resources in the visual APE for Offshore Project components would be different under Alternative D compared to the Proposed Action due to the removal of and modification of the height of Offshore Project components. Removal of WTGs and associated interlink cables may change the degrees of impact on marine cultural resources depending on the locations of the removed components in relation to the locations of marine cultural resources. ASLFs located within the area from which Offshore Project components would be removed would experience no or fewer impacts than for the Project. The ability to fully avoid impacts on ASLFs specified below could be possible depending on the adjusted interlink cable layout and Atlantic Shores' implementation of avoidance buffers around the defined resource boundaries. Removal of Offshore Project components from the Proposed Action would also reduce potential impacts on currently undiscovered marine archaeological resources that may be present in these areas. Reductions in height of the remaining WTGs in the Lease Area would reduce impacts on the number of individual historic aboveground resources subject to visual impacts and the severity of impacts on those resources. Details on each of the Alternative D sub-alternatives and their specific impacts on the aforementioned cultural resource types are provided below.

Alternative D1 would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs from Project 1 (a 10.5 percent reduction from the Proposed Action) and associated interarray cables. Under this alternative, the height of the remaining WTGs in Project 1 would also be restricted to a maximum hub height of 522 feet (159 meters) ASML and a maximum blade tip height of 932 feet (284 meters) ASML. Implementation of this alternative would reduce impact severity on one ASLF and could result in the full avoidance of impacts on seven other ASLFs. Additionally, while Alternative D1 may reduce impact severity on historic aboveground resources in the visual APE for Offshore Project components compared to those under the Proposed Action due to the decreased visibility of the Project, the visual impacts from the size, location, and number of retained WTGs under this alternative would not be substantially different from those of the Proposed Action. Alternative D1 would not enable the avoidance of visual adverse effects on any aboveground historic properties that would be adversely affected by the Proposed Action. This is due to the proximity of the adversely affected historic properties to the coastline; even with the removal or height restrictions under any of the Alternative D sub-alternatives, the views of the Project from these historic properties would still result in an adverse effect. However, BOEM found that the removal of WTGs and institution of WTG height restrictions may allow for a reduction in the severity of these visual adverse effects. As such, overall impacts on historic aboveground resources are anticipated to be similar to those under the Proposed Action despite the decreased visibility of the Project.

Alternative D2 would exclude placement of WTGs up to 12.75 miles (20.5 kilometers) from shore, resulting in the removal of up to 31 WTGs from Project 1 (a 15.5 percent reduction from the Proposed Action) and associated interarray cables. The height of the remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) ASML and a maximum blade tip height of 932 feet (284 meters) ASML. Implementation of this alternative would reduce the impact severity on two ASLFs and could result in the full avoidance of impacts on seven other ASLFs. Additionally, while Alternative D2 may reduce the severity of impacts on historic aboveground resources in the visual APE for Offshore Project components compared to those under the Proposed Action due to the decreased visibility of the Project, the visual impacts from the size, location, and number of retained WTGs under this alternative would not be substantially different from those of the Proposed Action. Alternative D2 would not enable the avoidance of visual adverse effects on any aboveground historic properties that would be adversely affected by the Proposed Action due to the proximity of these historic properties to the coastline. As such, overall impacts on historic aboveground resources are anticipated to be similar to those under the Proposed Action despite the decreased visibility of the Project. Refer to Appendix I, Section I.4.1.1, for figures of the Alternative D2 viewshed in comparison with the Project visual APE.

Alternative D3 would exclude placement of WTGs up to 10.8 miles (17.4 kilometers) from shore, resulting in the removal of up to six WTGs from Project 1 (a 3 percent reduction from the Proposed Action) and associated interarray cables. The height of the remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. Implementation of this alternative would not reduce the impact severity on any ASLFs but could result in the full avoidance of impacts on two ASLFs. Additionally, while Alternative D3 would slightly reduce the visibility of the Project on historic aboveground resources in the visual APE for Offshore Project components, the visual impacts from the size, location, and number of retained WTGs under this alternative would not be substantially different from those of the Proposed Action. Alternative D3 would not avoid visual adverse effects on any aboveground historic properties that would be adversely affected by the Proposed Action due to the proximity of these historic properties to the coastline. As such, the impacts and severity of impacts on these historic aboveground resources are anticipated to be similar to those under the Proposed Action despite the slight decreased visibility of the Project.

Overall, the majority of ASLFs are located in other areas of the marine APE that would be unchanged under Alternative D. As a result, this alternative and its sub-alternatives would not substantially change the impacts on ASLFs overall, and impacts on marine cultural resources under Alternative D would be similar to those of the Proposed Action. Finally, while Alternative D may reduce the severity of visual impacts on historic aboveground resources in the visual APE for Offshore Project components, Alternative D would not reduce the number of visually adversely affected aboveground historic properties from the number affected under the Proposed Action due to the proximity of these historic properties to the coastline.

Cumulative Impacts of Alternative D. The incremental impacts contributed by Alternative D to the cumulative impacts on cultural resources would be the same or similar to those described for the Proposed Action. BOEM anticipates that the cumulative impacts on cultural resources associated with Alternative D and other ongoing and planned activities would be major.

Conclusions

Impacts of Alternative D. The impacts resulting from individual IPFs associated with Alternative D alone on cultural resources may be reduced or similar compared to the Proposed Action depending on the size, location, and number of removed Offshore Project components. The degree of impacts on cultural resources under Alternative D1 and D2 would be reduced compared to that of the Proposed Action, but the degree of impacts on cultural resources under Alternative D3 would be similar. However, the reduction in the severity of impacts on cultural resources under Alternative D would not avoid visual adverse effects on any aboveground historic properties that would be adversely affected by the Proposed Action due to the proximity of these historic properties to the coastline. As a result, Alternative D would have **major** impacts on cultural resources that may be avoided, minimized, or mitigated depending on Atlantic Shores' implementation of mitigation measures developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative D. The incremental impacts contributed by Alternative D to the overall impacts on cultural resources would be noticeable to appreciable. BOEM anticipates that the overall impacts on cultural resources associated with Alternative D when combined with the impacts from ongoing and planned activities including offshore wind would be **major** because the IPFs of anchoring, cable emplacement and maintenance, gear utilization, land disturbance, and presence of structures would result in long-term or permanent disturbance, damage, disruption, and destruction of cultural resources and historic properties located onshore and offshore.

3.6.2.8 Impacts of Alternative E on Cultural Resources

Impacts of Alternative E. Alternative E (Wind Turbine Layout Modification to Establish a Setback Between Atlantic Shores South and Ocean Wind 1) would involve modifications to the wind turbine array layout to create a setback between the WTGs in the lease areas of Atlantic Shores South (OCS-A 0499) and Ocean Wind 1 (OCS-A 0498) to reduce impacts on existing ocean uses. A setback of 0.81 to 1.08 nautical miles (1,500 to 2,000 meters) would occur along the southern boundary of the Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions proposed under the Proposed Action.

Due to Atlantic Shores commitment to avoidance of marine archaeological resources (CUL-17, Appendix G, Table G-1), impacts on marine archaeological resources under this alternative are anticipated to be the same as the Proposed Action. However, removal of Offshore Project components under this alternative would reduce potential impacts on presently undiscovered marine archaeological resources areas of removal. Proposed activities under Alternative E would not involve changes to any Onshore Project components; therefore, impacts on historic aboveground resources in the visual APE for Onshore Project components and terrestrial archaeological resources under Alternative E would be the same as those under the Proposed Action. Given the size, locations, and number of WTGs unaffected by removal under this alternative, impacts on historic aboveground resources in the visual APE for Offshore Project components would not substantially change the overall visual impact of the Project on this type of cultural resource. As such, impacts on historic aboveground resources under this alternative are anticipated to be the same or similar to those under the Proposed Action.

Removal or micrositing of Offshore Project components under this alternative may change the degrees of impact on marine cultural resources depending on the locations of the removed or microsited components in relation to the locations of marine cultural resources. No known marine archaeological resources are located within the proposed setback area; however, the removal of Offshore Project components from the Proposed Action would reduce potential impacts on presently undiscovered but potential marine archaeological resources in this area. Impacts on ASLFs would be different under Alternative E than those anticipated under the Proposed Action due to the removal of Project components to form the setback area. Four ASLFs have been identified within the proposed setback areas under Alternative E. Any setback measuring 0.81 to 1.08 nautical miles (1,500 to 2,000 meters) would result in a reduction of impact severity on these four ASLFs compared to impacts under the Proposed Action but would not fully avoid impacts on these resources. Overall, the majority of ASLFs are located in other areas of the marine APE that would be unchanged under Alternative E. As a result, this alternative would not substantially change the impacts on marine cultural resources overall; therefore, impacts on marine cultural resources under Alternative E would be similar to those of the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on cultural resources would be the same or similar to those described for the cumulative impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on cultural resources associated with Alternative E and other ongoing and planned activities would be major.

Conclusions

Impacts of Alternative E. The impacts resulting from individual IPFs associated with Alternative E alone on cultural resources would be similar to those under the Proposed Action. This is because the nature and physical extent of proposed activities under this alternative would be largely comparable to those of the Proposed Action. As a result, Alternative E would have similar **major** impacts on cultural resources that may be avoided, minimized, or mitigated depending on Atlantic Shores' implementation of mitigation measures developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the overall impacts on cultural resources would be appreciable—the same as for the Proposed Action. BOEM anticipates that the overall impacts on cultural resources associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **major** because the IPFs of anchoring, cable emplacement and maintenance, gear utilization, land disturbance, and presence of structures would result in long-term or permanent disturbance, damage, disruption, and destruction of cultural resources and historic properties located onshore and offshore.

3.6.2.9 Impacts of Alternative F on Cultural Resources

Impacts of Alternative F. Alternative F (Foundation Structures) includes three sub-alternatives (F1, F2, and F3) to analyze the maximum design scenario for each of the three different foundation categories that could be used for WTGs, OSSs, and the met tower proposed for Project 1 and Project 2. Due to Atlantic Shores commitment to avoidance of marine archaeological resources (CUL-17, Appendix G, Table G-1), impacts on marine archaeological resources under this alternative are anticipated to be the same as the Proposed Action. However, removal of Offshore Project components under this alternative would reduce potential impacts on presently undiscovered marine archaeological resources areas of removal. Proposed activities under Alternative F would not involve changes to any Onshore Project components; therefore, impacts on historic aboveground resources in the visual APE for Onshore Project components and terrestrial archaeological resources under Alternative F would be the same as those under the Proposed Action. Additionally, differences in foundation type are not anticipated to result in measurable differences in the impacts on historic aboveground resources in the visual APE for Offshore Project components. As such, impacts on historic aboveground resources overall (i.e., those in the visual APE for both Onshore and Offshore Project components) under Alternative F are anticipated to be the same as those under the Proposed Action.

Impacts on ASLFs would be different under Alternative F than those anticipated under the Proposed Action. These impacts are caused by temporary and permanent seabed disturbances that occur during the construction of WTGs and OSSs. The maximum area of seabed disturbance for each of the three foundation types is subject to differ (COP Volume I, Sections 4.4.1 and 4.6.1 and Tables 4.2-1 and 4.4-2; Atlantic Shores 2024).

Under Alternative F1, piled foundations would be used. Use of the monopile subtype would cause greater seabed disturbance than the piled jacket subtype and therefore greater potential impacts on marine cultural resources. Analyzing the maximum design scenario of this sub-alternative (i.e., use of the monopile subtype), Alternative F1 would result in less severe impacts on ASLFs than Alternative F2 but more severe impacts than Alternative F3. Under Alternative F2, suction bucket foundations would be used. The jacket subtype would cause the greatest seabed disturbance and therefore the most severe impacts on ASLFs among the suction bucket foundations, followed by the mono-bucket subtype, and then the tetrahedron base subtype. Analyzing the maximum design scenario of this sub-alternative (i.e., use of the jacket subtype), Alternative F2 would result in more severe impacts on ASLFs than Alternatives F1 or F3. Under Alternative F3, gravity foundations would be used. Use of the GBS subtype would cause greater seabed disturbance than the gravity-pad tetrahedron base and therefore greater potential impacts on ASLFs. Analyzing the maximum design scenario of this sub-alternative (i.e., use of the GBS subtype), Alternative F3 would result in less severe potential impacts on ASLFs than either Alternative F1 or F2.

In summary, foundations proposed under Alternative F3 would have the least potential for and severity of impacts on ASLFs as a result of having the least area of maximum seabed disturbance. Alternative F2 would have the most potential for and severity of impacts on ASLFs as a result of having the greatest area of maximum seabed disturbance.

Cumulative Impacts of Alternative F. The incremental impacts contributed by Alternative F to the cumulative impacts on cultural resources would be the same or similar to those described for cumulative impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on cultural resources associated with Alternative F and other ongoing and planned activities would be major.

Conclusions

Impacts of Alternative F. The impacts resulting from individual IPFs associated with Alternative F alone on cultural resources may be reduced, the same, similar, or increased compared to those under the

Proposed Action depending on the final foundation type(s) selected under the Proposed Action and specific locations of ASLFs in relation to proposed WTGs and OSSs. The severity of impacts on ASLFs increases with the size of the foundation type and anticipated seabed disturbance. However, overall, the nature and physical extent of proposed activities under this alternative would be largely comparable to those of the Proposed Action. As a result, Alternative F would have similar **major** impacts on cultural resources as the Proposed Action that may be avoided, minimized, or mitigated depending on Atlantic Shores' implementation of mitigation measures developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative F. The incremental impacts contributed by Alternative E to the overall impacts on cultural resources would be appreciable—the same as for the Proposed Action. BOEM anticipates that the overall impacts on cultural resources associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **major** because the IPFs of anchoring, cable emplacement and maintenance, gear utilization, land disturbance, and presence of structures would result in long-term or permanent disturbance, damage, disruption, and destruction of cultural resources and historic properties located onshore and offshore.

3.6.2.10 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM, cooperating agencies, and NHPA Section 106 consulting parties as conditions of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Table G-2 and summarized and assessed in Table 3.6.2-3.

The following mitigation measures to resolve adverse effects on historic properties were developed through BOEM's NHPA Section 106 consultations with federally recognized Tribal Nations, SHPOs, ACHP, and consulting parties. These measures and additional specifics on implementation will be stipulated in the MOA (refer to Appendix I, Attachment A, for a draft of the MOA as of April 10, 2024).

Table 3.6.2-3. Proposed mitigation measures – cultural resources

Mitigation Measure	Description	Effect
Compliance with Section 106 Memorandum of Agreement	The Lessee will comply with stipulations of *The Memorandum of Agreement Among the Bureau of Ocean Energy Management, The Delaware Nation, The Delaware Tribe of Indians, The Mashantucket (Western) Pequot Tribal Nation, The Mashpee Wampanoag Tribe, The Shinnecock Indian Nation, The Stockbridge-Munsee Community Band of Mohican Indians, The State Historic Preservation Officer of New Jersey, The New Jersey Historic Trust, Atlantic Shores Offshore Wind Project 1, LLC, and Atlantic Shores Offshore Wind Project 2, LLC, and the Advisory Council on Historic Preservation*	Compliance with stipulations in the MOA would result in the resolution of adverse effects on historic properties through avoidance, minimization, mitigation, and monitoring measures.

Mitigation Measure	Description	Effect
	Regarding the Atlantic Shores Offshore Wind South Project (hereafter referred to as the MOA) as developed by BOEM through NHPA Section 106 consultations with federally recognized Tribes, New Jersey SHPO, ACHP, and consulting parties to resolve adverse effects on historic properties. As defined in the Section 106 regulations, consulting parties include those who are property owners of or have demonstrated interest in the historic properties BOEM has determined would be adversely affected by the Project.	
Avoidance of Adverse Effects on Historic Properties in Marine Area of Potential Effect	Per MOA Stipulation I.A.1, the Lessee will comply with protective buffers recommended by the Qualified Marine Archaeologist (QMA) for all 22 identified marine archaeological resources to avoid adverse effects on these historic properties in the marine APE.	Implementation of and compliance with horizontal protective buffers to avoid these historic properties in the marine APE would result in negligible impacts on these resources.
Archaeological Monitoring in the Marine Area of Potential Effects	Per MOA Stipulation XII, the Lessee will implement a construction monitoring program consistent with the monitoring plan for marine archaeology (MOA, Attachment 4).	Implementation of and compliance with archaeological monitoring would result in negligible impacts by avoiding these resources, or minor impacts by preventing further physical impacts on the resources. Greater moderate or major impacts could occur if further physical impacts on the resources are unavoidable or require mitigation.
Funding and Implementation of Historic Properties Treatment Plans for Historic Properties in the Marine Area of Potential Effects	Per MOA Stipulation III.A.1 and the associated HPTP (MOA, Attachment 7), the Lessee will implement the measures described in the HPTP and fund these measures per the agreed-upon amounts in *Mitigation Funding Amounts* (Attachment 6) to resolve adverse effects on historic properties in the marine APE.	Implementation of HPTPs detailing and specifying processes, responsibilities, and schedule for completion associated with fulfilling compensatory mitigation actions appropriate to fully address the nature, scope, size, and magnitude of impacts, including cumulative impacts, caused by the Project, on historic properties would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would guide fulfillment of compensatory mitigation actions and resolve adverse effects on specified historic properties per NHPA Section 106.
Marine Archaeology Post-Review Discovery Plan	Per MOA Stipulation XIII, if historic properties are discovered that may be historically significant or unanticipated effects on historic properties are found, or in the event of a post-review discovery of a historic property or unanticipated effects on a historic property prior to or during construction, installation, O&M, or decommissioning of the Project, the Lessee will implement the actions	Implementation of a PRDP would reduce potential impacts on any archaeological resources discovered during construction and installation, O&M, or decommissioning of the Project to a minor level by preventing further physical impacts on the resources. Greater moderate or major impacts could occur if further physical impacts on the resources are unavoidable or require mitigation.

Mitigation Measure	Description	Effect
	described in the post-review discovery plan (PRDP) for marine archaeology (MOA, Attachment 4).	
Archaeological Monitoring in the Terrestrial Area of Potential Effects	Per MOA Stipulation I.A.2 and Stipulation XII, the Lessee will implement a construction monitoring program consistent with the monitoring plan for terrestrial archaeology (MOA, Attachment 5).]	Implementation of and compliance with archaeological monitoring would result in negligible impacts by avoiding these resources or minor impacts by preventing further physical impacts on the resources. Greater moderate or major impacts could occur if further physical impacts on the resources are unavoidable or require mitigation.
Terrestrial Archaeology Post-Review Discovery Plan	Per MOA Stipulation XIII, if historic properties are discovered that may be historically significant or unanticipated effects on historic properties are found, or in the event of a post-review discovery of a historic property or unanticipated effects on a historic property prior to or during construction and installation, O&M, or decommissioning of the Project, Atlantic Shores will implement the actions described in the PRDP for terrestrial archaeology (MOA, Attachment 5).	Implementation of a PRDP would reduce potential impacts on any archaeological resources discovered during construction and installation, O&M, or decommissioning of the Project to a minor level by preventing further physical impacts on the resources. Greater moderate or major impacts could occur if further physical impacts on the resources are unavoidable or require mitigation.
Contribution to a Mitigation Fund	Per MOA Stipulation III.C.1.i, Atlantic Shores will make contributions to a Mitigation Fund per the agreed-upon amounts in *Mitigation Funding Amounts* (Attachment 6) to resolve adverse effects on historic properties in the visual APE. As applicable and specified in the MOA, this will be required in lieu of or in addition to the funding and implementation of HPTPs per Stipulation III.C.1.ii.	Contributions to a mitigation fund would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would provide support for historic preservation and public interpretive and commemorative activities and resolve adverse effects on specified historic properties per NHPA Section 106.
Funding and Implementation of Historic Properties Treatment Plans for Historic Properties in the Visual Area of Potential Effects	Per MOA Stipulation III.C.1.ii and the associated HPTPs, Atlantic Shores will implement the measures described in the HPTPs and fund these measures per the agreed-upon amounts in *Mitigation Funding Amounts* (Attachment 6) to resolve adverse effects on historic properties in the visual APE. As applicable and specified in the MOA, this will be required in lieu of or in addition to contributions to a Mitigation Fund per Stipulation III.C.1.i.	Implementation of HPTPs detailing and specifying processes, responsibilities, and schedule for completion associated with fulfilling compensatory mitigation actions appropriate to fully address the nature, scope, size, and magnitude of impacts, including cumulative impacts, caused by the Project, on historic properties would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would guide fulfillment of compensatory mitigation actions and resolve adverse effects on specified historic properties per NHPA Section 106.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.6.2-3 and Table G-2 in Appendix G are incorporated in the Preferred Alternative. Mitigation to resolve adverse effects on historic properties in compliance with the stipulations of the MOA would not reduce the impacts on the historic property. Rather, these measures would compensate appropriately for the nature, scope, size, and magnitude of impacts, including cumulative impacts, caused by the Project. Implementation of phased identification of terrestrial archaeological resources would not reduce impacts or change the impact level but would ensure identification and evaluation of historic properties within the terrestrial APE that could not be surveyed prior to publication of the Final EIS. Implementation of post-review discovery plans (PRDPs) would reduce potential impacts on presently undiscovered archaeological resources to a minor level by preventing further physical impacts on these resources if any are encountered during construction.

3.6.2.11 Comparison of Alternatives

None of the other action alternatives would affect the types, placement, or areal extent of the onshore components of the Project. As a result, all of the other action alternatives would have the same impacts on historic aboveground resources in the visual APE for Onshore Project components and terrestrial archaeological resources as for the Proposed Action.

All of the other action alternatives would affect the types, placement, or areal extent of the offshore components of the Project. As a result, impacts on historic aboveground resources in the visual APE for Offshore Project components and marine cultural resources are subject to change under the other action alternatives compared to the Proposed Action.

Three of the other action alternatives (i.e., Alternatives C, D1, D2, and F) may reduce the number of individual cultural resources subject to adverse impacts depending on the specific locations of affected Offshore Project components and cultural resources. However, while Alternatives D1 and D2 would reduce the impacts on cultural resources overall to a moderate level, Alternatives C and F would not reduce the overall impacts and would still result in major impacts. Several action alternatives (i.e., Alternatives C, D3, E, and F) may also result in the same or similar major impacts on cultural resources as the Proposed Action due to the largely comparable nature or physical extent of proposed activities under these alternatives compared to the Proposed Action. Lastly, two of the other action alternatives (i.e., Alternatives C and F) may increase the number of or scale to which individual cultural resources would be subject to adverse impacts, depending on the specific locations of affected Offshore Project components and cultural resources, and result in major impacts on cultural resources. In all of the other action alternatives, individual cultural resources are still subject to negligible to major impacts on a case-by-case basis.

3.6.2.12 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of the Proposed Action and Alternatives C4, D3, and E, as well as two agency-proposed mitigation measures, as described in Section 2.1.7. Under the Preferred

Alternative, 29 WTGs, 1 OSS, and their associated interarray cables would be microsited outside of the 1,000-foot (305-meter) buffer of the sand ridge and swale features within AOC 1 (Lobster Hole) and AOC 2 (NMFS-identified sand ridge complex); WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and a maximum blade tip height of 932 feet (284 meters); 2 WTGs would be removed and 1 WTG would be microsited to establish a 0.81-nautical mile (1,500-meter) setback between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area; and no permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1,.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. Additionally, one WTG sited approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site) would be removed. The Preferred Alternative would require the proposed OSSs, met tower, and WTGs be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart. The Preferred Alternative would include up to 195 WTGs,[2] up to 10 OSSs, up to 1 permanent met tower, interarray and interlink cables, 2 onshore substations and/or converter stations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

The **major** adverse impacts on cultural resources associated with the Proposed Action would not change substantially under the Preferred Alternative. The Preferred Alternative would include a reduction in the number of WTGs compared to the Proposed Action and modify the wind turbine array layout. This would lessen the overall severity of physical and visual impacts on a limited proportion of identified cultural resources; however, the impact level would not change. Accordingly, impacts of the Preferred Alternative alone would remain of the same level as for the Proposed Action.

BOEM anticipates that the cumulative impacts of ongoing and planned activities, including the Preferred Alternative and connected action, would result in similar impacts as the Proposed Action: **major**.

[2] 195 WTGs assume that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

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3.6.3 Demographics, Employment, and Economics

The reader is referred to Appendix F, *Assessment of Resources with Moderate (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.

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3.6.4 Environmental Justice

The reader is referred to Appendix F, *Assessment of Resources with Moderate (or Lower) Impacts,* for a discussion of current conditions and potential impacts on environmental justice from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.6.5 Land Use and Coastal Infrastructure

The reader is referred to Appendix F, *Assessment of Resources with Moderate (or Lower) Impacts,* for a discussion of current conditions and potential impacts on land use and coastal infrastructure from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.6.6 Navigation and Vessel Traffic

This section discusses navigation and vessel traffic characteristics and potential impacts on waterways and water from the proposed Project, alternatives, and ongoing and planned activities in the navigation and vessel traffic geographic analysis area. The navigation and vessel traffic geographic analysis area, described in the NSRA (COP Volume II, Appendix II-S; Atlantic Shores 2024) as the WTA, and shown on Figure 3.6.6-1, is located within Lease Area OCS-A 0499 and includes coastal and marine waters within a 10-mile (16.1-kilometer) buffer of the Offshore Project area and adjacent Lease Areas OCS-A 0498 (Ocean Wind 1), OCS-A 0532 (Ocean Wind 2), and OCS-A 0549 (Atlantic Shores North), as well as waterways leading to ports in New Jersey, Virginia, and Texas that may be used by the Project. This study area as defined by the NSRA was used for analysis in this Final EIS. These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction and installation, O&M, and decommissioning.

The Atlantic Shores South Project includes two wind energy facilities (Project 1 and Project 2), one in the western section and one in the eastern section of the Lease Area and includes two offshore ECCs within federal and New Jersey state waters. Information presented in this section draws primarily upon the NSRA,[1] which was conducted per the guidelines in USCG Navigation and Vessel Inspection Circular (NVIC 01-19) (USCG 2019) and Commandant Instruction (COMDTINST) 16003.2B (USCG 2019).

[1] The NSRA analyzed vessel traffic that navigated within or near the WTA (Figure 3.6.6-1) based on 3 years of AIS data (2017–2019). The analysis included studies of vessel traffic patterns, density, and numbers as well as anticipated changes in traffic from the Atlantic Shores South Project.

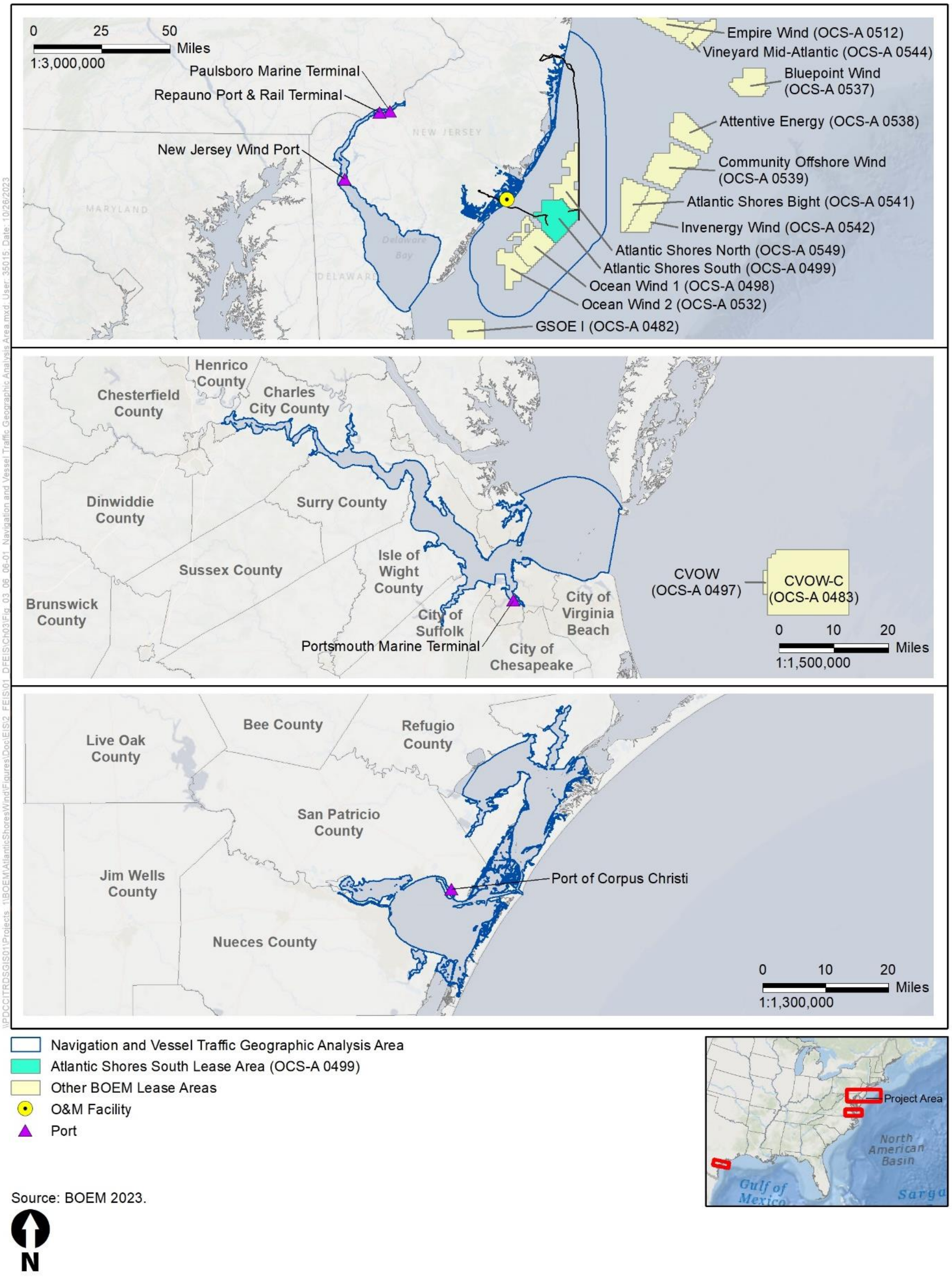


Figure 3.6.6-1. Navigation and vessel traffic geographic analysis area

3.6.6.1 Description of the Affected Environment and Future Baseline Conditions

Regional Setting

Marine transportation in the region is diverse and sourced from many ports and private harbors. Commercial vessel traffic in the region includes research, tug/barge, tankers (such as those used for liquefied petroleum gas (LPG), cargo, cruise ships, smaller passenger vessels, and commercial fishing vessels. Recreational vessel traffic includes private motorboats and sailboats. The Northeast Regional Planning Body (2016) anticipates that major vessel traffic routes will be relatively stable in the region for the foreseeable future, but that coastal developments and market demands that are unknown at this time could affect them. One new regional maritime highway project received funding from the Maritime Administration: a new barge service (Davisville/Brooklyn/Newark Container-on-Barge Service) is proposed to run twice each week in state waters between Newark, New Jersey, and Brooklyn, New York (Appendix D, *Ongoing and Planned Activities Scenario*, Section D.2.9).

The Atlantic Shores South Project would be located approximately 8.7 miles (14 kilometers) from the New Jersey shoreline under a Commercial Lease for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0499). The nearest major port to the Project area is the NJ Wind Port which is in the Delaware Bay, New Jersey, approximately 70 miles (113 kilometers) west of the Project area.

An assessment of shipping fairways along the Atlantic Coast, the Atlantic Coast Port Access Route Study (ACPARS) (USCG 2016) has advanced in the rulemaking process into Advanced Notice of Proposed Rulemaking (ANPRM) (USCG 2022), seeking to formally establish the proposed shipping safety fairways along the Atlantic Coastline. There may be updates as the USCG rulemaking process advances. There are two fairways in the vicinity of the Lease Area: the St. Lucie to New York Fairway to the east of the Lease Area, which is outside the WTA and would not affect the WTA layout; and the Cape Charles to Montauk Point Fairway to the west of the Lease Area, which is indicated as a Tug-Tow Extension Lane intended for use primarily by tug-barge tows and does show occasional overlap with the western edge of the Lease Area.

As part of supplementing and updating ACPARS, there are several regional ongoing PARS, which also consider port approaches and international approaches and departures connecting to the ANPRM-identified shipping safety fairways. On September 9, 2022, USCG released a Consolidated Port Approaches Port Access Route Studies (PARS). This report summarizes the findings of four regional PARS: the Northern New York Bight; Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware; Approaches to the Chesapeake Bay, Virginia; and the Seacoast of North Carolina Including Approaches to the Cape Fear River and Beaufort Inlet, North Carolina. The final report for this study (COP Volume II, Appendix II-S, Section 3.2.3; Atlantic Shores 2024), *Seacoast of New Jersey Including Offshore Approaches to Delaware Bay, Delaware*, included two recommendations relevant to the Lease Area: a modification of the proposed Cape Charles to Montauk Point Fairway such that it does not interfere with the offshore wind lease areas, and support for the proposed establishment of a deep-draft fairway to the east of the Lease Area.

Traffic patterns, density, and statistics were developed from 3 years of AIS data (2017–2019) supplemented with NOAA's VMS data (COP Volume II, Appendix II-S; Atlantic Shores 2024). A summary of the data indicates that traffic is highest in the months between May and September, with June and July having the highest traffic each year. The vessel traffic varies by year, with 2019 having the highest number of vessel tracks and 2017 the lowest. The majority of the traffic traveled in a north-northeast and south-southwest heading.

Project Area

Vessel Traffic

The NSRA used AIS vessel traffic data, VMS data for fishing vessels, USCG maritime incident data, NOAA nautical charts, and other publicly available data. AIS is only required on vessels with a length of 65 feet (19.8 meters) or longer, although some smaller recreational and fishing vessels may choose to carry it. As many commercial fishing vessels are less than 65 feet (19.8 meters) in length, the NSRA supplemented the AIS data with VMS data. As commercial fishing vessels in the combined VMS and AIS are likely to be somewhat underreported (COP Volume II, Appendix II-S, Section 6.2; Atlantic Shores 2024), the number of fishing vessels that could potentially transit near or within the WTA was increased by 100 percent to account for the non-AIS equipped fishing vessels. "Other" vessels consist of 113 unique commercial vessels not covered by other categories, including dredgers, cable-laying, and survey vessels (COP Volume II, Appendix II-S, Section 6.3; Atlantic Shores 2024). The vessel transits within the WTA are summarized in NSRA Table 6.2, with "unique vessels" being those identified by name and Maritime Mobile Service Identity (MMSI), and "unique tracks" identified by the time and distance intervals between data points. Figure 3.6.6-2 illustrates vessel traffic in the vicinity of the Lease Area.

Table 3.6.6-1. Vessel types within the WTA based on 2017–2019 AIS data

	Unique Vessels		Unique Tracks	
	Number	Percentage	Number	Percentage
Dry Cargo Vessels	780	27	3,169	26
Tankers	186	6	302	2
Passenger Vessels	84	6	304	2
Tug-barge Vessels	177	6	861	7
Military Vessels*	0	0	0	0
Recreational Vessels	998	34	1,713	14
Fishing Vessels	329	11	5,101	41
Other Vessels	113	4	489	4
Unspecified AIS Type	218	9	489	4
Total (2017–2019)	**2,915**	**100**	**12,315**	**100**
Annual Average Vessel Tracks			**4,105**	

Source: COP Volume II, Appendix II-S, Table 6.2; Atlantic Shores 2024.
*No military vessels had transits through the WTA.

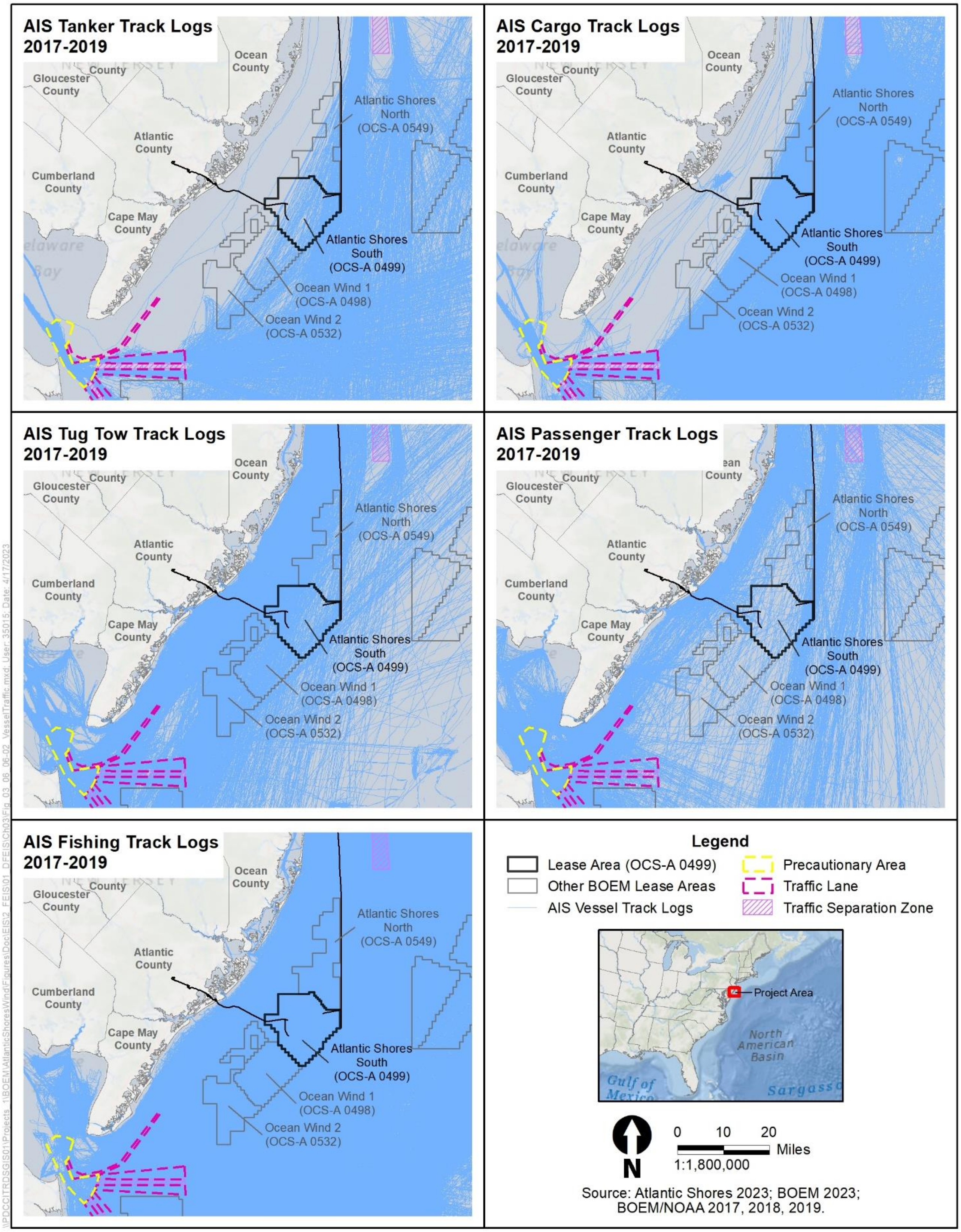


Figure 3.6.6-2. Vessel traffic in the vicinity of the Lease Area

Aids to Navigation

There are Private Aids to Navigation (PATONs), Federal Aids to Navigation (ATONs), and radar transponders located in the vicinity of the WTA but not within the WTA. They consist of lights, sound horns, buoys, and onshore lighthouses and are intended to serve as visual references to support safe maritime navigation. Near the WTA, there are several buoys, with the closest buoy being a PATON located approximately 1 nautical mile south of the southeast corner of the WTA. Other ATONs are located inshore of the WTA. ATONs are developed, established, operated, and maintained or regulated by USCG to assist mariners in determining their position, identifying safe courses, and warning of dangers and obstructions.

There are several federal aids to navigation near shore of the Monmouth ECC, and two private aids outside but near to the Monmouth ECC. There are no federal or private aids to navigation within or near the Atlantic ECC (Figure 3.6.6-3).

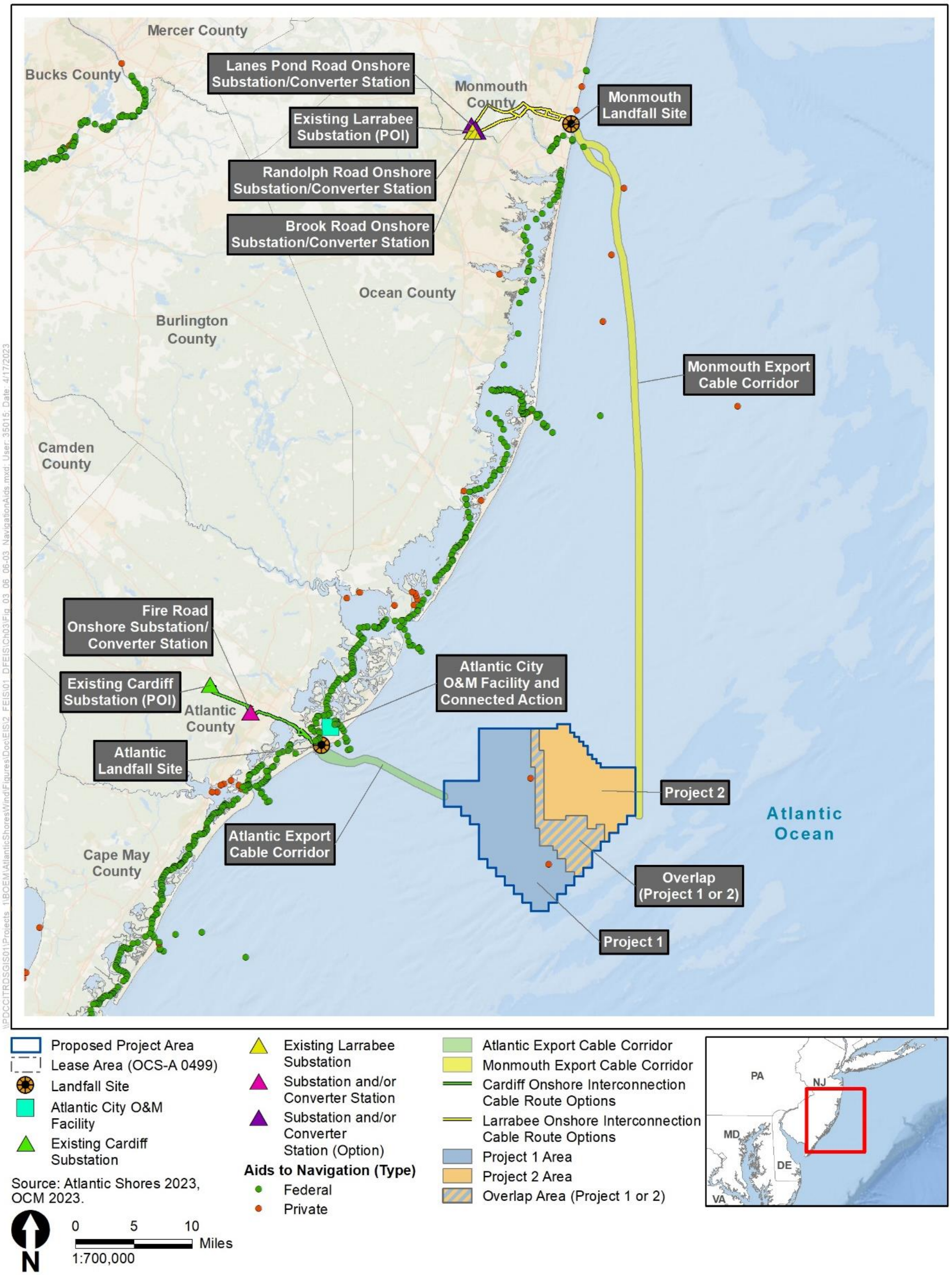
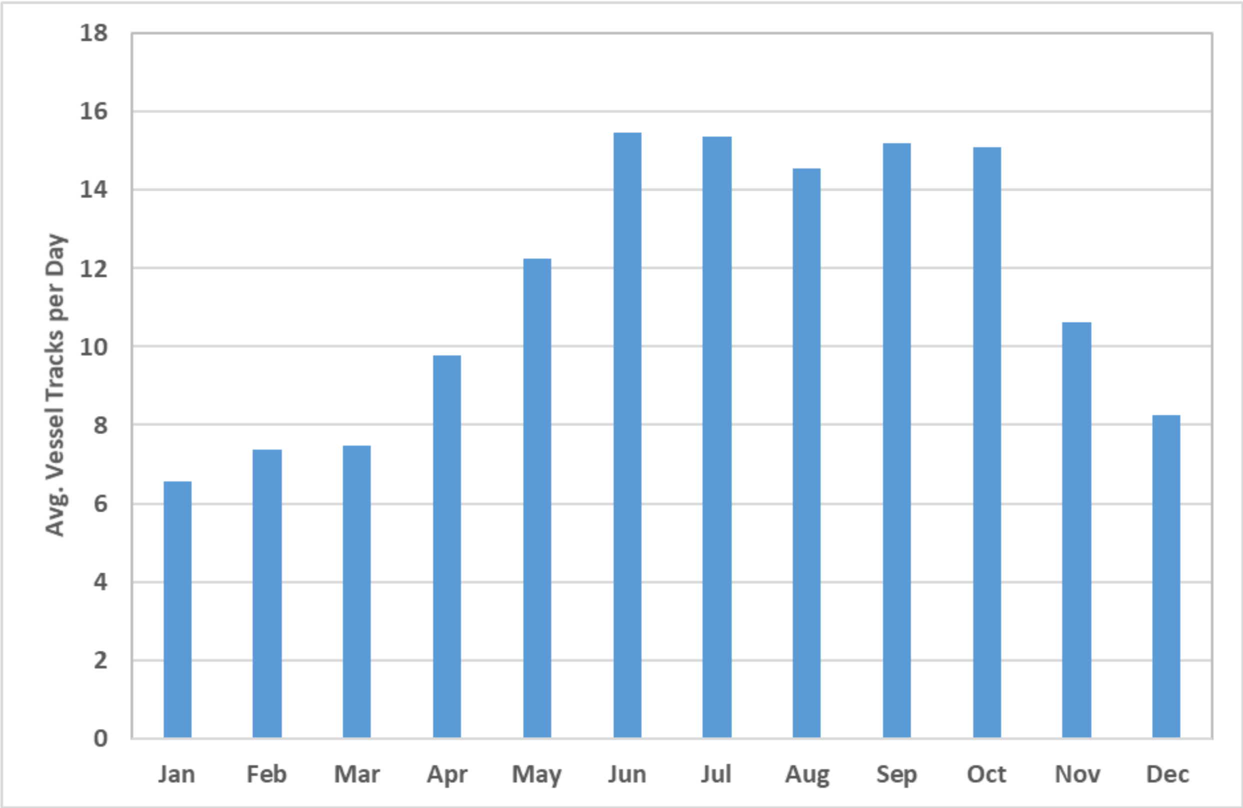


Figure 3.6.6-3. Aids to Navigation in the vicinity of the Lease Area

Ports, Harbors, and Navigation Channels

The closest ports to the Project area and the Cable Landing Locations are the NJ Wind Port, the Paulsboro Marine Terminal, and the Port of Wilmington within the Delaware Bay and River, Delaware basin. These are ports of call for large commercial deep-draft ships and tug/barge units as well as smaller commercial and non-commercial shallower-draft vessels. Most of the traffic in the vicinity of the Project area consists of transits of fishing and pleasure vessels to or from three major New Jersey commercial fishing ports: Long Beach-Barnegat, Atlantic City, and Cape May-Wildwood. North of the Project area is the outer portion of the approach to New York Harbor, Ambrose Channel, and the AIS data shows a large distribution of deep-draft ships within this passage. Larger commercial vessels—including passenger, dry cargo, and tanker vessels—made an average of 1,258 transits through the WTA in a 3-year period. Deep-draft traffic within the WTA is predominately along a north-northeast to south-southwest course and density within the WTA increases towards the east with very little traffic in the western section of the WTA (COP Volume II, Appendix II-S, Section 6.9; Atlantic Shores 2024).

USACE documents vessel and trip information for major American ports. The NSRA considers commercial cargo vessels, military vessels, towing, fishing, and recreation vessels (COP Volume II, Section 7.6.1.2; Atlantic Shores 2024). As shown in Figure 3.6.6-4, during the study period (2017–2019), an average of 11.5 unique vessels per day passed through the WTA; however, the traffic is seasonal and recorded vessel traffic through the WTA averaged 15.5 vessels per day in June of each year of the study. Vessel traffic is highest in the months between May and September, with June and July having the highest vessel traffic each year. The most frequently recorded unique vessel type transiting within the Project area were dry cargo vessels at 27 percent, with fishing vessels next at 11 percent. It should be noted that there was a higher percentage (41 percent) of fishing vessel “unique tracks,” indicating that an individual fishing vessel transited the WTA more than once.



Source: COP Volume II, Appendix II-S, Figure 6.2; Atlantic Shores 2024.

Figure 3.6.6-4. Summary of average vessel tracks per day through the WTA (2017–2019)

Atlantic Shores has identified five port facilities in New Jersey, Virginia, and Texas that may be used for major construction staging activities for the Atlantic Shores South Project. These are the New Jersey Wind Port, Paulsboro Marine Terminal, and Repauno Port and Rail Terminal in New Jersey, Portsmouth Marine Terminal in Virginia, and the Port of Corpus Christi in Texas.

Construction ports would be utilized for the following functions:

- Crew transfers;
- Component fabrication and assembly;
- Receiving and offloading shipments of Project components;
- Storing Project components;
- Preparing Project components for installation;
- Loading Project components onto installation vessels or other suitable vessels for delivery to the Offshore Project area for installation; and
- Preparing vessels to tow floating components to the WTA.

All port facilities being considered to support Project construction are located within industrial waterfront areas with existing marine industrial infrastructure or where such infrastructure is proposed for development within the required timeframe. Atlantic Shores would not implement any port improvements itself. Any port development would occur independent of the Project, including any permitting or approvals that the port facility owner/lessor may need to obtain for port improvements.

The NSRA analyzed vessel incidents using data gathered from USCG for a period of 14 years (2004–2018). This information is discussed in Section 3.6.7, *Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys).* In summary, SAR incidents occurred during all seasons, half during daylight hours and half during nighttime, and varied between disabled vessels, medical issues, and other incidents, but there were no recorded allisions, collisions, or groundings in the WTA (COP Volume II, Appendix II-S, Section 10.1; Atlantic Shores 2024). In July 2021, Atlantic Shores conducted a SAR Risk Assessment Workshop to methodically review the potential impacts of the proposed Project on the USCG's SAR operations and to identify recommended mitigations. Participants of this workshop included Atlantic Shores, BOEM, and USCG. The SAR Risk Assessment Workshop Summary Report is part of the COP (Volume II Appendix II-T4; Atlantic Shores 2024), and recommendations from this workshop that would be adopted would be included in Atlantic Shores' Emergency Response Plan.

3.6.6.2 Impact Level Definitions for Navigation and Vessel Traffic

This Final EIS uses a four-level classification scheme to characterize potential impacts of alternatives, including the Proposed Action, as shown in Table 3.6.6-2. See Section 3.3, *Definition of Impact Levels,* for a comprehensive discussion of the impact level definitions. There are no beneficial 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 small, localized, and temporary. 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 activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for navigation and vessel traffic. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix D.

Impacts of Alternative A – No Action

Under the No Action Alternative, baseline conditions for navigation and vessel traffic described in Section 3.6.6.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore and offshore wind activities. See Appendix D, Table D.A1-13 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for navigation and vessel traffic. There is one ongoing offshore wind activity within the geographic analysis area for navigation and vessel traffic: Ocean Wind 1 in Lease Area OCS-A 0498.

Ongoing non-offshore 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 have the potential to require modifications to existing port infrastructure and aids to navigation, with the former adding to port congestion and limited berths during construction activities.

Cumulative Impacts of Alternative A – No Action

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

Planned non-offshore wind activities that may affect navigation and vessel traffic in the geographic analysis area include dredging and port improvement projects, and installation of new structures on the OCS (see Appendix D, Section D.2 for a description of 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. Planned offshore wind projects include Ocean Wind 2 in Lease Area OCS-A 0532 and Atlantic Shores North in Lease Area OCS-A 0549. In addition, USCG is planning to establish shipping safety fairways or other vessel-routing measures along the Atlantic Coast of the United States as referenced in Section 3.6.1. The purpose of the fairways is to protect maritime commerce and safe navigation amidst the non-offshore wind activities described in this section. See Table D.A1-13 for a summary of non-offshore wind activities and the associated IPFs for navigation and vessel traffic. BOEM expects offshore wind development 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 USCG to avoid laying export cables through any traditional or designated lightering/anchorage areas, meaning that any risk of impacts for deep-draft vessels would come from anchoring in an emergency scenario. Generally, larger vessels accidently dropping anchor on top of an export cable (buried or otherwise 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.

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. Given the small size of the geographic analysis area compared to the remaining area of open ocean around and near the Project area, 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. The overall traffic density within the WTA was found to be relatively low, with two or more vessels present in the WTA for only 15.6 percent of the time on average (COP Volume II, Appendix II-S, Section 13.1; Atlantic Shores 2024).

Lightering and anchoring operations are expected to continue at or near current levels, with the expectation of moderate increase commensurate with any increase in tankers visiting ports. Deep-draft visits to major ports are expected to increase as well, increasing the potential for an emergency need to anchor, and thereby creating navigational hazards for other vessels. Recreational activity and commercial fishing activity would likely stay largely the same related to this IPF.

Cumulative impacts on navigation and vessel traffic from anchoring would likely be minor because impacts would be small, short term, and localized, and navigation and vessel traffic would be expected to fully recover following the disturbance.

Cable emplacement and maintenance: Based on the assumptions in Appendix D, Table D.A2-1, the 98 WTGs for the ongoing Ocean Wind 1 Project would require a maximum of 194 miles (312 kilometers) of export cable, plus a maximum of 190 miles (306 kilometers) of interarray cables; the 109 WTGs for the planned Ocean Wind 2 Project would require a maximum of 200 miles (322 kilometers) of export cable plus a maximum of 173 miles (278 kilometers) of interarray cables; and the 157 WTGs for the planned Atlantic Shores North Project would require a maximum of 331 miles (533 kilometers) of export cable plus a maximum of 466 miles (750 kilometers) of interarray cable (Appendix D, Table D.A2-1).

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 that there would likely be simultaneous cable-laying activities from multiple projects based on the estimated construction timeline (Appendix D, Table D-3). 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 cumulative impacts of this IPF on vessel traffic and navigation under the No Action Alternative would be minor because impacts would be short term, localized, and most disruptive during peak construction activity of the offshore wind projects in the geographic analysis area in 2026 (Appendix D, Table D.A2-1).

Port utilization: As described in Section D.2 of Appendix D, offshore wind development would support planned expansions and modifications at ports in the geographic analysis area for navigation and vessel traffic, including Paulsboro Marine Terminal, New Jersey, New Jersey Wind Port in New Jersey, and Portsmouth Marine Terminal in 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.

Major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The Marine Commerce Terminal (MCT) is being upgraded by the Port of New Bedford specifically to support the construction of offshore wind facilities, and the New Jersey Wind Port is being developed as a marshaling and manufacturing site for offshore wind projects (COP Volume I, Table 4.10-2; Atlantic Shores 2024). As explained in Appendix D, Section D.2.6, *Dredging and Port Improvement Projects,* the New Jersey Wind Port would be sited on the eastern shore of the Delaware River in Lower Alloways Creek, Salem County. The development plan includes dredging the Delaware River Channel, and construction commenced in September 2021 with a targeted completion date of 2024 (New Jersey Wind Port 2021, 2024; Salem County 2021). Phase 2 of the project is anticipated to come online in 2026 and would include 35 acres of additional marshalling space, enabling two projects to marshal from the Port concurrently (New Jersey Wind Port 2024). The Delaware River Channel dredging project provides deepening of the existing Delaware River Federal Navigation Channel, bend widening, partial deepening of the Marcus Hook anchorage, and relocation and addition of aids to navigation. The deeper channel would allow for more efficient transportation of containerized, dry and liquid bulk, break bulk, roll-on/roll-off, and project cargoes to and from Delaware River ports (USACE 2021). The channel project would improve port access to the New Jersey Wind Port, Paulsboro Marine Terminal, and Repauno Port and Rail Terminal. Expansion of port facilities can introduce large, modern port infrastructure into the viewsheds of nearby historic properties, impacting their setting and historic significance.

USACE is implementing a dredging and beach nourishment project in Monmouth County for the Shrewsbury and Navasink Rivers and Long Branch and Monmouth Beach. The Long Beach nourishment project is scheduled to be completed in 2024 (Office of Congressman Frank Pallone 2023). A USACE project for dredging Wildwood Channel is expected to be completed in mid-2024 (City of Wildwood 2023.)

A channel deepening project at the Port of Virginia is currently underway with USACE and a private contractor engaged in dredging approximately 1.1 million cubic yards (0.84 cubic meters) of sediment from the federal channel in Norfolk Harbor and Newport News, Virginia (USACE 2019). The project is anticipated to be completed in 2024, resulting in a channel depth of over 50 feet (15 meters) in the harbor, which would allow it to accommodate two ultra-large container vessels simultaneously (The Port of Virginia 2021).

In 2018, two NJDOT projects, High Bar Harbor channel and Barnegat Light Stake channel, both near Barnegat Inlet in Ocean and Long Beach Townships, New Jersey, underwent dredging of approximately 39,150 cubic yards (29,932 cubic meters) and 3,230 cubic yards (2,469 cubic meters), respectively, to maintain the depths of these channels. Maintenance dredging for both projects is authorized until December 2025 and is expected to occur before the permits expire (USACE 2015a, 2015b). Barnegat Light is the primary commercial seaport on Long Beach Island and is the homeport to approximately 36 commercial vessels. Barnegat Light's two commercial docks are home to several scallop vessels, longliners, and a fleet of smaller inshore gillnetters (New Jersey Department of Agriculture 2020).

USACE has received numerous permit applications for private dock, boat lift, and bulkhead repairs in Barnegat Bay, New Jersey (USACE 2022).

Under the No Action Alternative, three ongoing and planned offshore wind projects in the analysis area—Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North—would generate vessel traffic during construction (Appendix D, Table D-3). Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North are estimated to be under construction between 2026 and 2030 (Appendix D, Table D.A2-1). During peak construction activity for these three projects, impacts on port utilization would be moderate, short term, continuous, and localized to the ports and their maritime approaches.

Ports would need to perform maintenance and upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Impacts would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.

Future activities with the potential to result in port expansion impacts include construction and operation of 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; fisheries use and management; and oil and gas activities. Port expansion would continue at current levels, which reflect efforts to capture business associated with the offshore wind industry (irrespective of specific projects).

The increase in port utilization due to this 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. As discussed under the *Impacts of Alternative A – No Action,* section, offshore wind construction activities may result in competition for scarce 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 being approximately 34 years, with magnitudes and impacts similar to those described for construction.

Presence of structures: Under the No Action Alternative, approximately 378 foundations (Appendix D, Table D-3) would be constructed in the geographic analysis area. Structures in this area would pose navigational hazards to vessels transiting within and around areas leased for offshore wind projects. Offshore wind projects would increase navigational complexity and ocean space use conflicts, including the presence of WTG and OSS structures in areas where no such structures currently exist, potential compression of vessel traffic both outside and within offshore wind lease areas, and potential difficulty seeing other vessels due to a cluttered view field.

Another potential impact of offshore wind structures is interference with marine vessel radars. The BOEM-sponsored National Academies study *Wind Turbine Generator Impacts to Marine Vessel Radar* (2022), which assessed the impact of WTGs located on the OCS on marine vessel radar, concluded that impacts of wind turbines on marine vessel radar are situation-dependent, and that there are active and passive means to ameliorate any interference. USCG noted in its final *Areas Offshore of Massachusetts and Rhode Island Port Access Route Study* (USCG 2020) that various factors play a role in potential marine radar interference by offshore wind infrastructure, stating that “the potential for interference with marine radar is site specific and depends on many factors including, but not limited to, turbine size, array layouts, number of turbines, construction material(s), and the vessel types.” In the event of radar interference, other navigational tools are available to ship captains.

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 and OSSs. If marine mammals choose to avoid WTGs and OSSs, this could potentially increase the risk of cetacean interaction with vessels, marginally increasing the likelihood of a vessel strike outside the offshore wind lease areas. Fishing near artificial reefs is not expected to change meaningfully over the next 34 years. Overall, the impacts of this IPF on navigation and vessel traffic would be moderate, long term (as long as structures remain), regional (throughout the entire geographic analysis area for navigation and vessel traffic), and constant (COP Volume II, Section 7.4.4; Atlantic Shores 2024).

Traffic: Offshore wind projects would generate vessel traffic during construction, operation, and decommissioning within the navigation and vessel traffic geographic analysis area. Other vessel traffic in the region (e.g., from 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 that the total increase in vessel traffic would be distributed across multiple ports in the region.

As shown in Appendix D, Table D-3, the increase in vessel traffic and navigation risk due to offshore wind projects in the Project area would increase beginning in 2026 through 2030 when up to 378 foundations associated with offshore wind projects other than the Proposed Action (Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North) would be under construction. During this construction period for Ocean Wind 1, a maximum of 18 vessels could be operating simultaneously in the geographic analysis area at any given time (Ocean Wind COP Volume I, Chapter 6, Table 6.1.2-3; Ocean Wind 2022). The presence of offshore wind project vessels would add to the overall Atlantic Coast vessel traffic levels as each offshore WTAs are developed, leading to increased congestion and navigational complexity, which could result in crew fatigue, damage to vessels, injuries to crews, engagement of USCG SAR, and vessel fuel spills. Increased offshore wind-related vessel traffic during construction would have moderate, short-term, localized impacts on overall (wind and non-wind) vessel traffic and navigation.

After offshore wind projects are constructed, related vessel activity at the construction ports would decrease in the O&M period, but total vessel traffic including to and from the O&M facility would increase in the O&M period. Vessel activity related to the operation of offshore wind facilities would consist of scheduled inspection and maintenance activities with corrective maintenance as needed. During operations, project-related vessel traffic would have long-term, intermittent, localized impacts on overall vessel traffic and navigation. Vessel activity would increase again during decommissioning at the end of the assumed 30-year operating period of each project, with magnitudes and impacts similar to those described for construction. As stated under the *Presence of Structures* IPF*,* absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 30 years. Even with increased port visits by deep-draft vessels, this is still a relatively small adjustment when considering the whole of mid-Atlantic vessel traffic. The presence of navigation hazards is expected to continue at or near current levels.

Conclusions

Impacts of Alternative A – No Action. BOEM expects ongoing 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 that the navigation and vessel traffic impacts as a result of ongoing activities, especially port utilization and vessel traffic, would be **moderate**.

Cumulative Impacts of Alternative A – No Action. 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. Planned activities other than offshore wind include port expansion, cable emplacement and maintenance, and SAR operations. BOEM anticipates that 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 moderate impacts on navigation and vessel traffic.

The increased vessel traffic associated with these activities 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 areas where no such structures currently exist, also increasing the risk for collisions, allisions, and resultant accidental releases and threats to human health and safety. BOEM anticipates that the overall impacts associated with the No Action Alternative, when combined with all other planned activities (including offshore wind) in the geographic analysis area would result in overall **moderate adverse** impacts due to the presence of structures, port utilization, and vessel traffic.

3.6.6.4 Relevant Design Parameters and Potential Variances in Impacts

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

- The Project layout includes the number, type, and placement of the WTGs, off-grid OSSs, and met tower, including the location, width, and orientation of the WTA rows and columns;
- The number of and types of vessels utilized for construction and installation;
- The offshore electric cable corridor routes/locations;
- Time of year and duration of offshore construction;
- Ports utilized to support construction and installation;
- The number of and types of vessels utilized for O&M support; and
- Ports selected to support O&M.

Variability of the proposed 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 OSSs; the exact placement of the met tower; and the construction sequence, as shown in Table 2-2 in Chapter 2, *Alternatives*. Variances in these factors could affect vessel traffic and navigation choices. This section has assessed the maximum-case scenario, so variances from this scenario should lead to similar or reduced impacts.

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 Project area and on the approach to ports used by the Proposed Action, as well as obstructions to navigation caused by Proposed Action activity. During construction, the potential IPFs to marine transportation and navigation may include short-term increase in Project-related construction vessel traffic, short-term presence of partially installed structures, and short-term safety zone implementation. Atlantic Shores would implement measures, as appropriate, to avoid, minimize, and mitigate impacts during Project construction. COP Volume I, Table 4.10-1 (Atlantic Shores 2024) summarizes the Project-related vessel traffic (representative numbers and types of vessels) anticipated during Proposed Action construction.

Anticipated changes in vessel traffic from the Project were estimated to include:

- Project-related vessel traffic related to construction and installation, O&M, and decommissioning activities;

- Additional non-Project traffic that might be generated by the presence of the Project, for example, pleasure vessel trips for sight-seeing or recreational fishing; and
- The modification of usual traffic routes for larger commercial cargo ships, tankers and military vessels due to the presence of WTGs, off-grid OSSs, and met tower and due to the OSSs and met tower being sited outside of the gridded layout of the WTGs.

Impacts on navigation and vessel traffic would also include changes to navigational patterns and to 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. The Proposed Action's impacts on recreation and tourism and commercial fisheries and for-hire recreational fishing are addressed in Sections 3.6.8 and 3.6.1, respectively.

The NSRA marine risk analysis modeled the frequency of non-Project vessel accidents that could result from installation of the Proposed Action WTGs, OSSs, and met tower. The future case assessments for marine accidents account for Project- and location-specific environmental, traffic, and operational parameters. Detailed information about the risk analysis is included in the NSRA (COP Volume II, Appendix II-S, Section 8.3.2; Atlantic Shores 2024). The risk analysis calculated the frequency of hazards due to the following navigation hazards (COP Volume II, Appendix II-S, Section 8.3.2; Atlantic Shores 2024):

- Vessel grounding
- Vessel collisions
  - Head-on
  - Overtaking
  - Crossing
- Vessel to structure allision risk
  - Powered vessel
  - Drifting vessel
  - Results of the NSRA risk modeling are described in the *Traffic* IPF below.

Anchoring: There are no designated anchoring areas in the proximity of the WTA and ECCs. There are two fairways in the vicinity of the Lease Area: the St. Lucie to New York fairway to the east of the Lease Area, which is outside the WTA and would not affect the WTA layout, and the Cape Charles to Montauk Point Fairway to the west of the Lease Area, which is indicated as a Tug-Tow Extension Lane intended for use primarily by tug-barge tows.

It is not expected that anchorage areas would have an impact on the Project (COP Volume II, Section 7.6.1.1; Atlantic Shores 2024). There would be no restrictions on anchoring within the Lease Area, it is considered unlikely that commercial vessels would seek to do so once the Offshore Project components were installed, and as such the existing activity is likely to be displaced. Based on the NSRA study data, the level of activity which may be displaced is low and there is established anchoring space inshore of the Lease Area.

The presence of the Offshore Project components may create an underwater snapping or contact risk to vessel anchoring in close proximity, such as:

- A vessel drops anchor over a subsea cable in an emergency;
- The deployed anchor of a vessel fails to imbed causing the anchor to drag over a subsea cable;
- A departing vessel neglects to raise anchor and drags it over a subsea cable; or
- The anchor is negligently or accidently deployed over a subsea cable.

Given the small size of the Offshore Project 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, impacts on navigation and vessel traffic are anticipated to short term and minor.

Cable emplacement and maintenance: The Proposed Action would require the installation of offshore export cables and interarray cables. The presence of slow-moving (or stationary) installation or maintenance vessels would increase the risk of collisions and spills. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes, or would need to avoid installation or maintenance areas entirely during installation and maintenance activities. Atlantic Shores intends to bury offshore cables to a target depth of 5 to 6.6 feet (1.5 to 2 meters) to avoid interference with existing marine uses (e.g., some anchoring and commercial fishing) and protect the cable (GEO-07; Appendix G, *Mitigation and Monitoring,* Table G-1). 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 upon 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 shut-down 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. 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. BOEM expects that all Project features would be appropriately charted on navigation charts. The presence of installation or maintenance vessels would have minor localized, short-term, intermittent impacts on navigation and vessel traffic.

Port utilization: Atlantic Shores has identified five port facilities in New Jersey, Virginia, and Texas that may be used during construction (Table 3.6.3-3). The construction and installation, O&M, and decommissioning activities associated with the Project may result in restricted access at local ports. The Proposed Action would generate trips by support vessels, such as crew transports vessels, hotel vessels, tugs, and miscellaneous vessels (see Table 3.6.6-3). Project vessels are not anticipated to cause access issues in these areas, with the potential exception of larger vessels such as jack-up barges when in transit to/from the Lease Area. The onshore O&M facility is anticipated to be based in Atlantic City's Inlet Marina and any Project vessel activity would be taking a similar route to/from the Lease Area. Project traffic would decrease during the operation phase, and no significant impact is anticipated. The presence of these vessels could cause delays for non-Proposed Action vessels and could cause some fishing or recreational vessel operators to change routes or use an alternative port. During construction and installation, the Proposed Action's impacts on vessel traffic due to port utilization would be moderate and short term. During O&M, impacts would be minor, long term, and intermittent. Impacts would increase to moderate for decommissioning, comparable to construction and installation impacts.

Table 3.6.6-3. Estimated vessel trips for each port for O&M and construction

Port	# Round Trips During Construction (total)	# Round Trips During Operations (per year)
Atlantic City (O&M Facility)	315	1,825
New Jersey Wind Port	1,250	32
Paulsboro Marine Terminal	120	2
Repauno Port & Rail Terminal	20	1
Portsmouth Marine Terminal	20	1
Port of Corpus Christi	20	0
TOTAL	**1,745**	**1,861**

Note: These are the maximum estimates and could change based on selected foundation technology, selected contractors, and other factors.

Presence of structures: The Proposed Action would include up to 200 WTGs (inclusive of the 31 WTGs in the Overlap Area), up to 1 met tower, and up to 10 small OSSs, or up to 5 medium OSSs, or up to 4 large OSSs, operating for up to 30 years, within the WTA where no such structures currently exist. The OSSs and met tower are proposed outside of the gridded layout for the proposed WTG locations (Figure 3.6.6-5). Atlantic Shores developed the layout by analyzing the predominant flow of vessel traffic across the entirety of the Atlantic Shores South Lease Area (OCS-A 0499) and adjacent Atlantic Shores North Lease Area (OCS-A 0549) and initiated consultations to determine the preferences of commercial fishermen and USCG. The predominant direction for fishing vessel traffic varies across the Lease Area; however, commercial fishermen and USCG preferred a uniform layout across the entire lease area to facilitate navigation and SAR missions. The proposed siting of the OSSs and met tower is a deviation from the stated preferences of the fishing industry and USCG.

The grid rows would have an orientation of 80 degrees true north (TN) spaced 1 nautical mile (1.9 kilometers) apart, and the columns would have an orientation of 357 degrees TN 0.6 nautical mile (1.1 kilometers) apart. This creates diagonal corridors with an orientation of 325 degrees TN that are 0.54 nautical mile (1.0 kilometer) wide and orientation 28 degrees TN that are 0.49 nautical mile (0.9

kilometer) wide. The OSS positions would be located along the same east-northeast to west-southwest rows as the WTGs, but between the WTGs in the north to south direction. USCG has determined that 0.6 nautical mile (1.1 kilometers) is the minimum spacing between WTGs for vessels to safely maneuver within a wind farm (USCG 2020). Presently, there are no approved routing measures within the proposed Project area that would be altered by the presence of structures (COP Volume II, Appendix II-S; Atlantic Shores 2024). Vessels that exceed a height of 72.2 feet (22 meters) would be at risk of alliding with WTG blades at mean high water and would need to navigate around the Project area or navigate with caution through the area to avoid the WTGs.

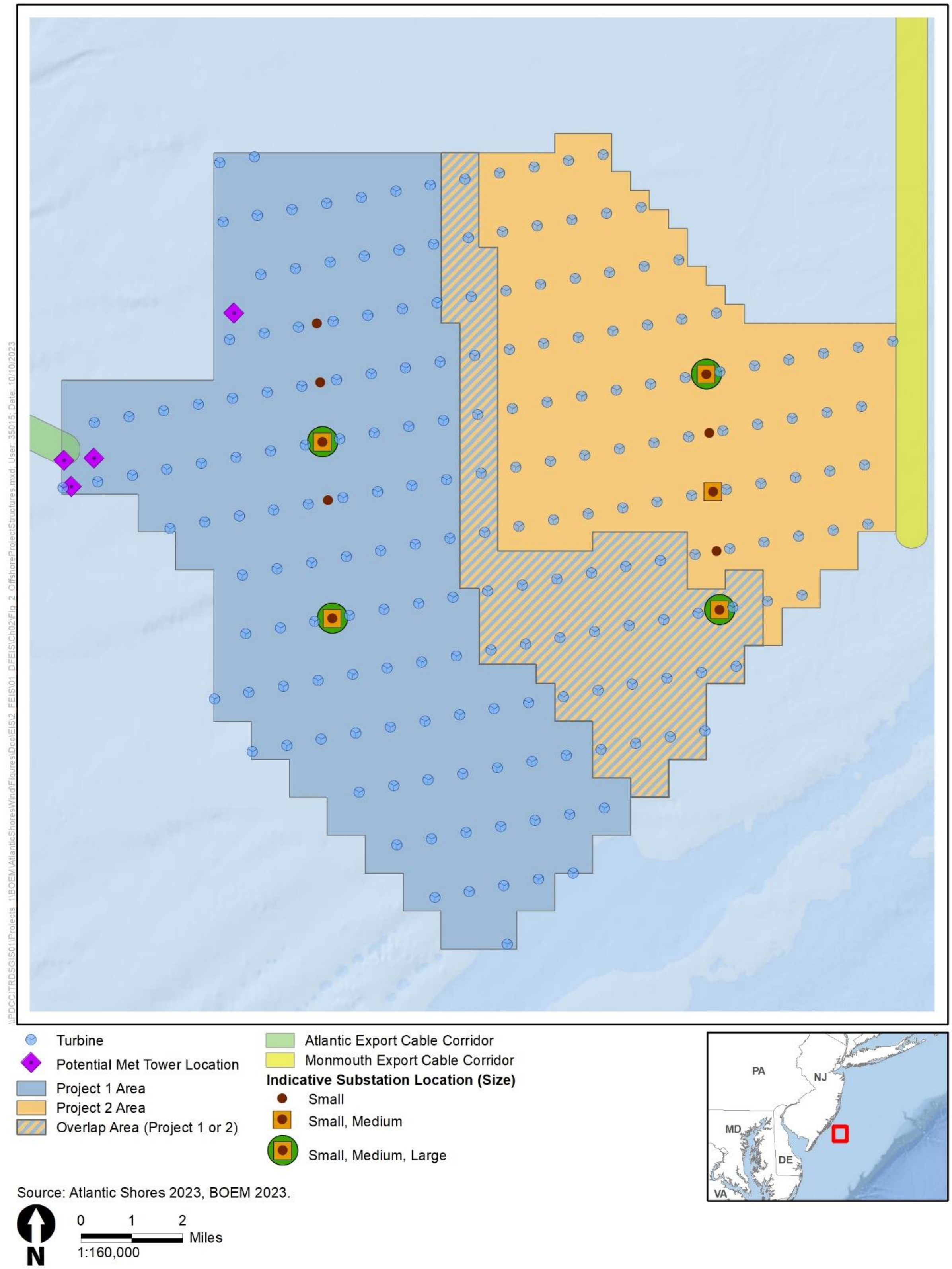


Figure 3.6.6-5. Offshore Project structures

Offshore Project structures associated with the Proposed Action would increase the risk of allision as well as the risk of collision between vessels navigating through the WTG areas, due to added navigational complexity. The positioning of the OSSs and met tower outside of the WTG gridded layout would increase the risk for vessels navigating through the WTA. The transit corridor would be reduced in the grid sections where the OSSs and met tower are sited, rendering the impacted corridors oriented true north to south unusable for any vessels larger than smaller recreation vessels in those proposed off-gridded locations. Locating the OSSs and met tower outside of the WTG gridded layout, as shown in Figure 3.6.6-5, could potentially shutdown the uninterrupted use of the corridor to fishing vessel transiting and operating as well as other vessels conducting other activities. This would lead to increased funneling and traffic density in other corridors increasing navigation risk. The location of the structures outside of the WTG gridded layout would offset the existing standard lighting, marking, and signaling scheme for the project and other neighboring lease. The cumulative combined impacts from the similar proposal in ASOW North OCS-A 0549 could lead to narrower corridors being unusable for vessel that choose to transit through the area. Additionally, this is a distinct difference from the other currently planned offshore wind patterns, and the uncertainty that mariners are aware of the non-conformities and where they are located would increase the risk factor for allision.

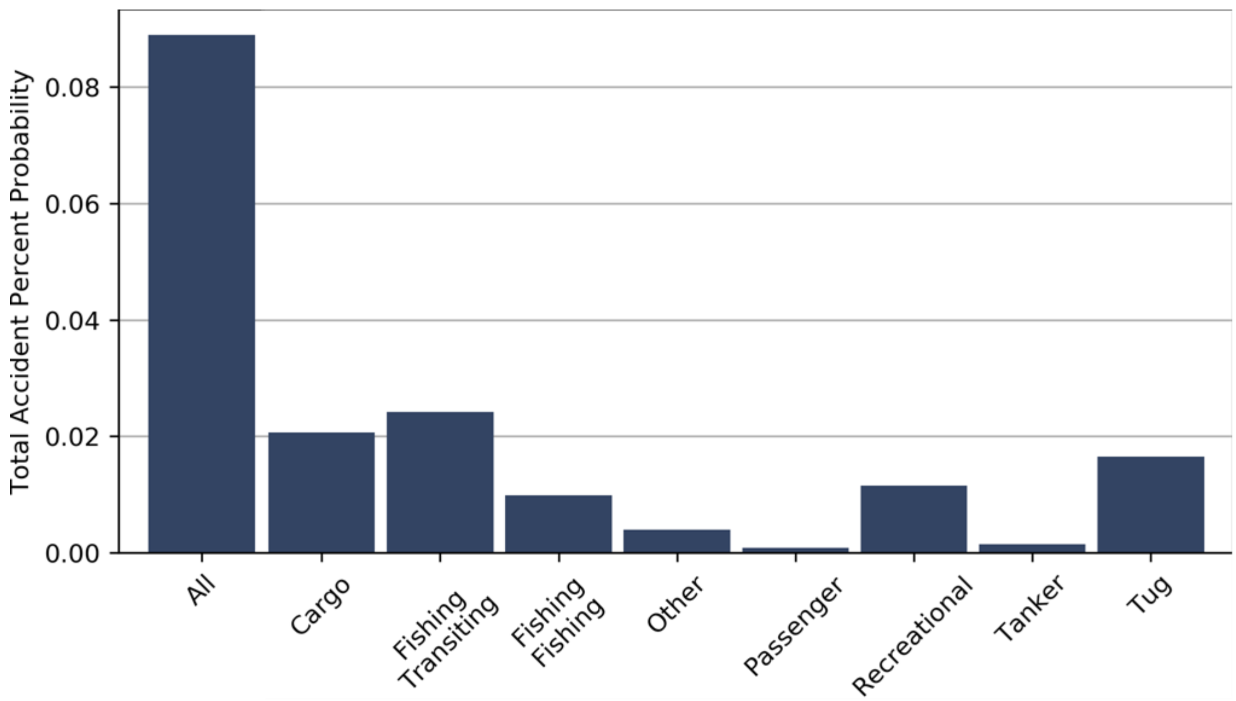
WTGs could also interfere with the use of marine radars (although other navigation tools are available to ship captains). The siting of structures outside of the WTG gridded layout would also add complexity to radar navigation. The structures would offset the layout and predictability of navigation for mariners expecting no structures in the spacing between gridded locations. An aerial SAR risk assessment with associated mitigation measures was prepared in coordination with USCG, BOEM, and other relevant stakeholders (see COP Volume II, Appendix II-T4; Atlantic Shores 2024). The OSS and met tower structures sited outside of the WTG gridded layout would also create an added complexity to the turn radius for SAR helicopters during operations.

All construction and installation vessels and equipment would display the required navigation lighting and day shapes and make use of AIS as required by USCG (NAV-02; Appendix G, Table G-1). The increased risk of allisions and collisions could, in turn, increase the risk of spills (refer to Section 3.4.2, *Water Quality*, for a discussion of the likelihood of spills). Nearly all vessels that travel through the WTA where no structures currently exist would need to navigate with greater caution under the Proposed Action to avoid WTGs, OSSs and the met tower, particularly with regard to the latter two structure types being sited outside of the WTG gridded layout; however, there would be no restrictions on use or navigation in the Project area. All structures would be appropriately lit, marked, and charted with a requirement that each structure receives a valid PATON from USCG. Many small vessels that currently navigate that area would continue to be able to navigate through the Project area between the WTGs and OSSs. The proposed gridded WTG and off-grid OSS layout has been developed in consideration of commercial fishing patterns and in close coordination with the surf clam/quahog dredging fleet. The layout is designed to facilitate the transit of vessels through the WTA based on a review of existing traffic patterns (NAV-03; Appendix G, Table G-1). To facilitate safe navigation, all offshore structures would include appropriate marine navigation lighting and marking in accordance with USCG and BOEM guidance. Atlantic Shores would continue to work with USCG and BOEM to determine the appropriate marine lighting and marking schemes for the proposed offshore facilities (NAV-04; Appendix G, Table G-1). While some non-Project vessel traffic may navigate through the Project area, many vessels may choose not to pass through the area during construction (due to the presence of construction-related activities and the emergence of fixed structures), during the life of the Project (due to the presence of fixed structures), and during decommissioning. The NSRA modeled the frequency of marine accidents under the Proposed Action assuming there would be a rerouting of common vessel traffic routes around the Project area for the larger commercial traffic utilizing the proposed shipping safety fairways in the Consolidated PARS (COP Volume II, Appendix II-S, Section 8.3.3.3; Atlantic Shores 2024; USCG 2022). The NSRA assumed other vessel types, including fishing, pleasure, and other vessels, would not reroute around the WTA.

Operation of the WTGs associated with the Proposed Action would likely affect marine radar on vessels near or within the Project area. As noted in the BOEM-sponsored National Academies (2022) study referred to previously, the potential impacts on marine radar are variable, with the most likely effect being signal degradation. Proximity to the WTGs is the primary factor that determines the degree of radar signal degradation. Due primarily to the quality of radars and the proficiency of professionally licensed crew, radar operations on commercial ships are not anticipated to be affected. Smaller vessels operating in the vicinity of the Project may experience radar cluttering and shadowing (COP Volume II, Appendix II-S, Section 9.7; Atlantic Shores 2024) 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. The navigational complexity of transiting through the Project area, including the potential effects of gridded WTGs and off-grid OSSs on marine radars, would increase risk of collision with other vessels (including non-Project vessels and Proposed Action vessels), and the risk of vessel allisions with the Project structures. Furthermore, the presence of the gridded WTGs, off-grid OSSs, and off-grid met tower could complicate offshore SAR operations or surveillance missions within the Project area and lead to abandoned SAR missions and resultant increased fatalities. This would have localized, long-term, continuous, major impacts on navigation and vessel traffic. Impacts on SAR missions are discussed further under Section 3.6.7.

Traffic: Construction of the Proposed Action would generate approximately 51 vessels operating in the Project area or over the offshore export cable route at any given time (COP Volume II, Section 7.6.2.1; Atlantic Shores 2024). Various vessel types (scour protection, installation, cable-laying, support, transport/feeder, and crew vessels) would be deployed throughout the Offshore Project area during the construction and installation phase. Estimated vessel trips for each port for construction and O&M of the Project are shown in Table 3.6.6-3. The presence of these vessels would increase the risk of allision, collision, and spills (refer to Section 3.4.2 for a discussion of the likelihood of spill). The vessels would typically be transiting to the Offshore Project area from staging and support areas throughout the New Jersey and other port areas. However, construction activities within the Offshore Project area would be compatible with existing marine transportation uses and would not represent a substantial increase in existing vessel traffic in the region (a maximum of 51 construction vessels plus up to 15 non–construction-related vessels depending on the season). Project-related vessel traffic would not interfere with existing marine and navigation traffic patterns as shown in COP Volume II, Appendix II-S (Atlantic Shores 2024). Project-related vessel traffic would follow existing transit routes to the extent practicable. During offshore export cable route construction, non-Project vessels that may travel a more restricted (narrow) lane could potentially 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. Atlantic Shores routed around existing ATONs where practical in the planning of this project, but there were some areas where existing obstructions (such as artificial reefs, sand borrow areas, and other constraints) did not allow for avoidance. In these cases, Atlantic Shores surveyed around the ATON and is investigating whether there is enough clearance to route cables around the anchors. Atlantic Shores would not know whether any ATONs within the surveyed corridors would require repositioning until final cable routing is completed. Cable burial near ATONs must be deconflicted with USCG prior to installation (GEO-22, Appendix G, Table G-1). Any relocation of USCG-maintained ATON would incrementally increase impacts on vessel navigation/ USCG activities. Non-Project vessels transiting between the Proposed Action ports and the Project area would be able to avoid Proposed Action vessels, components, and any safety zones (where USCG is authorized and elects to establish such zones) through routine adjustments to navigation. Although fishing vessels may experience increased transit times in some situations, these situations would be spatially and temporarily limited. An increase in avoidance measures could lead to over-avoiding and alliding with fixed structures or non-moving vessels. The Proposed Action's construction and installation vessel traffic would have localized, short-term, continuous impacts on overall navigation and vessel traffic in opens waters and near ports.

As shown in Figure 3.6.6-6 and Tables 3.6.6-4 and 3.6.6-5, the NSRA risk modeling suggests that under the Proposed Action, the overall total frequency of all operations phase accident scenarios for all vessel classes was calculated to be 0.10 to 0.11 accidents per year (10 percent to 11 percent annual probability), a slight increase from pre-construction. The primary risks for collision under existing conditions occur between the cargo, tug tows, transiting fishing, and recreational vessels. It is anticipated that this traffic would reroute to bypass the Project to the east, as noted in the 2016 ACPARS/ANPRM (USCG 2016).



Source: COP Volume II, Appendix II-S, Figure 8.9; Atlantic Shores 2024.

Figure 3.6.6-6. Estimated pre-construction inter-class accident annual frequencies

Table 3.6.6-4. Estimated operational phase inter-class accident annual frequencies

Vessel Class	Collisions	Allisions	Total
Cargo	0.021 (0.021)	--	0.021 (0.021)
Fishing – Fishing	0.011 (0.011)	0.00013 (0.00041)	0.011 (0.012)
Fishing – Transiting	0.023 (0.023)	0.0015 (0.0048)	0.025 (0.028)
Passenger	0.00092 (0.00092)	--	0.00092 (0.00092)
Recreational	0.012 (0.012)	0.00038 (0.0012)	0.013 (0.013)
Tanker	0.0015 (0.0015)	--	0.0015 (0.0015)
Tug-Tow	0.018 (0.018)	--	0.018 (0.018)
Other	0.0048 (0.0048)	--	0.0048 (0.0048)
O&M	0.0069 (0.0069)	0.00080 (0.0025)	0.0077 (0.0093)
All	**0.10 (0.10)**	**0.0028 (0.0089)**	**0.10 (0.11)**

Source: COP Volume II, Appendix II-S, Table 8.11; Atlantic Shores 2024.
Note that the source table in the COP utilizes scientific notation, which has been converted to facilitate correlation between the data.
Note that results for both the 39.4-foot (12.0-meter) and 98.4-foot (30.0-meter) foundation widths are presented. The 39.4-foot (12.0-meter) foundation width is associated with the monopile, mono-bucket, suction bucket tetrahedron base, gravity-pad tetrahedron base, and GBS WTG foundation types. The 98.4-foot (30.0-meter) foundation width is associated with the piled jacket and suction bucket jacket WTG foundation types; the results for these foundation types are presented in parentheses.

Table 3.6.6-5. Estimated operational phase inter-class accident average recurrence intervals (years)

Vessel Class	Collisions (years)	Allisions (years)	Total Average Recurrence Interval (years)
Cargo	47 (47)	--	47 (47)
Fishing – Fishing	89 (89)	7,775 (2461)	88 (85)
Fishing – Transiting	43 (43)	665 (208)	40 (35)
Passenger	1,084 (1084)	--	1084 (1084)
Recreational	82 (82)	2,604 (803)	79 (74)
Tanker	679 (679)	--	679 (679)
Tug-Tow	56 (56)	--	56 (56)
Other	209 (209)	--	209 (209)
O&M	145 (145)	1,256 (403)	129 (106)
All	**10 (10)**	**356 (112)**	**10 (9)**

Source: COP Volume II, Appendix II-S, Table 8.12; Atlantic Shores 2024.
Note that results for both the 394-foot (12.0-meter) and 98.4-foot (30.0-meter) foundation widths are presented. The 39.4-foot (12.0-meter) foundation width is associated with the monopile, mono-bucket, suction bucket tetrahedron base, gravity-pad tetrahedron base, and GBS WTG foundation types. The 98.4-foot (30.0-meter) foundation width is associated with the piled jacket and suction bucket jacket WTG foundation types; the results for these foundation types are presented in parentheses.

Vessel traffic generated by the Proposed Action could restrict maneuvering room and cause delays accessing the port. Vessel traffic within the Lease Area is expected to increase once the WTGs and OSSs are in place, and the O&M phase of the Proposed Action would result in the same types of vessel traffic and navigation impacts as those described during construction. To assist with mitigation of these risks, an emergency response plan (ERP) would be developed to specify coordination, shutdown, and rescue procedures. The ERP would be reviewed and updated at least annually between Atlantic Shores and BSEE with input from USCG, as appropriate (NAV-10; Appendix G, Table G-1). Updated asset and operational awareness bulletins would be regularly distributed showing the development area, depicted on local nautical charts, with a description of the assets in the area, the activities taking place, timelines, and relevant contact information. Atlantic Shores would also publish announcements and share updates with print and online industry publications and local news outlets (NAV-11; Appendix G, Table G-1). A "For Mariners" project webpage (http://www.atlanticshoreswind.com/mariners/) has been developed that contains the latest news and events, real-time Project buoy data display and Project vessel tracking chart, Project vessel schedules, and Fisheries Liaison Officer and Fishing Industry Representative contact information (NAV-12; Appendix G, Table G-1). Specific methods for communicating with offshore fishermen while they are at sea are being established, including a 24-hour phone line to address any real-time operational conflicts and/or safety issues (NAV-13; Appendix G, Table G-1). A Marine Coordinator would be employed to monitor daily vessel movements, implement communication protocols with external vessels both in port and offshore to avoid conflicts, and monitor safety zones. Daily coordination meetings between contractors are expected to be held to avoid conflicting operations at port facilities and transit routes to the Offshore Project area. The Marine Coordinator would be responsible for coordinating with USCG for any required Notices to Mariners (NAV-14; Appendix G, Table G-1). Activities related to the operation of the Proposed Action would be minor, localized, short term, and infrequent relative to the life of the Project.

Impacts of the Connected Action

As described in Chapter 2, as part of the Proposed Action, an O&M facility would be constructed in Atlantic City, New Jersey, on a site previously used for vessel docking or other port activities. Construction of the O&M facility would involve construction of a new building and potentially an associated parking structure, repairs to the existing docks, and installation of new dock facilities. Independently of the Proposed Action, Atlantic Shores is pursuing a USACE Nationwide Permit 13 to install an approximately 541-foot (165-meter) bulkhead composed of corrugated steel sheet pile. The final design and scope of proposed activities, including dimensions, areas, volumes, construction methodologies, mitigation measures, and other details are subject to change following ongoing design work and permit review and approval. Final details will be included in the approved permit. Bulkhead repair and/or installation, as well as maintenance dredging in coordination with Atlantic City's dredging of the adjacent basins, would be conducted regardless of the construction and installation of the Proposed Action. However, the bulkhead and dredging are necessary for the use of the O&M facility included in the Proposed Action. Therefore, the bulkhead installation and dredging activities are considered to be a connected action and are evaluated in this section.

The connected action would affect navigation and vessel traffic in the geographic analysis area through the following IPFs:

Port utilization: During the bulkhead installation and dredging activities, there could be delays to other vessels trying to enter or leave the port. Activities related to the connected action of the Proposed Action would be minor, localized, short term, and infrequent relative to the life of the Project.

Traffic: During the bulkhead installation and dredging activities, vessel traffic could experience delays transiting to and from the port. Activities related to the connected action of the Proposed Action would be minor, localized, short term, and infrequent relative to the life of the Project.

Cumulative Impacts of Alternative B – Proposed Action

The cumulative impact analysis of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities including offshore wind activities, and the connected action.

Anchoring: The Proposed Action would contribute a small increment to the cumulative anchoring impacts, 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 around and near the Project area, as well as the low likelihood that any anchoring risk would occur in an emergency scenario.

Cable emplacement and maintenance: The Proposed Action would contribute a small increment to the cumulative cable emplacement and maintenance impacts, which would be localized, intermittent, and minor. Cable installation and maintenance for other offshore wind activities would generate comparable types of impacts to those of the Proposed Action for each offshore export cable route and interarray and interconnector cable system. As shown in Table D.A2-1 in Appendix D, offshore export cable and interarray/interconnector cables for three other offshore wind projects (Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North) could be operating simultaneously while the Proposed Action is under construction. Simultaneous construction of interarray 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 interarray/interconnector system at any given time. Substantial areas of open ocean are likely to separate simultaneous offshore export cable and interarray/interconnector installation activities for other offshore wind projects.

Port utilization: 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 Proposed Action would commence offshore construction in 2025. Offshore construction of the ongoing and potential offshore wind projects in the geographic analysis area, Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North, would commence in 2026 and continue through 2030. Therefore, the increase in port utilization due to other offshore wind project vessel activity would be limited during construction and installation of the Proposed Action. The adjacent Ocean Wind 1 project anticipates utilizing the Port of Atlantic City, Paulsboro Marine Terminal, New Jersey Wind Port, and the Port of Elizabeth, New Jersey; Port of Norfolk, Virginia; and Port of Charleston, South Carolina. The Proposed Action would primarily use ports in the local New Jersey area, including the Paulsboro Marine Terminal, New Jersey Wind Port, and Repauno Port and Rail Terminal, in addition to the Portsmouth Marine Terminal in Virginia, and the Port of Corpus Christi in Texas. This should allow the total increase in vessel traffic to be distributed across multiple ports in the region; however, there could be delays for vessels using those ports if two or more projects are under construction at the same time and accessing the same ports. Accordingly, cumulative port utilization impacts on navigation and vessel traffic would be continuous and moderate.

Presence of structures: The Proposed Action would contribute a noticeable increment to the cumulative impacts from the presence of structures. Structures from other offshore wind activities would generate comparable types of impacts as under the Proposed Action across the entire geographic analysis area. Up to 200 gridded WTGs, up to 10 (small) off-grid OSSs, and 1 off-grid met tower would be constructed under the Proposed Action. The presence of up to 585 structures from all offshore wind projects in the geographic analysis area including the Proposed Action (211 structures) and other offshore wind projects (374 structures) would further increase the navigational complexity in the region, resulting in an increased risk of collisions and allisions, which could result in 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.

Unique structure orientation patterns are planned within the Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North projects and the Proposed Action to accommodate different traffic patterns within each lease area. The BOEM lease agreements for Atlantic Shores South and Ocean Wind 1 do not require setbacks from adjoining borders, so the Proposed Action WTG layout does not include a setback from the adjacent Ocean Wind 1 lease area. However, when adjacent offshore wind projects share borders, USCG recommends a common WTG spacing and layout across the projects to provide consistent straight-line orientation through the adjoining areas. A common WTG spacing and layout facilitates predictable navigation patterns, navigational safety, consistent and continuous marking and lighting, SAR, and other uses such as commercial fishing. In the absence of a common spacing and orientation between adjacent wind projects, USCG recommends setbacks from the shared border to create a separation between projects. The space between projects should be greater than the WTG spacing within either WTA to provide a clear visual reference to easily distinguish separate projects (USCG 2021). A change in orientation or spacing without this separation would increase risk for surface and aerial navigation through the WTAs and could make it more difficult for SAR aircraft to perform operations in the geographic analysis area, leading to a less optimized search pattern and a lower probability of success. This could lead to increased possibility of loss of life due to maritime incidents. SAR is further addressed in Section 3.6.7. The lack of a shared WTG layout or setback from the shared boundary between the Ocean Wind 1 and Atlantic Shores South projects would increase navigational complexity in the geographic analysis area and have a moderate to major impact on navigation depending on the final layout and proximity of WTGs in the adjoining lease areas.

Traffic: The other offshore wind projects in the geographic analysis area (Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North) would generate amounts of vessel traffic comparable to that of the Proposed Action. While construction of the Proposed Action is expected to be completed in 2027 (Chapter 2) an overlap in construction is expected in 2026–2027 with Ocean Wind 2 and Atlantic Shores North, causing vessel traffic impacts to increase. Following construction, Ocean Wind 1, Ocean Wind 2, and the Atlantic Shores offshore wind projects would be operating simultaneously and could generate up to 22 vessel trips to support O&M activities at any given time (COP Volume I, Section 5.6; Atlantic Shores 2024). Traffic from these projects could be spread among multiple ports within and outside the geographic analysis area for navigation and vessel traffic, thus potentially moderating the effect of offshore wind-related vessel traffic at any single location. The contribution of the Proposed Action to cumulative vessel traffic impacts would be localized, short term, and intermittent.

Conclusions

Impacts of Alternative B – Proposed Action. In summary, construction and installation, O&M, and decommissioning of the Proposed Action would have adverse impacts on navigation and vessel traffic. The impacts of the Proposed Action alone on navigation and vessel traffic would be **major**. 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 WTA, all of which would increase navigational safety risks. The OSS and met tower positioning off-grid also increases risk of allision for vessels transiting through the WTA. Some commercial fishing, recreational, and other vessels would choose to avoid the WTA altogether, leading to some potential funneling of vessel traffic along the Project area borders. In addition, the increase in potential for marine accidents, which may result in injury, loss of life, and property damage, could produce disruptions for ocean users in the geographic analysis area.

BOEM expects that the connected action alone would have minor impacts on navigation and vessel traffic due to port utilization and traffic.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on navigation and vessel traffic would range from noticeable to appreciable. The main IPF from which impacts are contributed is the presence of structures, which increases 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 that the cumulative impacts associated with the Proposed Action when combined with impacts from ongoing and planned activities, including offshore wind would be **major**, 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 Alternatives C, D, and F on Navigation and Vessel Traffic

Impacts of Alternatives C, D, and F. Impacts of Alternative C (Habitat Impact Minimization/Fisheries Habitat Impact Minimization) would be similar to those of the Proposed Action for navigation and vessel traffic except for the impact of the presence of structures. The construction of Alternative C could install fewer WTGs (up to 29 fewer WTGs) and associated off-grid OSS (1 fewer OSS) and interarray cables, which would slightly reduce the construction impact footprint and installation period. The removal of these WTGs and off-grid OSS would result in a minor reduction of impacts on navigation and vessel traffic compared to the Proposed Action, with fewer structures to consider.

Impacts of Alternative D (No Surface Occupancy at Select Locations to Reduce Visual Impacts) would be similar to those of the Proposed Action for navigation and vessel traffic. Alternative D would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum bade tip height of 932 feet (284 meters) AMSL. Alternative D could result in a reduced impact to navigation and vessel traffic, but the overall impact would be major.

Impacts of Alternative F (Foundation Structures) would be the same as those of the Proposed Action for navigation and vessel traffic. The construction of Alternative F would either use monopile and piled jacket, suction bucket, or gravity-based foundations. The foundation type has little to no impact on navigation and traffic.

Cumulative Impacts of Alternatives C, D, and F. The incremental impacts contributed by Alternatives C, D, and F to the cumulative impacts on navigation and vessel traffic would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternatives C, D, and F. The same grid pattern as the Proposed Action would remain intact; therefore, the impacts on navigation and vessel traffic from Alternative C would be similar to the impacts from the Proposed Action, which would be **major.** The impacts on navigation and vessel traffic from Alternative D would be similar to or slightly less than the **major** impacts from the Proposed Action, based on the new layout, as well as the number and location of WTGs removed. The impacts on navigation and vessel traffic from Alternative F would be similar to the **major** impacts from the Proposed Action as the WTG grid would remain the same. Modeling indicated an increase of one additional accident the overall total frequency of all operations phase accident scenarios for all vessel classes was calculated to be 0.10 to 0.11 accidents per year (10 percent to 11 percent annual probability) (Table 3.6.6-4) depending on the type of foundation ultimately used; however, it does not change the outcome of the risk assessment as the risk for the highest number of accidents remains negligible (COP Volume II, Appendix II-S; Atlantic Shores 2024).**Cumulative Impacts of Alternatives C, D, and F.** The incremental impacts contributed by Alternatives C, D, and F to the cumulative impacts on navigation and vessel traffic would be similar to those described under the Proposed Action: **major**.

3.6.6.7 Impacts of Alternative E on Navigation and Vessel Traffic

Impacts of Alternative E. Alternative E (Wind Turbine Layout Modification to Establish a Setback Between Atlantic Shores South and Ocean Wind 1) was developed to address concerns raised in public scoping comments regarding the different layouts between the Ocean Wind 1 and Atlantic Shores South projects and the need for a setback for each of the two projects in the adjacent lease areas (refer to Section 2.1.3). USCG recommends that, when multiple lease areas share borders, there is a common WTG spacing and layout throughout all adjoining wind projects; additionally, in the absence of the common spacing and orientation between adjacent wind projects, a setback from the shared border is recommended (USCG 2021). Alternative E encompasses wind turbine layout modifications that would result in a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) and the Atlantic Shores South Lease Area (OCS-A 0499).

Alternative E would accomplish the setback with the exclusion or micrositing of up to 5 WTG positions.

The proposed setback (0.81 to 1.08 nautical miles [1,500 to 2,000 meters]) would be an improvement to vessel navigation and SAR considerations over no separation between lease areas, particularly as there is a lack of common WTG spacing and layout throughout. The separation would provide a clear visual reference for each project to mariners within the area and to USCG aviators on SAR missions so that the operators can adjust their course as needed. It also provides the sea and air space required to conduct that course adjustment. Overall, Alternative E would have slightly reduced impacts on navigation and vessel traffic compared to the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on navigation and vessel traffic would be slightly reduced from those described under the Proposed Action.

Conclusions

Impacts of Alternative E. Alternative E would reduce the impacts on navigation and vessel traffic compared to the Proposed Action, but due to the presence of off-grid offshore structures, the impact level would remain **major**.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E on navigation and vessel traffic to the cumulative impacts on navigation and vessel traffic would be appreciable. Alternative E would reduce the impacts on navigation and vessel traffic compared to the

Proposed Action, but due to the presence of off-grid offshore structures, the impact level would remain **major**.

3.6.6.8 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 and G-3 and summarized and assessed in Table 3.6.6-6. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts on navigation and vessel traffic could be further reduced.

Table 3.6.6-6. Proposed mitigation measures – navigation and vessel traffic

Mitigation Measure	Description	Effect
Export cable spacing	When possible, the cable spacing should be minimized.	This will reduce potential impacts to ocean users.
Cable Maintenance Plan	In conjunction with cable monitoring, develop and implement a Cable Maintenance Plan that requires prompt remedial burial of exposed and shallow-buried cable segments, review to address repeat exposures, and a process for identifying when cable burial depths reach unacceptable risk levels.	This will allow for timely response to any issues related to the cables and reduce the risk to vessels navigating the ECC from any cable issues.
Expand Fisheries Communication Plan	Expand Fisheries Communication Plan to include outreach and communication with all mariners, including the commercial shipping industry and recreational users. Communication and outreach should cover all project phases from pre-construction to decommissioning.	This will facilitate coordination with all mariners, including the commercial shipping industry, commercial and for-hire fishing industries, and other recreational users, and allow for a reduction of vessel traffic in the area and a commensurate reduction of risk of allision or collision with other vessels or structures.
Incident reporting	Provide written notification of incidents (e.g., gear interactions, anchor strikes, vessel allisions, property damage less than $25,000) that fall below or are simply not captured by the regulatory thresholds outlined in 30 CFR §§ 285.832 and 285.833. Summaries could be provided to BOEM/BSEE and USACE during construction, operations, and decommissioning.	This will increase awareness of the frequency and circumstances surrounding these incidents and assess whether any actions are needed to address them in a timely manner, to reduce risk of recurrence.
Navigational Safety	No permanent structures will be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, met tower, and WTGs will be aligned in a uniform grid with	This will modify the array layout to meet the USCG requirement of 0.6 nautical mile (1.1 kilometers) spacing between offshore structures, reducing impacts on marine navigation and SAR operations.

Mitigation Measure	Description	Effect
	rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.	

3.6.6.9 Measures Incorporated in the Preferred Alternative

BOEM has identified the additional measures in Table 3.6.6-6 as incorporated in the Preferred Alternative. These measures, if adopted, would have the effect of reducing potential impacts on navigational safety, thereby reducing overall impacts on navigation and vessel traffic to moderate. Comparison of Alternatives

3.6.6.10 Comparison of Alternatives

Construction of Alternatives C, D, and F would have the same major impacts on navigation and vessel traffic as described under the Proposed Action. Alternative E could reduce the impact to a degree by creating a setback between the Atlantic Shores South and Ocean Wind 1 projects, but the impacts on navigation and vessel traffic would remain major due to the presence of off-grid offshore structures.

3.6.6.11 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of the Proposed Action and Alternatives C4, D3, and E, as well as two BOEM-proposed mitigation measures, as described in Section 2.1.7. Under the Preferred Alternative, 29 WTGs, 1 OSS, and their associated interarray cables would be microsited outside of the 1,000-foot (305-meter) buffer of the sand ridge and swale features within AOC 1 (Lobster Hole) and AOC 2 (NMFS-identified sand ridge complex);[2] WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and a maximum blade tip height of 932 feet (284 meters); 2 WTGs would be removed and 1 WTG would be microsited to establish a 0.81-nautical mile (1,500-meter) setback between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area; and no permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. Additionally, one WTG sited approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site) would be removed. The Preferred Alternative would include up to 195 WTGs,[3] up to 10 OSSs, up to 1 permanent met towner, interarray and interlink cables, 2 onshore substations and/or converter stations,

[2] Micrositing would not materially change the grid layout. No microsited permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines or orientation in a grid pattern.

[3] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and/or met tower) would not exceed 197.

The major adverse impacts to navigation and vessel traffic associated with the Proposed Action would change substantially under the Preferred Alternative. The Preferred Alternative would include a reduction in the number of WTGs compared to the Proposed Action and would modify the array layout to meet the USCG requirement of 0.6 nautical mile (1.1 kilometers) spacing between structures, reducing impacts on marine navigation and SAR operations. Accordingly, impacts would be reduced to **moderate** under the Preferred Alternative.

BOEM anticipates that the cumulative impacts of ongoing and planned activities, including the Preferred Alternative and the connected action, would be **minor to moderate adverse**.

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3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, and Scientific Research and Surveys)

This section discusses potential impacts on other uses not addressed in other portions of this Final EIS, including marine minerals, military use, aviation, and scientific research and surveys that would result from the proposed Atlantic Shores South Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis areas for these topics are described below and shown in Figure 3.6.7-1.

- Marine minerals: Areas within 0.31 mile (0.5 kilometer) of the ECCs and WTA that could affect marine minerals extraction (Figure 3.6.7-1).
- Aviation and air traffic, military and national security, and radar systems: Areas within 10 miles (16.1 kilometers) of the ECCs and WTA and the Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North Lease Areas, as well as Atlantic City International Airport, Ocean City Municipal Airport, Woodbine Municipal Airport, Cape May County Airport, and Warren Grove Range Airport (Figure 3.6.7-1).
- Cables and pipelines: Areas within 1 mile (1.6 kilometers) of the ECCs and WTA 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).

These areas encompass locations where BOEM anticipates direct and indirect impacts associated with the Project's construction, O&M, and conceptual decommissioning.

3.6.7.1 Description of the Affected Environment and Future Baseline Conditions

Marine Minerals 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. At this time, there are no active or requested BOEM leases in the geographic analysis area. The closest previous lease in BOEM's Marine Minerals Program is known as the D2 borrow area, offshore New Jersey near Harvey Cedars, Surf City, Long Beach Township, Ship Bottom, and Beach Haven (Lease Area OCS-A-0505; executed July 1, 2014), which was approved through September 30, 2018, for the use of up to 10,000,000 cubic yards of material. Periodic nourishment for this project has been authorized in a 7-year cycle, with an estimated final nourishment year of 2055 (Cresitello 2020).

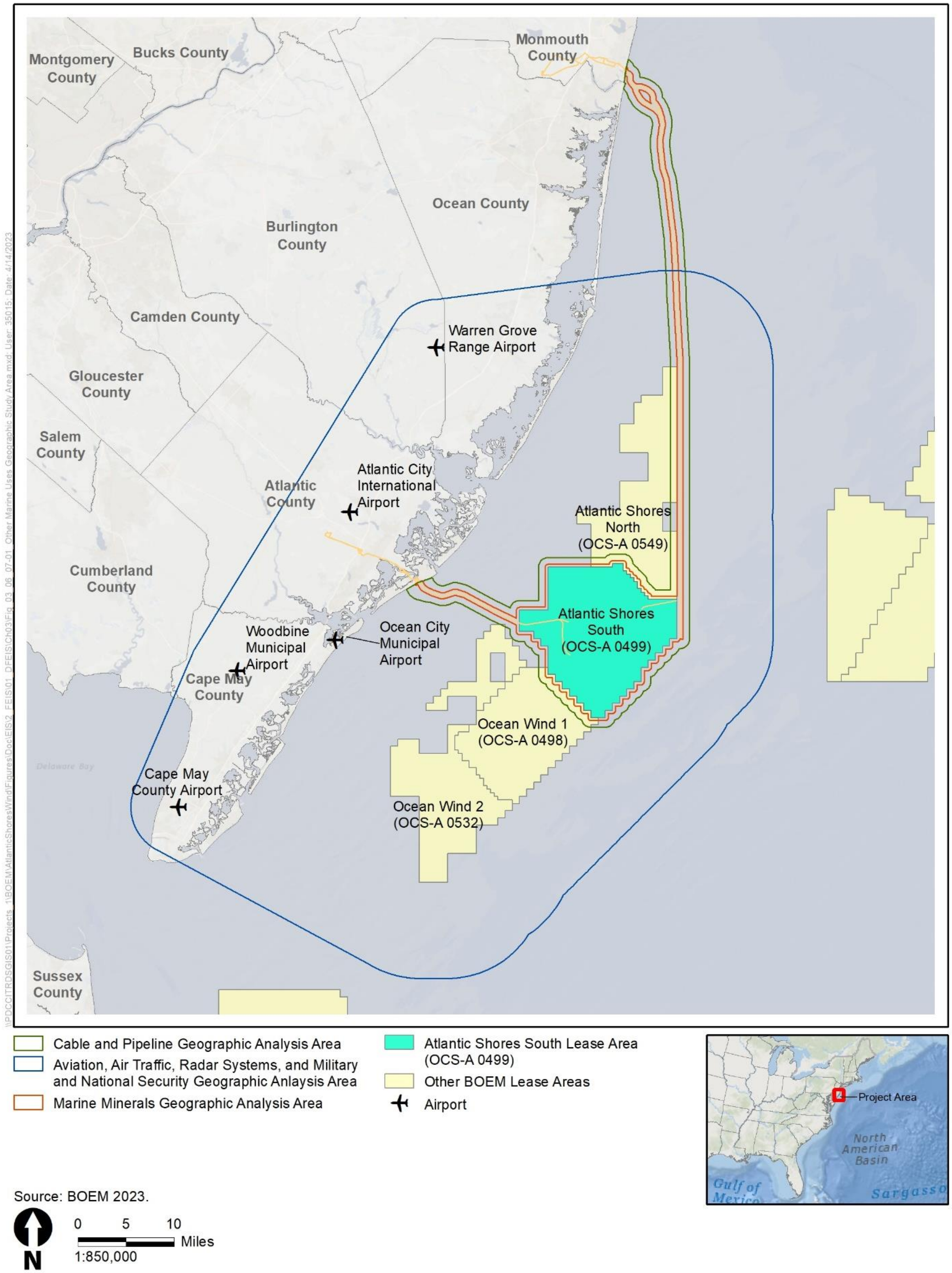

Figure 3.6.7-1. Other uses geographic analysis area

Offshore sand and gravel are important resources managed by federal and state agencies and used for coastal protection and restoration, beach nourishment, and habitat reconstruction purposes. Within or adjacent to the Offshore Project area, BOEM, USACE, NJDEP, and New Jersey Geological and Water Survey (NJGWS) coordinate the management of areas of potential and confirmed sand resources for these coastal management and restoration activities. Beach nourishment projects are common along the sandy coast of New Jersey with several active and proposed projects documented for the beaches of Atlantic City, adjacent to the Atlantic ECC, and in Sea Girt, adjacent to the Monmouth ECC (NOAA 2020).

Military and National Security Use

Of the United States Armed Forces with installations and operations in the vicinity of the Project, the U.S. Navy and USCG (Department of Homeland Security [DHS]) has the most significant presence in and around the Offshore Project area as shown in Figure 3.6.7-2. There is a designated U.S. Navy at-sea area referred to as an Operating Area (OPAREA) located off the coast of New Jersey. The Atlantic City OPAREA extends from Seaside Heights to Sea Isle City and encompasses a majority of the Offshore Project area. This range complex is used for 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 conducts operations in this area. It is controlled by the Fleet Area Control and Surveillance Facility Virginia Capes, Naval Air Station, Oceana. The Atlantic City special use airspace (SUA), within the OPAREA, is used for surface-to-air gunnery exercises and is, therefore, designated as a Warning Area for nonparticipating pilots (COP Volume II, Section 7.7.2; Atlantic Shores 2024).

Within the Offshore Project area, there is the potential to encounter MEC that are the result of military testing and training. MEC is inclusive of UXO and discarded military munitions or constituents that could pose an explosive hazard. Two site-specific studies were commissioned by Atlantic Shores to gain a more detailed understanding of the potential for MEC in the Offshore Project area: the MEC Hazard Assessment and the MEC Risk Assessment with Risk Mitigation Strategy (COP Volume II, Appendix II-A4; Atlantic Shores 2024). The studies determined that the Offshore Project area is within low hazard zones (Zones 2 and 3) for MEC. The reports determined that the likelihood of encountering buried items that constitute a notable safety risk to be below the industry standard of As Low as Reasonably Practicable (ALARP). Furthermore, the studies recommended that the use of high-resolution magnetometry surveys are disproportionate to detect buried items.

The NSRA analyzed vessel incidents using data gathered from the USCG for a period of 14 years (2004–2018). A total of 24 SAR operations were found to have occurred within the confines of the study area, which is defined as 2 nautical miles (3.7 kilometers) beyond the lease boundary and is based on an assumed maximum 2-hour response time for the USCG. These incidents occurred during all seasons, half during daylight hours and half during nighttime, and varied between disabled vessels, medical issues, and other incidents, but there were no recorded allisions, collisions, or groundings in the WTA (COP Volume II, Appendix II-S, Section 10.1; Atlantic Shores 2024).

In July 2021, Atlantic Shores conducted a SAR Risk Assessment Workshop to methodically review the potential impacts of the proposed Project on the USCG's SAR operations and to identify recommended mitigations. Participants of this workshop included Atlantic Shores, BOEM, and USCG. The SAR Risk

Assessment Workshop Summary Report is part of the COP (Volume II Appendix II-T4; Atlantic Shores 2024), and recommendations from this workshop that would be adopted would be included in Atlantic Shores' Emergency Response Plan. 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.

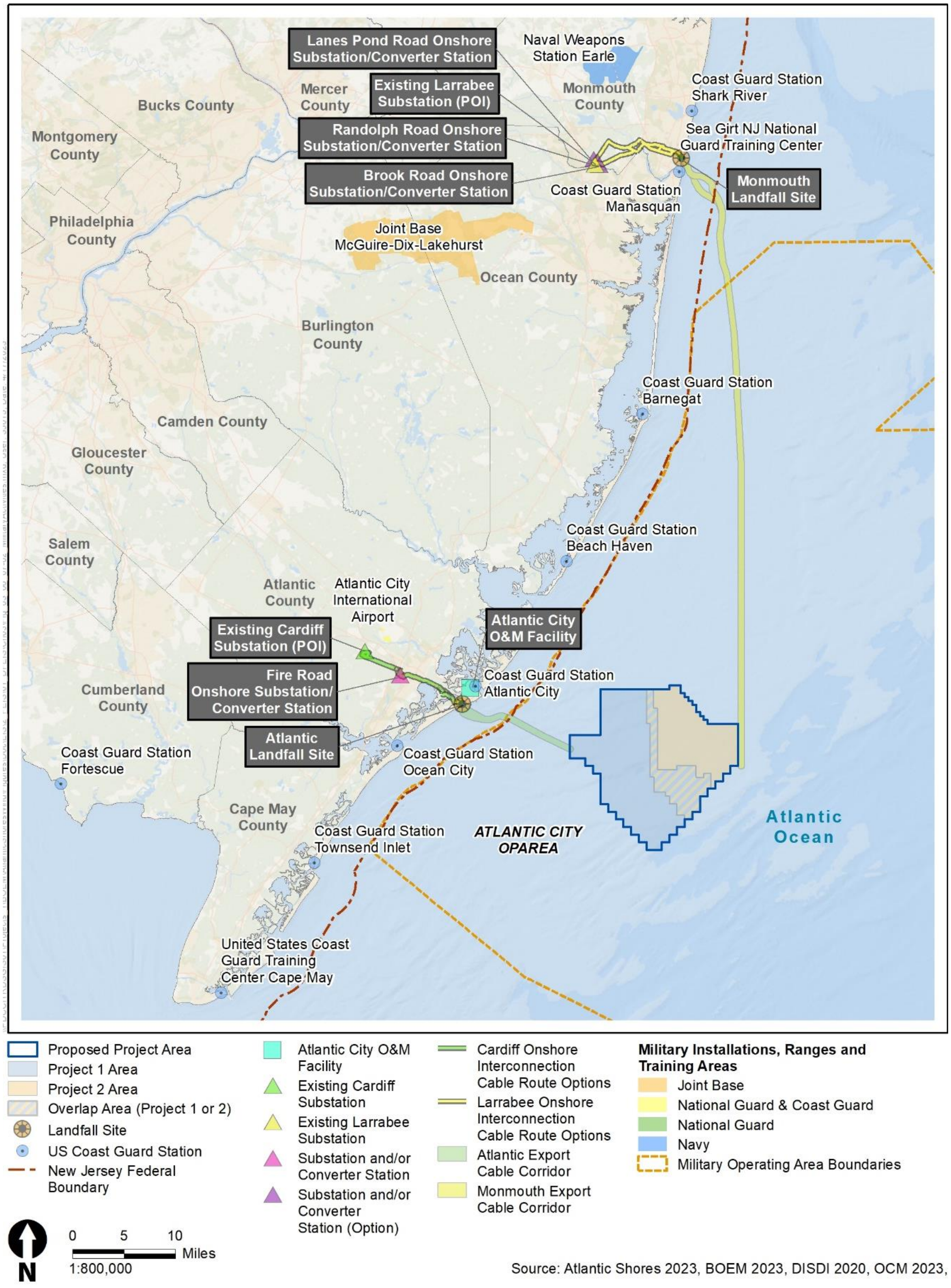

Figure 3.6.7-2. Military activities in the vicinity of the Offshore and Onshore Project areas

Aviation and Air Traffic

Multiple public and private-use airports serve the region surrounding the Project area, including Atlantic City International Airport, Ocean City Municipal Airport, Woodbine Municipal Airport, and Warren Grove Range Airport. The New Jersey and Delaware Air National Guard and the U.S. Navy use portions of the WTA for flight training. A list of public, private, and military airports within proximity to the WTA can be found in COP Volume II, Table 7.8-1 (Atlantic Shores 2024). In addition to the designated military airspace within the Offshore Project area, USCG will conduct flights over the water to support SAR operations using both vessel and helicopter assets (COP Volume II, Section 7.8.2; Atlantic Shores 2024).

Air traffic is expected to continue at current levels in and around the WTA.

Cables and Pipelines

The onshore export cable corridors for Cardiff and Larrabee are within developed areas of New Jersey that overlap multiple utilities including cables and pipelines.

There are approximately 20 publicly known telegraph and fiber optic cables (active and out of service) offshore within the geographic analysis area (Figure 3.6.7-3).

During the Initial Cable Burial Risk Assessment (CBRA) for the Monmouth ECC, it was found that, within the Monmouth ECC, there are five expected crossings of active cables, seven crossings of inactive cables, and two crossings of cable where the status is unconfirmed or unknown (COP Volume II, Appendix II-A5b, Section 6.2.1.4; Atlantic Shores 2024). Cables within the Monmouth ECC include:

- GlobeNet Segment 5, a high-capacity subsea cable system from Bermuda to New Jersey, active
- GlobeNet Segment 1, a high-capacity subsea cable system from Florida to New Jersey, active
- Transatlantic Telecommunications Cables (TAT-3 [inactive], TAT-14 [inactive], TAT-7 [inactive], TAT-8 [inactive], TAT-11 [inactive], and TAT-9 [inactive])
- Apollo South, an optical submarine communications cable system, active
- TGNA, a submarine telecommunications cable system, active
- Possible telephone cable, status unknown
- Unknown cable, status unknown

During the Initial CBRA for the Atlantic ECC, it was found that, within the Atlantic ECC, there were no identified cable crossings. There was a potential linear object interpreted from the geophysical survey; however, the interpreted object does not correspond to a charted cable. This linear feature is interpreted most likely to be a dropped pipe related to dredging operations (COP Volume II, Appendix II-

A5a, Executive Summary; Atlantic Shores 2024). The Initial CBRAs only surveyed existing cables within the Atlantic and Monmouth ECCs.

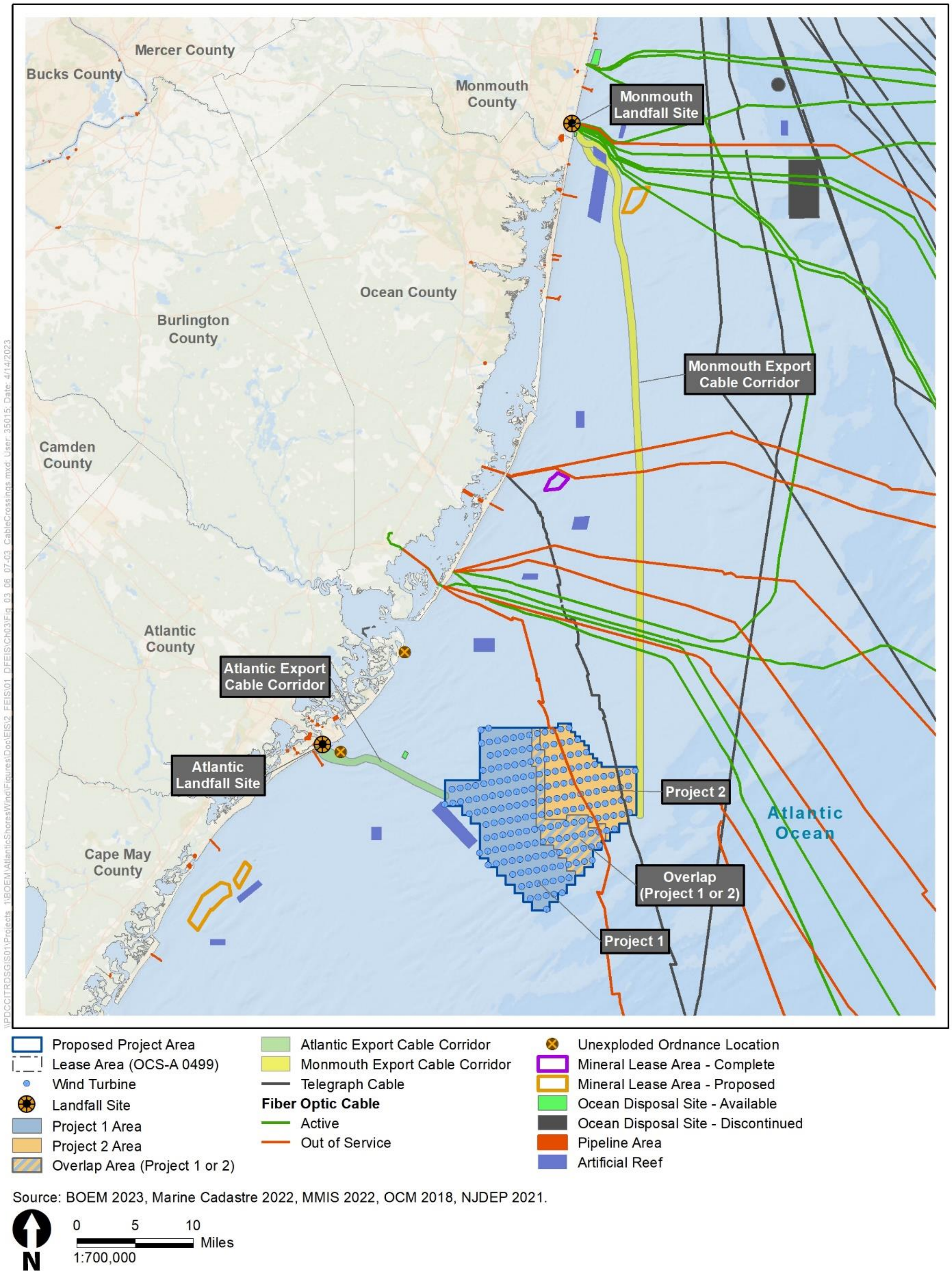

Figure 3.6.7-3. Atlantic Shores South cable crossings

BOEM has not identified any additional publicly noticed plans for planned submarine cables or pipelines in the geographic analysis area.

Radar Systems

Commercial air traffic control, national defense, and weather radar systems currently operate in the region. Radar facilities that overlap with the Offshore Project area include those that support air traffic control, military surveillance, high frequency (HF) coastal radars, and weather monitoring.

The FAA uses the following radar sites for air traffic control at multiple facilities, including the New York TRACON and the Philadelphia TRACON:

- Newark Airport Surveillance Radar model 9 (ASR-9)
- New York ASR-9
- Philadelphia ASR-9
- Naval Air Station Willow Grove ASR-11

The NOAA Integrated Ocean Observing System (IOOS) utilizes the following HF radars (which are operated by Rutgers University) as part of its Surface Currents Program, with the exception of Assateague Island HF, which is operated by Old Dominion University (COP Volume II, Appendix II-T2; Atlantic Shores 2024). The HF data collected in the IOOS is also utilized by the USCG for their Search and Rescue Optimal Planning System (SAROPS) software (IOOS 2012).

- Bradley Beach HF radar
- Brant Beach HF radar
- Brigantine Long Range HF radar
- Brigantine Medium Range HF radar
- Cape May Point HF radar
- Hempstead HF radar
- Loveladies HF radar
- Moriches HF radar
- North Wildwood HF radar
- Sandy Hook HF radar
- Sea Bright HF radar
- Seaside Park HF radar
- Strathmere HF radar
- Wildwood HF radar
- Assateague Island HF radar

HF (Land-Based) radars are one of the primary methods of collecting surface current data for USCG SAR. Existing radar systems will continue to provide weather, navigational, and national security support to the region. The number of radars and their coverage areas are anticipated to remain at current levels for the foreseeable future.

Scientific Research and Surveys

Research in the geographic analysis area includes oceanographic, biological, geophysical, and archaeological surveys focused on the OCS and nearshore environments, and resources that may be affected by offshore wind development. Federal and state agencies, educational institutions, and environmental non-governmental organizations participate in ongoing offshore research in the WTA and surrounding waters.

Off the coast of New Jersey, agency-sponsored research and survey efforts are conducted by the NEFSC, NJDEP, and the Northeast Area Monitoring and Assessment Program (NEAMAP) led by the Virginia Institute of Marine Sciences. The following in-water studies have historically traversed the Offshore Project area: NEFSC multi-species bottom trawls, NJDEP trawls, NEFSC Ocean Quahog and clam surveys, and NEAMAP trawl surveys. Gear used for these surveys include four-seam bottom and otter trawls, with the exception of NEFSC clam surveys, which used a hydraulic dredge (COP Volume II, Section 7.7.6; Atlantic Shores 2024). Additionally, NEFSC conducts an annual Integrated Sea Scallop and HabCam Research Survey, a sea scallop stock assessment and habitat characterization tool, and an ecosystem monitoring program, a more than 40-year shelf monitoring program within the mid-Atlantic region, both of which overlap with the Lease Area.

Scientific surveys support numerous other science products produced by NOAA Fisheries, including ecosystem and climate assessments. In addition to in-water surveys, aerial surveys to measure the abundance of marine mammals and sea turtles are conducted from Maine to the Florida Keys as part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS) by NOAA. NOAA conducts these surveys within the Offshore Project area utilizing aircraft that fly 600 feet (183 meters) above the water surface at 110 knots (200 kilometers per hour) (NEFSC 2020).

3.6.7.2 Impact Level Definitions for Other Uses (Marine Minerals, Military Use, Aviation, and Scientific Research and Surveys)

This Final EIS uses a four-level classification scheme to characterize potential impacts of the Proposed Action, as shown in Table 3.6.7-1. See Section 3.3, *Definition of Impact Levels,* for a comprehensive discussion of the impact level definitions. There are no beneficial impacts on other uses.

Table 3.6.7-1. Impact level definitions for other uses

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, and Scientific Research and Surveys)

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

Impacts of Alternative A – No Action

Under the No Action Alternative, marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar systems, and scientific research and surveys described in Section 3.6.7.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. See Appendix D, Tables D.A1-14 through D.A1-19 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for military and national security use, aviation and air traffic, cables and pipelines, marine minerals, radar systems, and scientific research and surveys, respectively.

There are no ongoing offshore wind activities within the geographic analysis area for marine mineral extraction and cables and pipelines. There is one ongoing offshore wind activity within the geographic analysis area for military and national security uses, aviation and air traffic, and radar systems: Ocean Wind 1 (OCS-A 0498). Within the geographic analysis area for scientific research and surveys, the following offshore wind activities are ongoing (based on the scenario shown in Appendix D):

- Continued O&M of the BIWF Project (5 WTGs) installed in state waters;
- Continued O&M of the CVOW pilot Project (2 WTGs) installed in OCS-00497; and

- Ongoing construction of six offshore wind projects: the Vineyard Wind 1 Project (62 WTGs and 1 OSS) in OCS-A 0501, the SFWF Project (12 WTGs and 1 OSS) in OCS-A 0517, the Ocean Wind 1 Project (98 WTGs and 3 OSSs) in OCS-A 0498, the Revolution Wind Project (65 WTGs and 2 OSSs) in OCS-A 0486, the Empire Wind Project (147 WTGs and 2 OSSs) in OCS-A 512, and the CVOW-C Project (202 WTGs and 3 OSSs) in OCS-A 0483.

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 ongoing offshore wind activity have the potential to affect ongoing military and national security uses, aviation and air traffic, radar systems, and research and surveys within the geographic analysis area.

Cumulative Impacts of Alternative A – No Action

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

No offshore developments, such as the installation of new structures on the OCS outside of planned offshore wind projects, were identified within the geographic analysis area (see Section D.1 in Appendix D for a description of ongoing and planned activities). Impacts on the marine environment associated with climate change and commercial fishing have the potential to affect ongoing research and surveys within the geographic analysis area. See Appendix D, Tables D.A-14 through D.A-19 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for other uses.

The sections below summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on other uses during construction and installation, O&M, and decommissioning of the projects. Other planned offshore wind activities in the geographic analysis area for other uses are limited to the construction and installation, O&M, and decommissioning of Ocean Wind 2 in Lease Area OCS-A 0532 and Atlantic Shores North in Lease Area OCS-A 0549.

BOEM expects ongoing and planned offshore wind development to 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.[1] There are, however, two open ocean dredged material disposal sites: Cold Spring Inlet and Absecon Inlet (USACE n.d.). In addition, within the geographic analysis area, there are two sand resource areas in federal waters (Shoal 236 and F2) and three in state waters (Shoal 235, Area G, and BI-

[1] BOEM Marine Mineral Lease Areas: https://www.boem.gov/marine-minerals/requests-and-active-leases.

J) (BOEM 2022). 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 of the shoreline, limiting adverse impacts to the offshore export cable routes. Additionally, it may be possible for other offshore wind projects to avoid existing and prospective borrow areas through consultation with the BOEM Marine Minerals Program, USACE, and relevant state agencies before an offshore wind cable route is approved. The adverse impacts on sand and marine mineral extraction of offshore wind activities are anticipated to be minor.

Military and National Security 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 along the coastline are limited to dock facilities and other structures. Installation of up 101 foundations (see Table D.A2-2, Appendix D) as part of other ongoing and planned offshore wind projects in the geographic analysis area would affect military and national security operations, 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 lighted 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 geographic analysis area.

The construction of offshore wind projects in the geographic analysis area would 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 operations 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. SAR operations are not required to be carried out in a specific area on the OCS or in open water only. Therefore, the presence of structures would not displace any specific SAR operation from a designated or dedicated area. SAR operations are tailored to the specific "rescue" area. When designing the SAR operation, the environment is taken into account when the operation is being developed. Additionally, military and security operations would be affected during the construction and operation periods of offshore wind activities. 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. Refer to Section 3.6.6, *Navigation and Vessel Traffic*, for additional discussion of navigation impacts in the offshore wind lease areas.

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 with military and national security vessels and to an increased demand for USCG SAR operations.

Navigational hazards would be eliminated as structures are removed during decommissioning. Due to anticipated coordination with agencies the overall impacts on military and national security uses from offshore wind energy activities are anticipated to be minor to moderate**.**

Traffic: Impacts on military and national security operations from vessel traffic related to the construction and operation of offshore wind activities on the OCS are expected to be short term and localized. Vessel traffic is expected to increase during construction. While construction periods of various offshore wind energy projects are expected to be staggered, there would be an overlap in construction between the three offshore wind projects in the geographic analysis area (Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North) in 2026–2027, which would result in a cumulative impact on traffic volumes. 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 101 foundations to the offshore environment in the nearby OCS (Appendix D, Table D.A2-2). WTGs could have a maximum blade tip height of 906 feet (276 meters) MLLW (Appendix D, Table D.A2-1). As these structures are built, aircraft navigational patterns and complexity would 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 (AVI-09). BOEM assumes that 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 at least 14 cables, including both active and inactive fiber optic and telephone cables within the geographic analysis area. One mapped pipeline area of unknown origin is present onshore along the Cardiff Onshore Interconnection Cable Route. Structures within and near the geographic analysis area that pose potential allision hazards include buoys that are used to mark inlet approaches, channels, and shoals; meteorological buoys associated with offshore wind lease areas; and shoreline developments such as docks, ports, and other commercial, industrial, and residential structures. Installed WTGs and OSSs, and the stationary lift vessels used during construction of offshore wind energy project infrastructure, may pose allision/collision risks and navigational hazards to vessels conducting maintenance activities on these existing cables and pipelines. Risk to cable maintenance vessels during construction and operations of nearby offshore wind projects would be limited due to the infrequent submarine cable maintenance required at any single location along existing cable routes. Allision risks would be mitigated by navigational hazard markings per FAA, USCG, and BOEM requirements and guidelines. Risk of allision by cable maintenance vessels would decrease to zero after project decommissioning as structures are removed.

Up to 1,170 miles (1,883 kilometers) of submarine cables are expected to be installed for the Ocean Wind 2, and Atlantic Shores North projects (Appendix D, Table D.A2-1). 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 interarray cables associated with those projects are removed. Minor adverse impacts on existing cables and pipelines due to anticipated offshore wind projects are expected.

As for buried structures, the presence of MECs, which include UXO and discarded military munitions or constituents, the Offshore Project area is within the low hazard zones. If any MECs are identified prior to construction, Atlantic Shores would mitigate through avoidance if possible. Should avoidance not be possible, Atlantic Shores would adhere to the U.S. Committee on the Marine Transportation System's *Proposed National Guidance for Industry on responding to Munitions and Explosives of Concern in U.S. Federal Waters* (2023).

Radar Systems

Presence of structures: WTGs that are near to or in the direct line of sight or over the horizon coverage area 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 add up to 366 WTGs with a maximum blade tip height of up to 1,049 feet (320 meters) MLLW in the geographic analysis area. The presence of these wind energy structures could lead to localized, long-term, moderate impacts on radar systems. Development of offshore wind projects could 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. 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.

BOEM assumes that project proponents would conduct an independent radar analysis and coordinate with the federal agency that manages the radar system (e.g., FAA, Department of Defense [DoD], NOAA) 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 for discussion of impacts on marine vessel radar.

HF radars are one of the primary methods of collecting surface current data for USCG SAR. Information from HF radars comes with caveats that exist outside of structures on the OCS. NOAA and Navy oceanographic models that provide current analyses and predictions are suitable for offshore use; however, a majority of USCG SAR cases occur within 20 nautical miles (37 kilometers) of the coast. Other model products that cover coastal areas, such as the Advanced Circulation Model, do not completely describe surface currents. Regional model product coverage is patchy, and current meter measurements provide limited spatial coverage (USCG 2008).

Scientific Research and Surveys

Presence of structures: Construction of other wind energy projects between 2026 and 2030 in the geographic analysis area would add up to 605 WTGs, OSSs and met towers (Appendix D, Table D-3), 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 Final EIS incorporates by reference the detailed summary of 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; impacts on the random-stratified statistical design that is the basis for assessments, advice, and analyses; alteration of benthic and pelagic habitats and airspace in and around the wind energy development, which would require new designs and methods to sample new habitats; and reduced sampling productivity through navigation impacts of wind energy infrastructure on aerial and vessel surveys. 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 would disrupt survey sampling statistical designs, such as random-stratified sampling. Impacts on the statistical design of regionwide 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. NOAA Fisheries and BOEM have drafted a Federal Survey Mitigation Implementation Strategy for the Northeast U.S. Region (Hare et al. 2022). The strategy addresses anticipated impacts of offshore wind energy development on NOAA Fisheries' scientific surveys. It also defines stakeholders, partners, and other ocean users that would be engaged throughout the process and identifies potential resources for successful implementation. Identification and analysis of specific measures are speculative at this time; however, these 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.

Conclusions

Impacts of Alternative A – No Action. Ongoing activities in the geographic analysis area would likely result in **minor** impacts for marine mineral extraction and SAR operations. This would be due to proximity to open ocean dredged material disposal sites and sand resource areas, and navigation around structures within the geographic area, respectively. The impacts on military and national security uses, aviation and air traffic, cables and pipelines, and radar systems would be **negligible** due to the other existing activities in the geographic analysis area. Currently, offshore structures in the geographic analysis area are limited to meteorological buoys associated with 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. Impacts of ongoing activities on scientific research and surveys are anticipated to be **moderate**, due to the presence of stationary structures from ongoing offshore wind activities impeding or preventing surveying activities.

Cumulative Impacts of Alternative A – No Action. In addition to ongoing activities, BOEM anticipates that the cumulative impacts associated with the No Action Alternative, when combined with all other planned activities (including offshore wind) in the geographic analysis area would result in moderate adverse impacts. Planned activities expected to occur in the geographic analysis area include increasing vessel traffic; continued residential, commercial, and industrial development onshore and along the shoreline; and continued development of FAA-regulated structures such as cell towers and onshore wind turbines. BOEM anticipates that any issues with aviation routes or radar systems would be resolved through coordination with DoD, FAA, and/or NOAA, 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.

BOEM anticipates that offshore wind activities in the geographic analysis area would result in noticeable impacts. The presence of stationary structures associated with ongoing and planned 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.

BOEM anticipates that the cumulative impact of the No Action Alternative in the geographic analysis area would result in **minor** impacts for marine mineral extraction, aviation and air traffic, and cables and pipelines; **minor** 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 Final EIS analyzes the maximum-case scenario; any potential variances in the proposed 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, OSSs, and met tower; and
- Timing of offshore construction and installation activities.

Variability of the proposed 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 visual impacts and the removal or relocation of turbines to avoid impacts on marine habitats and reefs.
- OSS size: Size would influence the number of structures located outside of the uniform grid pattern.
- WTG spacing: Removal of groups of WTGs to allow for a setback between lease areas could allow for movement of commercial and military vessels.
- Timing of construction: Construction could affect submarine or surface military vessel activity during typical operations and training exercises.

3.6.7.5 Impacts of Alternative B – Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation, and Scientific Research and Surveys)

Marine Mineral Extraction

Presence of structures: While there are two open ocean disposal sites in the vicinity of the Project within the geographic analysis area for marine mineral extraction, they have not been used in recent years (Ocean Disposal Database 2022). The Absecon Inlet, west of Atlantic City, was last used in 1978 and the Cold Springs Inlet, southwest of Cape May, was last used in 2016. The Project's ECCs were routed to avoid most federal and state designated sand resource areas (OTH-02, Appendix G, *Mitigation and Monitoring,* Table G-1). As shown on Figure 3.6.7-4 there are two unverified[2] sand resource areas that fall within the route of the Monmouth ECC: Shoal 236 (within federal waters) and Shoal 235 (within state waters), and one potential[3] resource area F2 (within federal waters). There are two potential sand resource areas along the Atlantic ECC: BI-J and Area G (within state waters) (BOEM 2022). Sand resources offshore New Jersey are limited and the presence of a cable or cables through these areas would restrict the use of the sand for future renourishment projects until decommissioning. Atlantic Shores conducted an analysis to approximate the volume of potential OCS sand that would become inaccessible within the overlapping 1,640-foot (500-meter) cable buffer zone using a 6-foot (1.8-meter) thickness volume for the Monmouth ECC. Utilizing these volumes, the Monmouth ECC route would exclude approximately 1,128,000 cubic yards (862,417 cubic meters) of sand resources. 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 due to the cable corridors is $15,341,000 (Crist 2021).

The need for federal sand resources 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. The Projects' ECCs that were surveyed in 2020 were routed to avoid most federal- and state-designated sand resource and sand borrow sites in the vicinity of the Offshore Project area. However, because small segments of both ECCs crossed designated sand borrow areas, Atlantic Shores coordinated with BOEM, as well as NJDEP and USACE to reroute small portions of the ECCs in 2021, to avoid mapped sand resource areas, including leased sand borrow sites (COP Volume II, Section 2.1.1.2.2; Atlantic Shores 2024). Details on the assumed number of cubic yards of sand that would be reserved for use by the BOEM Marine Minerals Program (MMP) can be found in the COP (Volume II, Table 7.7-2; Atlantic Shores 2024).

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[2] Resource areas hypothesized to exist on the basis of indirect evidence (seismic profiles, bathymetry, or side scan sonar). Inferred sediment types, unit thickness, and lateral extents have not been confirmed through direct sampling methods.

[3] Resource areas whose existence has been verified through sufficient geotechnical and geophysical data. Thickness and lateral extent has not been fully determined. All areas have some combination of geotechnical and geophysical datasets (vibracore, bathymetry, sidescan, and seismic).

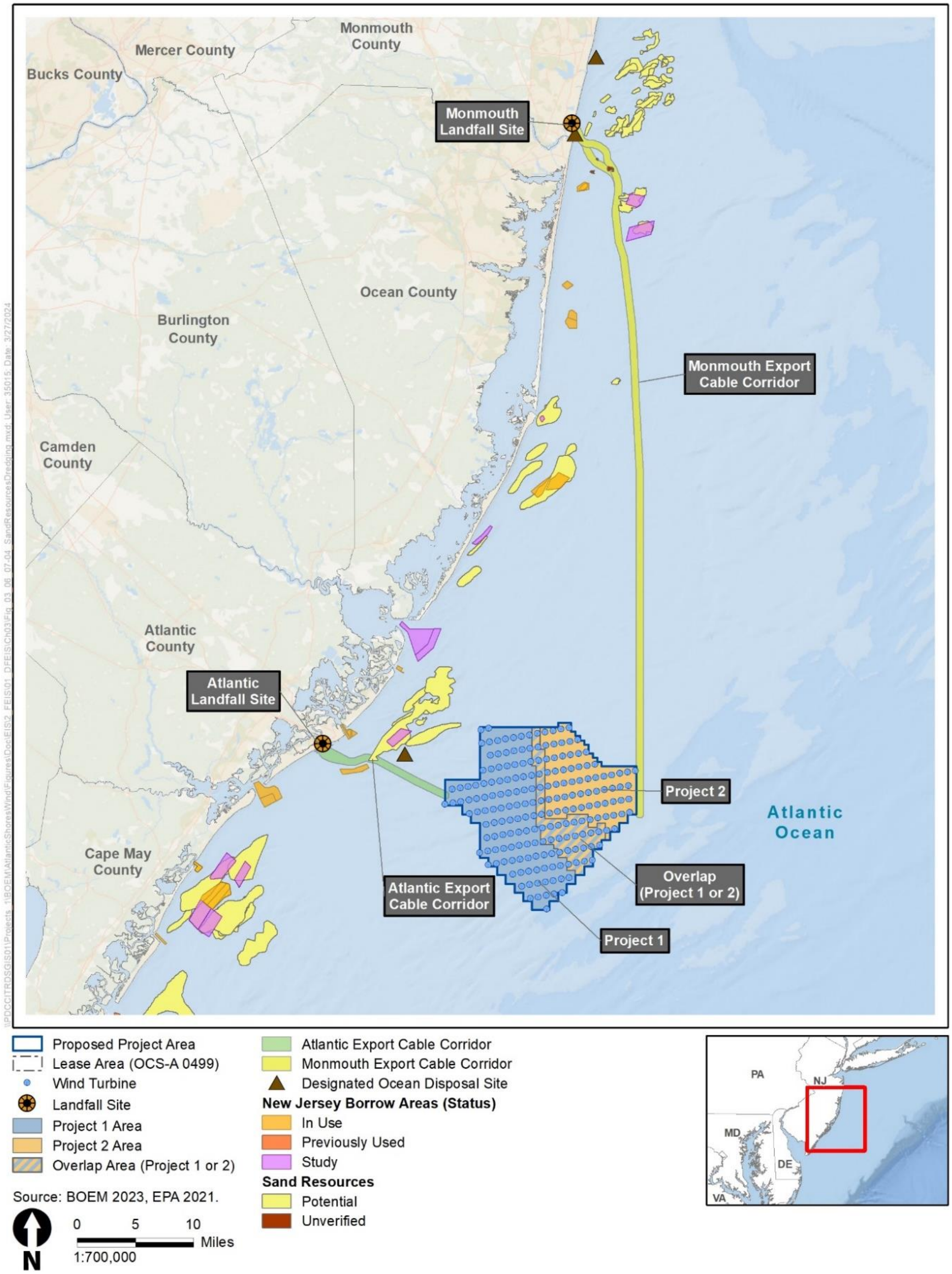

Figure 3.6.7-4. Atlantic Shores South sand resource and sand borrow areas

Military and National Security Uses

Presence of structures: The addition of up to 200 WTGs, one permanent met tower and up to 10 OSSs would increase the risk of allisions for military and national security 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 Proposed Action. The risk of allision for vessels transiting would be further increased by having the locations of the up to 10 OSSs and met tower placed outside of the uniformed grid pattern.

Project structures would be marked as a navigational hazard per FAA, BOEM, and USCG regulations and guidelines, and WTGs, OSSs, and the met tower would be visible on military and national security vessel and aircraft radar, minimizing the potential for allision and increased navigational complexity. Additional navigational complexity would increase the risk of collision and allisions for military and national security vessels or aircraft within the Project area.

If any anthropogenic hazard cannot be avoided during the installations, the agreed reporting protocol must be followed. Once Atlantic Shores has established the full situation, USCG would be informed of the item. They would then consult with the relevant military organizations to determine if the item presents a direct risk to infrastructure or personnel (COP Volume II, Appendix II-A4; Atlantic Shores 2024).

An Obstruction Evaluation/Airspace Analysis (OE/AA) report was completed to characterize the existing airspace surrounding the WTA and support the preliminary assessment of the WTGs potential effects on airspace (COP Volume II, Appendix II-T1; Atlantic Shores 2024). Potential impacts on military and national security operations from the permanent placement of structures within the water column and above the sea surface within the WTA are expected to be long term and localized.

As requested by BOEM, the Military Aviation and Installation Assurance Siting Clearinghouse coordinated a review of the within the DoD of the Atlantic Shores South COP. The review identified anticipated adverse Project impacts on North American Aerospace Defense Command (NORAD) radars and Department of the Navy missions. The potential adverse impacts identified are on the Gibbsboro New Jersey Air Route Surveillance Radar (ARSR-4) and the Wrightstown-McGuire AFB New Jersey Airport Surveillance Radar (ASR-11), both of which are used for NORAD air defense missions (Sample 2024). Atlantic Shores would continue to coordinate with DoD through the Military Aviation and Installation Assurance Siting Clearinghouse, as well as FAA and USCG (AVI-10; Appendix G, Table G-1).

USCG SAR operations could be hindered within the WTA due to navigational complexity and safety concerns of operating among WTGs, OSSs, and the met tower. Additionally, mariners may not be aware that there are up to 11 structures whose placement does not conform with the gridded layout of the WTGs. The WTGs would be placed in a uniform grid along east-northeast/west-southwest rows spaced 1.0 nautical mile (1.9 kilometers) apart and north/south columns spaced 0.6 nautical mile (1.1 kilometers) apart. The WTG grid would also create diagonal corridors of 0.54 nautical mile (1.0 kilometer) running approximately northwest/southeast as well as diagonal corridors of 0.49 nautical mile (0.9 kilometer) running approximately north-northeast/south-southwest. The OSSs would be sited along the same east-northeast/west-southwest rows of the WTGs, but outside of the uniform pattern, sited within the narrower north/south corridors. The met tower would be sited outside of the uniform grid pattern of the WTGs as well, not within the east-northeast/west-southwest rows or the north/south columns. Changing navigational patterns could also concentrate vessels within and around the outsides of the Project area, potentially causing space use conflicts in these locations or reducing the efficiency of SAR operations, resulting in moderate, adverse impacts on SAR operations. USCG may need to adjust its SAR planning and search patterns to accommodate the WTG layout, leading to a less-optimized search pattern and a lower probability of success. This could lead to increased loss of life due to maritime incidents.

ATONs, as discussed in Section 3.6.6, are developed, established, operated, and maintained or regulated by USCG to assist mariners in determining their position, identifying safe courses, and warning of dangers and obstructions. In the planning of routes for cables, Atlantic Shores avoided existing ATONs where possible while also considering the locations of other obstructions such as artificial reefs and sand borrow areas. Atlantic Shores would not know whether any ATONs within the surveyed cable corridors would require repositioning until the final cable routing is complete. Cable burial near ATONs must be deconflicted with USCG prior to installation (GEO-22; Appendix G, Table G-1). Any relocation of USCG-maintained ATON would increase impacts on vessel navigation/USCG activities such as SAR.

Construction of the Proposed Action would add up to 200 WTGs, one permanent met tower, and up to 10 OSSs that could create an artificial reef effect, attracting species of interest to recreational fishing or sightseeing, which would attract additional recreational vessels in addition to existing vessel traffic in the area. The presence of additional recreational vessels would add to the space use conflict and collision risks for military and national security vessels.

Traffic: Increased vessel traffic in the Project area 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 greatest and would be reduced during operations. The navigation corridors created by the foundations would become more difficult for vessels to traverse with the placement of the OSSs and met tower outside of the uniformed grid pattern of the WTGs. Vessel traffic and navigation impacts are summarized in Section 3.6.6. All structures would be marked and lighted in accordance with FAA, BOEM, and USCG guidelines.

Aviation and Air Traffic

Presence of structures: The Proposed Action would install up to 200 WTGs with maximum blade tip heights of up to 1,049 feet (320 meters) above MLLW in the WTA, and up to 10 OSSs. The addition of these structures would increase navigational complexity and change aircraft navigational patterns around the WTGs.

As the WTGs defined by the maximum PDE for the Atlantic Shores South Project would exceed 200 feet (61 meters), each WTG located within 12 nautical miles (22 kilometers) of the coastline would require review by the FAA in accordance with 14 CFR Part 77.9. Of the up to 200 WTGs in the WTA, up to 43 would require filing with the FAA (U.S. Territorial Airspace), including up to 41 within Project 1 and up to 2 within Project 2 (each including the Overlap Area) (COP Volume II, Section 7.8.2; Atlantic Shores 2024).

Atlantic Shores conducted an Air Traffic Flow Analysis (COP Volume II, Appendix II-T3; Atlantic Shores 2024) to ascertain if there is evidence of historic flights within FAA managed airspace to determine the potential to modify FAA operational procedures or adjust airspace or other mitigation requirements through formal filing and review under Federal Regulations, FAA Orders, and Flight Information Publications. The findings in the Air Traffic Flow Analysis indicate that turbines at 1,049 feet (320 meters) MLLW and below would not affect a significant volume of operations; and it is possible that the FAA would not object to increasing the affected altitudes of the various procedures and radar control facility charts to accommodate turbines. These mitigation options are available and are subject to FAA approval (COP Volume II, Section 7.8.2; Atlantic Shores 2024). Site-specific studies for the Proposed Action also included an Obstruction Evaluation and Airspace Analysis (COP Volume II, Appendix II-T1; Atlantic Shores 2024) and Navigational and Radar Screening Study (COP Volume II, Appendix II-T2; Atlantic Shores 2024). These studies assessed height constraints overlying each turbine in the Project area and the results of a radar and navigational aid screening study, respectively.

WTGs, OSSs, and the met tower would comply with lighting and marking regulations and be marked per FAA, BOEM, and USCG regulations and guidelines to minimize and mitigate impacts on air traffic. Due to their size, WTGs, OSSs, and the met tower would also be visible on aircraft radars. Navigational hazards and collision risks in transit routes would be reduced as construction is completed, but additional hazards due to the placement of the up to 11 OSSs and met tower would remain outside of the grid of the WTGs. The different placement of structures would offset the existing lighting, marking, and signaling schematic. Risks would be gradually eliminated during decommissioning as offshore WTGs, OSSs, and the met tower are removed. Adverse impacts on air traffic are anticipated to be localized, long term, and minor.

Aviation could be affected by the use of vessels and equipment (e.g., cranes) during construction, operations and maintenance, and decommissioning of offshore structures. The effects would result from the potential that tall structures could interfere with air traffic or radar transmission, or both, within the WTA. If vessels or cranes required to support construction, O&M, or decommissioning exceed 14 CFR Part 77.9 Notice Criteria and JO 7400.2N Instrument Approach Areas, Atlantic Shores would file a notice with the FAA for evaluation prior to the start of construction (COP Volume II, Section 7.8.5; Atlantic Shores 2024).

Atlantic Shores has also committed to implementing a comprehensive set of measures to avoid, minimize, or mitigate effects on SAR and improve search efforts overall. The measures include, but are not limited to, installing a direction finder system, high-resolution infrared cameras, and weather monitoring devices; employing a Marine Coordinator to liaise with the USCG; navigation lighting and marking in accordance with USCG and BOEM guidance; having the capability to mark each WTG, OSS, and met tower position with AIS; equipping WTG and OSS foundations with access ladders; and developing an Emergency Response Plan (ERP) (OTH-07, AVI-04 – AVI-08, PUB-03, NAV-04 NAV-05, NAV-06, NAV-08, NAV-09, NAV-14, Appendix G, Table G-1). Additionally, Atlantic Shores prepared a comprehensive risk assessment of aerial SAR (COP Volume II, Appendix II-T4; Atlantic Shores 2024) in coordination with USCG, BOEM, and other relevant stakeholders, to further evaluate effects of the Project on USCG SAR operations and identify additional risk mitigation strategies. As a result, all construction and installation vessels and equipment would display the required navigation lighting and day shapes and make use of AIS as required by USCG.

The USCG (2020) Massachusetts and Rhode Island Port Access Route Study (MARIPARS) undertook a detailed assessment of the effect of WTG spacing on aerial SAR and identified that 0.6 nautical mile (1.1 kilometers) is the minimum spacing between structures for vessels to safely maneuver within a wind farm. The Project is not expected to preclude helicopter use in the WTA. The turn diameter for a helicopter operating at normal search speeds, utilizing normal flight procedures, ranges from 0.8 to 1 nautical mile (1.5 to 1.9 kilometers). One nautical mile (1.9 kilometer) spacing between WTGs allows aircrews to safely execute turns to the adjacent lane using normal flight procedures in visual conditions. The WTGs would be placed along east-northeast/west-southwest rows spaced 1.0 nautical mile (1.9 kilometers) apart and north/south columns spaced 0.6 nautical mile (1.1 kilometers) apart. However, the OSSs and met tower would be sited outside of the uniformed grid of the WTGs. The OSSs would be placed between the WTG north/south columns, rendering the resulting corridor unusable for vessels transiting in that corridor. With the location of the OSSs and met tower outside of the grid, USCG SAR efforts by helicopter would be affected by the turn radius restrictions created by the structures.

Cables and Pipelines

Presence of structures: The ECCs would cross existing marine infrastructure, including submarine cables and pipelines. The Monmouth ECC could encounter up to 15 crossings, while the Atlantic ECC could have up to four crossings. These maximum numbers of crossings assume that other offshore wind energy cables may be installed prior to the start of Project construction. It is also estimated that up to 10 interarray cable crossings and up to 2 interlink cable crossings may be required (COP Volume I, Section 4.5.8; Atlantic Shores 2024). Atlantic Shores is currently coordinating with cable owners regarding crossing methods or setbacks (OTH-04; Appendix G, Table G-1). The presence of planned 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 Proposed Action’s offshore export cables 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 interarray cables are removed.

Before the installation of Offshore Project cables, the area around each cable crossing would be cleared of any marine debris and all existing structures identified. Depending on the status of the existing cable and its location, such as burial depth and substrate characteristics, cable protection may be placed between the existing cable and the Project overlying cable. However, if sufficient vertical distance exists, such protection may be avoided. Once the final CBRA is complete, the target burial depth would be determined. The presence of an existing cable likely would prevent the Project cable from being buried to its target burial depth of 5 to 6.6 feet (1.5 to 2 meters). In this case, cable protection may be required at the crossing location to cover the new cable (OTH-04; Appendix G, Table G-1). Following installation of the new cables, a visual survey of cable crossing would be conducted to ensure proper placement has occurred (COP Volume II, Section 2.1.1.2.4; Atlantic Shores 2024). Atlantic Shores would work with NOAA to ensure the location of the cables are included on navigational charts for mariner awareness and are monitored. This would ensure that any cables left in place after the decommissioning of the Project can be accurately located.

One pipeline within the Great and Turtle Gut Thorofares is present onshore along the Cardiff Onshore Interconnection Cable Route. Atlantic Shores would cross the waterbodies in this area via trenchless technologies such as HDD, jack-and-bore, and/or jack piping to avoid this identified pipeline. The NOAA nautical charts show no evidence that either ECC route would require a submarine pipeline crossing (COP Volume II, Section 7.7.5; Atlantic Shores 2024).

Project structures, including WTGs, OSSs, the permanent met tower, 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. However, FAA, USCG, and BOEM regulations and guidelines for navigational hazard marking as well as the relative infrequency of maintenance activities would minimize the risk of allision. 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.

Atlantic Shores is currently coordinating with cable owners regarding crossing methods or setbacks. Impacts during Project operations would be infrequent and limited to times when work at the cable crossings would be required. Impacts would decrease to zero after decommissioning if cables are removed. Cables can be protected through the use of either rock placement, concrete mattresses, rock bags, grout-filled bags, or half-shell pipes.

The ECCs have a low possibility of coming in contact with MECs during installation. Within the Offshore Project area, the likelihood of encountering buried items that constitute a notable safety risk within the low hazard zones of Zone 2 and Zone 3, is deemed to be below the ALARP threshold. Given the results of the MEC hazard assessments define the Offshore Project area as a low hazard zone for MEC, Atlantic Shores does not plan to conduct a site survey specifically for MEC. Atlantic Shores would avoid the use of high-resolution magnetometry surveys, as the survey would be disproportionate to the risk within the Offshore Project area (COP Volume II, Section 2.1.1.2.4; Atlantic Shores 2024).

Prior to the installation of the onshore export cables, temporary cofferdams are expected to be installed. The locations of the crossings would be verified during route constructability studies conducted by Atlantic Shores prior to the implementation of the proposed Project activities. It is not anticipated that the infrastructure of the cables would interfere with land uses or coastal infrastructure. Any necessary repairs on the interconnection cables would be accessed through manholes, and repairs would be completed within the installed transmission infrastructure.

The WTA and ECCs would be open to marine navigation, and no permanent restrictions to commercial or recreational fishing, and anchoring are proposed during the O&M phase of the Projects. Limited restrictions may occur during some maintenance activities, where temporary safety zones may be established around maintenance vessels and activities (COP Volume II, Sections 7.3.2.2 and 7.4.4.3; Atlantic Shores 2024). In relation to dredging around the cables, they would not be buried to a sufficient depth to allow for this activity above the cables. The exception is for existing marked channels that are actively dredged where cables are buried sufficiently deep to avoid any interference to planned dredge depths. Atlantic Shores would coordinate with NOAA to ensure the cables are included on navigational charts for mariner awareness.

Radar Systems

Presence of structures: Air traffic control, national defense, weather, and oceanographic 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. The WTA overlaps with radar facilities that support air traffic control, military surveillance, and weather monitoring. WTGs may affect radar by causing unwanted radar returns (i.e., clutter) resulting in a partial loss of target detection or false targets within and in proximity to the WTA. Other radar effects could include a loss of ocean surface current data and wave measurements, and a partial loss of weather detection and false weather indications. Atlantic Shores is committed to continue working to further evaluate potential effects on these radar facilities in coordination with the FAA, DoD, DHS, NOAA, and NWS and identify potential mitigating measures, if required (COP Volume II, Section 7.8.6; Atlantic Shores 2024).

To support the understanding of radar facilities operating in the Offshore Project area, Atlantic Shores conducted an initial analysis for Long Range Radar (LRR) and Next Generation Weather Radar (NEXRAD) using the DoD Preliminary Screening Tool (PST) on the FAA Obstruction Evaluation/Airport Airspace Analysis website. This analysis provides a cursory indication of whether wind turbines may be within line of sight of one or more radar sites, and likely to affect radar performance. The PST LRR analysis accounts for air route and airport surveillance radar associated with the FAA, DoD, and DHS. As a result of the analysis, Atlantic Shores identified four radar sites: Atlantic City Airport Surveillance Radar model-9 (ASR-9), Dover Air Force Base (AFB) Digital Airport Surveillance Radar (DASR), Gibbsboro Air Route Surveillance Radar model-4 (ARSR-4), and McGuire AFB DASR. The FAA uses the Atlantic City ASR-9 and the Gibbsboro ARSR-4 for air traffic control at multiple facilities, including the Atlantic City Terminal Radar Approach Control (TRACON) and the New York Air Route Traffic Control Center (Appendix II-T2, Atlantic Shores 2024). The PST NEXRAD analysis accounts for DoD, FAA, and NOAA Weather Surveillance Radar. The preliminary results indicate that Project 1 would overlap with LRR but neither Project 1 nor Project 2 would influence NEXRAD Radar. Specifically, the Line-of-Sight analysis results show that some of the wind turbines would be within line-of-sight of and would interfere with the Gibbsboro ARSR-4 and the McGuire AFB DASR radar facilities (COP Volume II, Section 7.8.3; Atlantic Shores 2024). Atlantic Shores is committed to continue working to further evaluate potential effects on these radar facilities in coordination with the FAA, DoD, DHS, and NOAA.

USCG also integrates IOOS HF-radar data into its SAR systems. The WTA is within the measurement range of 8 IOOS HF-radar systems operated by Rutgers University in Brant Beach, New Jersey; Brigantine, New Jersey; Hempstead, New York; Loveladies, New Jersey; North Wildwood, New Jersey; Seaside Park, New Jersey; Strathmere, New Jersey; and Wildwood, New Jersey.

Studies have been conducted to evaluate concerns that the WTGs may affect some shipborne radar systems, potentially creating false targets on the radar display or causing vessels navigating within the WTA to become “hidden” on radar systems due to shadowing created by the WTGs. The effectiveness of radar systems and any effects from WTGs, OSSs, and the met tower would vary from vessel to vessel based on several factors, including radar equipment type, settings, and installation (including location of placement on the vessel). The potential effects of WTGs may be reduced through adjustment of the radar gain control (COP Volume II, Section 7.6.2.3; Atlantic Shores 2024). The Proposed Action would be within the line of sight of and would affect the following radar systems: Newark ASR-9, New York ASR-9, Philadelphia ASR-9, and Naval Air Station Willow Grove ASR-11.

Atlantic Shores expects that radar operator training and dissemination of information regarding proper installation and adjustment of equipment would avoid or minimize effects on radar systems. Additionally, Atlantic Shores plans to use an AIS to mark the presence of WTGs, which would further limit potential effects (COP Volume II, Section 7.6.2.3; Atlantic Shores 2024).

Scientific Research and Surveys

Presence of structures: Scientific research and surveys would be affected during the construction and operations of the Proposed Action. Off the coast of New Jersey, agency-sponsored research and survey efforts are conducted by the NEFSC, NJDEP, and the NEAMAP led by the Virginia Institute of Marine Sciences. The following in-water studies have historically traversed the Offshore Project area: NEFSC multi-species bottom trawls, NJDEP trawls, NEFSC clam surveys, and NEAMAP trawl surveys. Gear used for these surveys include four-seam bottom and otter trawls, with the exception of NEFSC clam surveys, which used a hydraulic dredge (COP Volume II, Section 7.7.6; Atlantic Shores 2024). The presence of project-specific structures would affect survey operations by excluding certain portions of the Lease Area from sampling. These excluded areas would affect the statistical design of surveys, reducing survey efficiency, and causing habitat alteration within the WTA that cannot be monitored.

The *NOAA Fisheries and BOEM Federal Survey Mitigation Strategy – Northeast U.S. Region* was developed to provide guidelines for the growing implementation of offshore wind energy. While both agencies support this expansion of renewable energy, they also focus on protecting biodiversity and promoting ocean co-use. The NOAA Fisheries surveys are essential for sustainably managing the nation’s fisheries, promoting the protection and recovery of marine mammals and endangered and threatened species, and conserving coastal and marine habitats and ecosystems for future generations. The *Federal Survey Mitigation Strategy* was created with the intent to guide in the development and implementation of a program to mitigate impacts of wind energy development on fisheries surveys over the expected full duration (30+ years) of wind energy development in the Northeast United States (Hare et al. 2022).

The Proposed Action would install up to 200 WTGs with a maximum blade tip height of 1,049 feet (320 meters) above MLLW. In addition to in-water surveys, aerial surveys to measure the abundance of marine mammals and sea turtles are conducted from Maine to the Florida Keys as part of the AMAPPS by NOAA. NOAA NEFSC conducts these surveys within the Offshore Project area utilizing aircraft that fly 600 feet (183 meters) above the water surface at 110 knots (200 kilometers per hour) (Atlantic Shores 2024). Aerial survey track lines for cetacean and sea turtle abundance surveys would not be able to continue at the current altitude within the Project area. The increased altitude necessary for safe survey operations could result in lower chances of detecting marine mammals and sea turtles, especially smaller species.

Atlantic Shores has also committed to implementing a comprehensive set of measures to avoid, minimize, or mitigate effects on scientific research and studies. The measures include consultation with agencies and other research entities regarding scientific research and surveys (OTH-06; Appendix G, Table G-1).

Impacts of the Connected Action

As described in Chapter 2, *Alternatives*, under the connected action, bulkhead repair and/or replacement and maintenance dredging activities would be conducted within an approximately 20.6-acre (8.3-hectare) site within Atlantic City's Inlet Marina. Because the proposed activities are onshore and nearshore, no impacts are expected on marine mineral extraction and scientific research and surveys. No impacts from the connected action are anticipated on aviation and air traffic or radar systems because proposed bulkhead repair and/or replacement is occurring within an already developed area and would not result in structures tall enough to conflict with existing uses. Additionally, no impacts from the connected action on existing submarine cables and pipelines are expected because maintenance dredging has historically occurred in this area during the 1950s and 1980s (USACE 2022). Impacts from the connected action are not anticipated on military or national security uses, as this area is not typically used for these activities.

Cumulative Impacts of Alternative B – Proposed Action

The cumulative impact analysis of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, including offshore wind activities, and the connected action. Planned offshore wind activities in the geographic analysis area for other uses include the construction, O&M, and decommissioning of Ocean Wind 1 in Lease Area OCS-A 0498, Ocean Wind 2 in Lease Area OCS-A 0532 and Atlantic Shores North in Lease Area OCS-A 0549.

Marine Mineral Extraction

Presence of structures: The Proposed Action would place structures within the vicinity of sand resource areas and ocean disposal sites, thus resulting in a minor contribution to cumulative impacts on marine mineral extractions. It may be possible for other offshore wind projects to avoid existing and prospective borrow areas through consultation with the BOEM Marine Minerals Program, USACE, and relevant state agencies before an offshore wind cable route is approved. The adverse impacts on sand and marine mineral extraction of offshore wind activities are anticipated to be minor.

Military and National Security Uses

Presence of structures and traffic: Ongoing and planned activities, including the Proposed Action and siting for the up to 11 OSSs and met tower outside of the uniform grid of the WTGs, would create navigational complexity within the geographic analysis area through the construction and operation of offshore structures. While potential impacts on most military and national security uses are anticipated to be minor, installation of WTGs, OSSs, and the met tower throughout the geographic analysis area would hinder USCG SAR operations across a larger area, resulting in a major impact on SAR operations, potentially leading to increased loss of life. Additionally, the Proposed Action would contribute a noticeable increment to the cumulative vessel traffic impacts, which are most likely to occur during the construction and decommissioning timeframes. This would result in localized, temporary, and minor impacts on military and national security uses.

Aviation and Air Traffic

Presence of structures: Open airspace around the offshore wind lease areas in the geographic analysis area would still exist after all reasonably foreseeable future offshore wind energy projects are built. BOEM assumes that 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. The Proposed Action would contribute a noticeable increment to the minor cumulative impacts.

Cables and Pipelines

Presence of structures: The Proposed Action would contribute an undetectable increment to the cumulative impacts from cables and pipelines, which would be localized and long term. However, these impacts would be minor because they can be avoided by standard protection techniques.

Radar Systems

Presence of structures: 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. Cumulative impacts of the Proposed Action would be moderate, primarily due to the presence of WTGs and permanent met tower within the line of sight causing interference with radar systems.

Scientific Research and Surveys

Presence of structures: The Proposed Action would contribute a noticeable increment to the cumulative impacts on scientific research and surveys from ongoing and planned activities including planned offshore wind, which would be long term and major, particularly for NEFSC surveys that support commercial fisheries and protected-species research programs, NEAMAP surveys, and NJDEP surveys that historically take place in the proposed WTA. 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. The maximum-case scenario for the WTG blade tip height would exceed the aerial survey altitude within the WTA. The increased altitude necessary for safe survey operations could result in a lower chance of detecting marine mammals and sea turtles.

Conclusions

Impacts of Alternative B – Proposed Action. Under the Proposed Action, up to 200 WTGs with maximum blade tip heights of 1,049 feet (320 meters) above MLLW would be installed, operated, and eventually 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 short-term to long-term adverse impacts that range from minor 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 WTA and offshore export cable routes for the Proposed Action would avoid most of the regional sand borrow, sand resource, and ocean disposal areas. However, there are two unverified sand resource areas that fall within the route of the Monmouth ECC: Shoal 236 (within federal waters) and Shoal 235 (within state waters) and one potential resource area F2 (within federal waters). There are two potential sand resource areas along the Atlantic ECC: BI-J and Area G (within state waters). The crossings would result in **minor** but long-term potential impacts on marine mineral extraction.

- *Military and National Security Uses*: The installation of WTGs, OSSs, and met tower in the Project area would result in increased navigational complexity and increased allision risk, creating potential **major** adverse impacts on USCG SAR operations and potential **minor** impacts on all other military and national security uses.

- *Aviation and Air Traffic*: Potential **minor** impacts on low-level flights would occur, primarily due to the installation, operation, and decommissioning of WTGs in the Project area and changes in navigation patterns. Potential impacts on commercial and military flight operations are not anticipated, as WTGs would be constructed under the listed FAA flight level ceiling.

- *Cables and Pipelines*: Potential impacts on cables and pipelines would be **minor** due to the use of standard protection techniques to avoid impacts.

- *Radar Systems*: Potential **moderate** adverse impacts on radar systems would primarily be caused by the presence of WTGs, OSSs, and met tower within the line of sight causing interference with radar systems. Options are available to minimize or mitigate impacts and Atlantic Shores would continue to coordinate with the FAA, DoD, DHS, and NOAA on impacts.

- *Scientific Research and Surveys:* Potential impacts on scientific research and surveys would be **major**, particularly for NEFSC surveys that support commercial fisheries and protected-species research programs, and NEAMAP surveys. The presence of structures would exclude certain areas within the Project area occupied by Project components (e.g., WTG, OSS, and met tower foundations, cable routes) from potential vessel and aerial sampling, and by affecting survey gear performance, efficiency, and availability.

BOEM expects that the connected action alone would not impact marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar systems, and scientific research and surveys.

Cumulative Impacts of Alternative B – Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on other uses would range from undetectable to noticeable. Considering all IPFs together, BOEM anticipates that the cumulative impacts associated with the Proposed Action would be **minor** for marine mineral extraction, military and national security uses (except USCG SAR operations), aviation and air traffic, and cables and pipelines; **moderate** for radar systems; and **major** for USCG SAR operations and NEFSC, NJDEP, and NEAMAP scientific research and surveys. The presence of structures associated with the Proposed Action and increased risk of allisions are the primary drivers for impacts on other marine uses. Impacts on NEFSC, NJDEP, and NEAMAP 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 Alternatives C, D, and F on Other Uses (Marine Minerals, Military Use, Aviation, and Scientific Research and Surveys)

Impacts of Alternatives C, D, and F. The impacts resulting from individual IPFs associated with the construction and installation, O&M, and conceptual decommissioning of the Project under Alternatives C (Habitat Impact Minimization/Fisheries Habitat Impact Minimization), D (No Surface Occupancy at Select Locations to Reduce Visual Impacts), and F (Foundation Structures) would be similar to those described under the Proposed Action.

Construction of Alternatives C and D could install up to 29 and 31 fewer WTGs, respectively. Impacts under Alternatives C and D would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. These alternatives could potentially reduce impacts on scientific research and surveys by removing WTGs from areas populated by marine life; however, the structures that would remain throughout the remainder of the WTA could continue to show potential effects. In addition, Alternative D could potentially decrease impacts on radar systems by removing the WTGs closest to shore, which would possibly reduce line-of-sight impacts; however, localized, long-term impacts on radar systems are still anticipated.

Alternative F would involve the use of different foundations but would not affect the number of WTGs or the height of the WTGs. Construction of Alternative F would involve the use of different WTG, OSS, and met tower foundations, which could impact the construction impact footprint and installation period. All other design parameters and potential variability in the design would be the same as under the Proposed Action.

Impacts under Alternative F would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. The type of foundations chosen would not affect the number of WTGs that are included in the overall Project, but each foundation would have a different installation duration.

Cumulative Impacts of Alternatives C, D, and F. The incremental impacts contributed by Alternatives C, D, and F to the cumulative impacts from ongoing and planned activities including offshore wind would be similar to the Proposed Action.

Conclusions

Impacts of Alternatives C, D, and F. Implementation of Alternatives C, D, and F would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action. The overall level of impact would remain similar to that of the Proposed Action, and the impacts of each alternative alone resulting from individual IPFs associated with these alternatives would be **minor** for marine mineral extraction, military and national security uses (except USCG SAR operations), aviation and air traffic, and cables and pipelines; **moderate** for radar systems; and **major** for USCG SAR operations and NEFSC, NJDEP, and NEAMAP scientific research and surveys.

Cumulative Impacts of Alternatives C, D, and F. The incremental impacts contributed by Alternatives C, D, and F to the cumulative impacts on other uses would range from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the cumulative impacts associated with Alternatives C, D, and F would be **minor** for marine mineral extraction, military and national security uses (except USCG SAR operations), aviation and air traffic, and cables and pipelines; **moderate** for radar systems; and **major** for USCG SAR operations and 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.

3.6.7.7 Impacts of Alternative E on Other Uses (Marine Minerals, Military Use, Aviation, and Scientific Research and Surveys)

Impacts of Alternative E. Construction and installation of Alternative E (Wind Turbine Layout Modification to Establish a Setback Between Atlantic Shores South and Ocean Wind 1) would create a setback from the boundary between the Atlantic Shores South Lease Area and the Ocean Wind 1 Lease Area. All other design parameters and potential variability in the design would be same as under the Proposed Action.

Impacts of Alternative E would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. Alternative E could potentially reduce impacts on military and security use by increasing the navigational space between Atlantic Shores South and Ocean Wind 1. The increase in WTG spacing between Atlantic Shores South and Ocean Wind 1—0.81 nautical miles (1,500 meters) to 1.08 nautical miles (2,000 meters)—is not expected to increase impacts on military and national security uses, as deep-draft military vessels are not anticipated to transit outside of navigation channels unless necessary for SAR operations, and the separation would allow for safe navigation between lease areas. Alternative E could also lead to a reduction in WTGs, which would slightly reduce the construction impact footprint and installation period.

Cumulative Impacts of Alternative E. The impacts contributed by Alternative E to the cumulative impacts from ongoing and planned activities including offshore wind would be similar to the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. The setback between Atlantic Shores South and Ocean Wind 1 would allow for safe navigation between the two lease areas, known spacing USCG SAR operations under the Proposed Action.

Conclusions

Impacts of Alternative E. Implementation of Alternative E would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action, except with regard to USCG SAR operations. The setback would be an improvement to vessel navigation and SAR considerations, and lead to a reduction in potential impacts. The impacts of Alternative E alone resulting from individual IPFs would be **minor** for marine mineral extraction, military and national security uses (except USCG SAR operations), aviation and air traffic, and cables and pipelines; **moderate** for USCG SAR operations and radar systems; and **major** for scientific research and surveys.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on other uses would range from undetectable to noticeable except for reduced impacts on navigation. Considering all the IPFs together, BOEM anticipates that the cumulative impacts associated with Alternative E would be **minor** for marine mineral extraction, military and national security uses (except USCG SAR operations), aviation and air traffic, and cables and pipelines; **moderate** for USCG SAR operations and radar systems; and **major** for scientific research and surveys. These impact ratings are primarily driven by the presence of offshore structures such as WTGs and the setback providing an improvement to vessel navigations and SAR considerations.

3.6.7.8 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Table G-3 and summarized and assessed in Table 3.6.7-3. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts on other uses (marine minerals, military use, aviation, and scientific research and surveys) could be further reduced.

Table 3.6.7-2. Proposed mitigation measures – other uses (marine minerals, military use, aviation, and scientific research and surveys)

Mitigation Measure	Description	Effect
High-frequency radar interference	The Lessee will enter into a mitigation agreement with NOAA to mitigate operational impacts on oceanographic high-frequency (HF) radars, including the following measures: • Due to the potential interference with IOOS HF radar and the risk to public health, safety, and the environment, the Lessee must mitigate unacceptable interference with IOOS HF radar from the Lessee's Project. Interference must be mitigated before commissioning the first WTG or blades start spinning, whichever is earlier, and interference mitigation must continue throughout operations and decommissioning until the point of decommissioning where all rotor blades are removed. Interference is considered unacceptable if, as determined by BOEM in consultation with NOAA's IOOS Office, IOOS HF-radar performance falls or may fall outside any of the specific radar systems' operational parameters or fails or may fail to meet IOOS's mission objectives. • The Lessee must submit to BOEM documentation demonstrating how it will mitigate unacceptable interference with IOOS HF-radar systems in accordance with the Mitigation Requirement. The Lessee must submit this documentation to BOEM (renewable_reporting@boem.gov) at least 120 days prior to commissioning the first WTG or blades start spinning, whichever is earlier. If, after consultation with the NOAA IOOS Office, BOEM deems the mitigation acceptable, the Lessee must conduct activities in accordance with the proposed mitigations. If, after consultation with the NOAA IOOS Office, BOEM deems the mitigation unacceptable, the Lessee must resolve all comments on the documentation to BOEM's satisfaction. • The Lessee is encouraged to enter into an agreement with the NOAA IOOS Office to implement mitigation measures, and any such Mitigation Agreement may satisfy the requirement to mitigate unacceptable interference with IOOS HF radar.	While this mitigation measure would reduce impacts on radar systems, it would not reduce the impact rating for the Proposed Action IPF (presence of structures).
Navigational Safety	No permanent structures will be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, met tower, and WTGs will be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.	While this mitigation measure would reduce impacts on vessel navigation for military and research use, it would not reduce the impact rating for the Proposed Action IPF (presence of structures).

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.6.7-3, and Table G-3 in Appendix G are incorporated in the Preferred Alternative. These measures, if adopted, would have the effect of reducing some of the impacts on navigational safety and high frequency radar interference.

The mitigation measure of restricting the presence of permanent structures in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1,100 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern would improve navigational safety for operations impacted on the presence of structures; however, the overall Project impact would remain minor to major.

The mitigation measure for oceanographic high-frequency radars was developed through coordination with the NOAA Integrated Ocean Observing System Office. This mitigation measure would de-conflict the Project development and the ability of this office to meet mission objectives and would reduce impacts; however, the overall Project impact on radar systems would remain moderate.

3.6.7.9 Comparison of Alternatives

The impacts of Alternatives C, D, and F would be similar to those of the Proposed Action, ranging from minor to major impacts on other uses (marine minerals, military use, aviation, and scientific research and surveys). Alternatives C, D, and E would lead to a possible reduction in the number of WTGs, but the quantitative impact change cannot be determined without more definitive information. The overall impacts under Alternative E would be similar to those of the Proposed Action, with the exception of impacts on USCG SAR operations. The setback would be an improvement to vessel navigation and SAR considerations and would lead to reduced impacts when compared to the Proposed Action: from major to moderate. The different foundations of Alternative F require different installation times and would thereby extend the duration of impacts on military use, radar, and aviation.

3.6.7.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of the Proposed Action and Alternatives C4, D3, and E, as well as two agency-proposed mitigation measures, as described in Section 2.1.7. Under the Preferred Alternative, 29 WTGs, 1 OSS, and their associated interarray cables would be microsited outside of the 1,000-foot (305-meter) buffer of the sand ridge and swale features within AOC 1 (Lobster Hole) and AOC 2 (NMFS-identified sand ridge complex); WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and a maximum blade tip height of 932 feet (284 meters); 2 WTGs would be removed and 1 WTG would be microsited to establish a 0.81-nautical mile (1,500-meter) setback between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area; and no permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. Additionally, one WTG sited approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site) would be removed. The Preferred Alternative would include up to 195 WTGs,[4] up to 10 OSSs, up to 1 permanent met tower, interarray and interlink cables, 2 onshore substations and/or converter stations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

The reduction and placement of structures could potentially reduce impacts on scientific research and surveys by removing WTGs from areas populated by marine life; however, the structures that would remain throughout the WTA could continue to show potential effects. The height restriction of the WTGs could potentially decrease impacts on radar systems, aviation and air traffic; however, localized, long-term impacts on radar systems are still anticipated. The layout modification to allow a setback between Atlantic Shores South and Ocean Wind 1 could potentially reduce impacts on military and security use by increasing the navigational space.

The mitigation measure to restrict the placement of structures would result in the Project's proposed WTGs, OSSs, and met tower to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction. This uniformed grid formation would improve the navigation of vessels within the WTA. Specifically, when highlighting the concerns of the USCG, uniform placement of the structures will standardize lighting patterns, allow the clearer passage of vessels, and facilitate the needed turn radius of SAR helicopters.

Impacts under the Preferred Alternative would not be measurably different from those anticipated under the Proposed Action, with the exception of USCG SAR operations associated with military and national security uses, which would be reduced from major under the Proposed Action to moderate under the Preferred Alternative due to the siting of permanent structures in accordance with the uniform grid formation. Thus, under the Preferred Alternative impacts would be **minor** for marine mineral extraction, military and national security uses (except USCG SAR operations), aviation and air traffic, and cables and pipelines; **moderate** for radar systems and USCG SAR operations; and **major** for 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.

BOEM anticipates that the cumulative impacts of ongoing and planned activities, including the Preferred Alternative and connected action, would result in similar impacts as those for the Proposed Action, with the exception of USCG SAR operations associated with military and national security uses, which would be **moderate** due to the siting of permanent structures in accordance with the uniform grid formation. The overall impact range would be **minor** to **major**.

[4] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

3.6.8 Recreation and Tourism

The reader is referred to Appendix F, *Assessment of Resources with Moderate (or Lower) Impacts,* for a discussion of current conditions and potential impacts on recreation and tourism from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.6.9 Scenic and Visual Resources

This section discusses potential impacts on open ocean, seascape, and landscape character and viewers from the proposed Project, alternatives, and ongoing and planned activities in the scenic and visual resources geographic analysis area, as advised in the Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Developments on the Outer Continental Shelf of the United States (BOEM 2021) and the Guidelines for Landscape and Visual Impact Assessment (3rd Edition) (Landscape Institute and Institute of Environmental Management and Assessment 2013). The 45.1-mile (72.6-kilometer) radius geographic analysis area, as shown on Figures 3.6.9-1 and 3.6.9-2, includes the New Jersey coastline from Cape May Borough to Hamilton Township and extends 68.9 miles (110.9 kilometers) offshore and 36 miles (57.9 kilometers) inland to incorporate potential views of the Project. The onshore geographic analysis area encompasses the 3-mile (4.8-kilometer) perimeters for the Cardiff and Larrabee onshore substations. Geographic analysis areas extend 0.25 mile (0.4 kilometer) for landfalls, onshore export cable routes to the onshore substations, and the connections from the onshore substations to the existing grid.

Appendix H, *Seascape, Landscape, and Visual Impact Assessment*, contains additional analysis of the seascape character units, open ocean character unit, landscape character units, and viewer experiences that would be affected by the Proposed Action and alternatives, as well as visual simulations of the Proposed Action alone and in combination with other reasonably foreseeable offshore wind projects (i.e., cumulative simulations). Cumulative simulations assess where the WTGs proposed for other planned offshore wind projects may combine with the Project to produce cumulative visual effects. The cumulative impacts analysis area includes the visibility buffers of lease areas along the New York to Maryland coast. The buffers constitute the maximum theoretical distance a WTG could be visible and were developed using earth curvature (EC)–calculated distances based on WTG heights. Figure 3.6.9-1 shows the buffer for each lease area and Figure 3.6.9-2 shows the buffer for each lease area clipped to the geographic analysis area of the Atlantic Shores South Project. In this way, Figure 3.6.9-2 demonstrates what could be seen from various points within the Atlantic Shores South geographic analysis area.

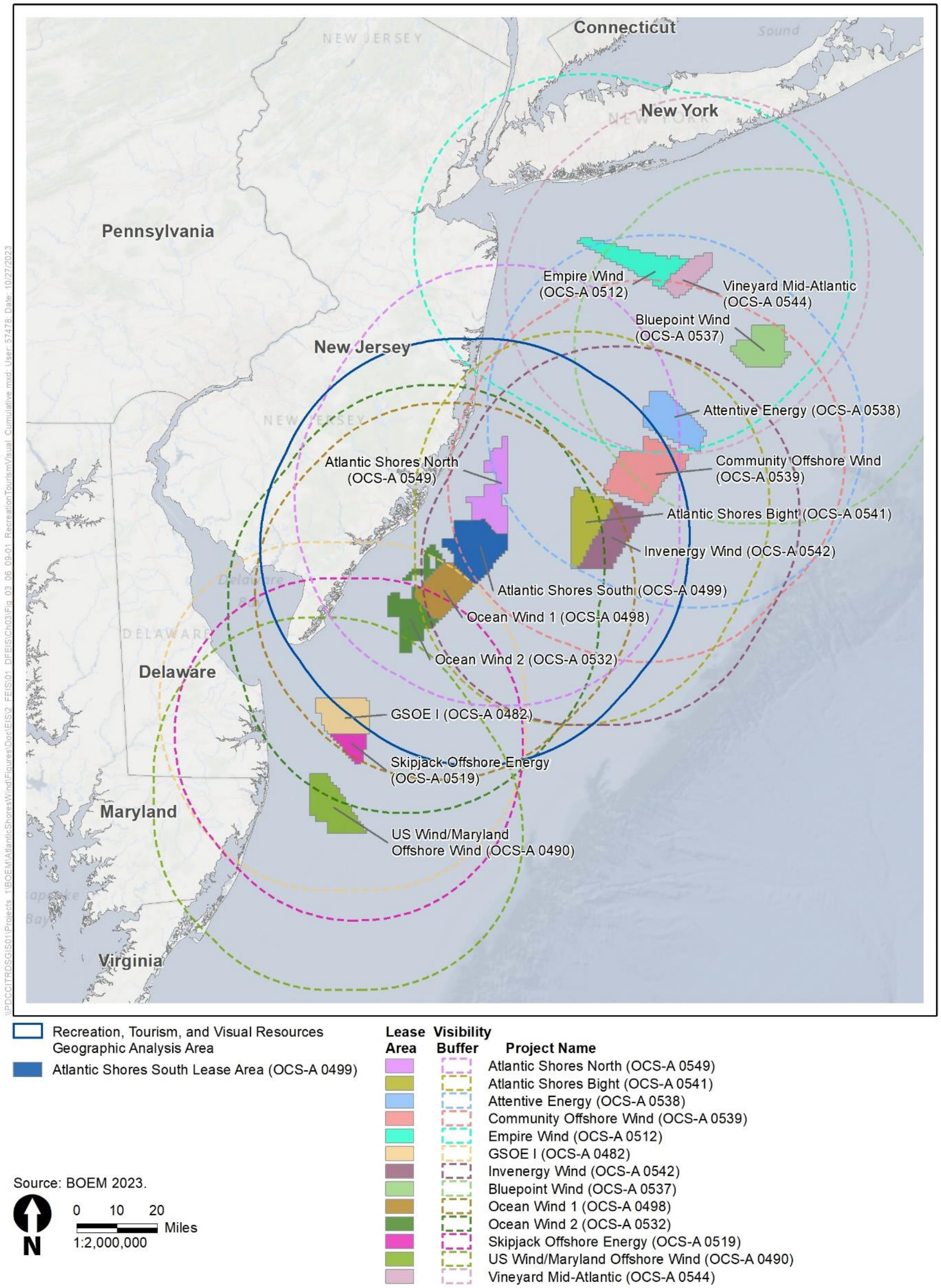

Figure 3.6.9-1. Scenic and Visual Resources geographic analysis area and lease visibility buffers

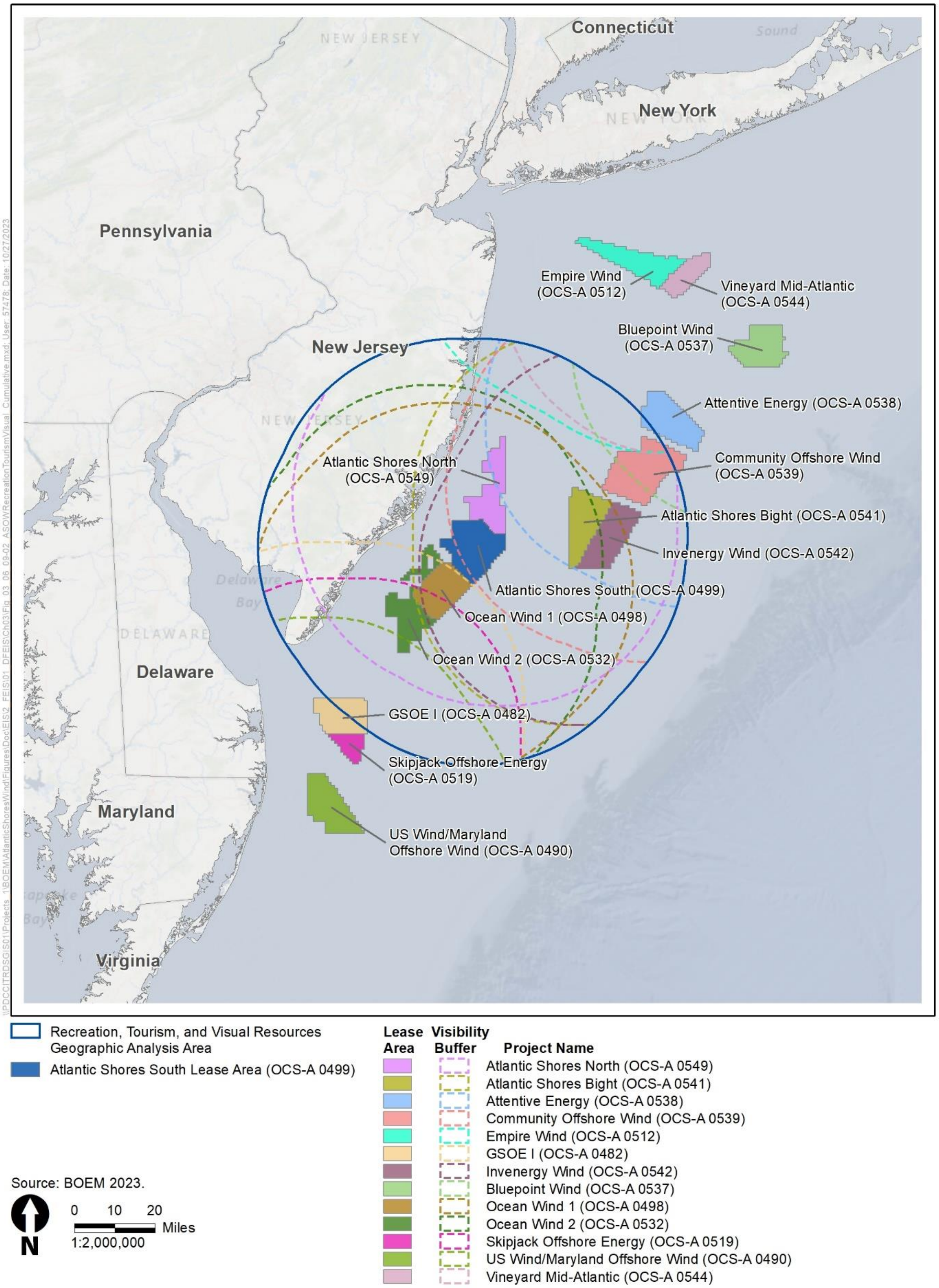

Figure 3.6.9-2. Scenic and Visual Resources geographic analysis area and cumulative impacts analysis area

3.6.9.1 Description of the Affected Environment and Future Baseline Conditions

Seascape and Landscape Impact Assessment Affected Environment

New Jersey's Public Trust Doctrine (New Jersey Supreme Court 1821) holds all tidally flowed lands in trust for the use and enjoyment of the public. This includes the ocean, bays, and tidal rivers, as well as the adjacent shoreline over which these waters flow and, in certain circumstances, some amount of upland area, even if the upland area is privately owned. This section summarizes the open ocean, seascape, landscape, and viewer baseline conditions as described in Volume II, Appendices I-1 (Visual Impact Assessment [VIA]- WTA), I-2 (Visual Impact Assessment-Onshore Facilities-Cardiff), and I-3 (Visual Impact Assessment-Onshore Facilities-Larrabee) of the Atlantic Shores South COP (Atlantic Shores 2024). The demarcation line between seascape and open ocean is the U.S. state jurisdictional boundary, 3 nautical miles (3.45 statute miles [5.5 kilometers]) seaward from the coastline (U.S. Congress Submerged Lands Act, 1953). This line coincides with the area of sea visible from the shoreline. The line defining the separation of seascape and landscape stems from the juxtaposition of apparent seacoast and landward landscape elements, as defined by terrain, water (bays and estuaries), vegetation, and structures.

Laws, Ordinances, and Regulations

Seascape, landscape, and visual resource protection and management laws, ordinances, and regulations summaries are listed in Table 3.6.9-1 (COP Volume II, Appendix II-M1; Atlantic Shores 2024).

Table 3.6.9-1. Laws, Ordinances, and Regulations

Jurisdiction	Document	Scenic Objectives
Federal		
National Park Service	National Register of Historic Places (National Historic Preservation Act 1966)	The geographic analysis area contains 43 historic districts and individual properties listed or eligible for listing on the National Register of Historic Places and two properties or districts listed as National Historic Landmarks (NHL). The two NHL sites include the Atlantic City Convention Hall in Atlantic City and Lucy, the Margate Elephant in Margate City. They are sited approximately 11.4 miles (18.3 kilometers) and 14.4 miles (23.2 kilometers) from the WTA, respectively.
National Park Service	Public Law 100-515 (1988)	The New Jersey Coastal Heritage Trail was established by federal legislation to promote awareness, stewardship, and protection of natural and cultural resources along 300 miles (482.8 kilometers) of New Jersey's Atlantic coast and Delaware Bay.
National Park Service	National Natural Landmarks Program (2021)	Manahawkin Bottomland Hardwood Forest is the only designated National Natural Landmark (NNL) within the geographic analysis area and is located approximately 21.0 miles (33.8 kilometers) from the WTA.
U.S. Fish and Wildlife Service	National Wildlife Refuge System (2021)	The Edwin B. Forsythe NWR is located 9.2 miles (14.8 kilometers) from the nearest proposed WTG. The Cape May NWR is located 22.9 miles (36.9 kilometers) from the WTA.

Jurisdiction	Document	Scenic Objectives
USDA Forest Service and USDI National Park Service	Wild and Scenic Rivers Act (1968)	The National Wild and Scenic Rivers System was created to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition. Within the ZVI there is one such designated resource, the Great Egg Harbor Wild and Scenic River, located approximately 19.6 miles (31.5 kilometers) from the WTA.
National Oceanic and Atmospheric Administration	Coastal Zone Management Act (1972)	Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. 1451 et seq.) to protect the coastal environment from growing demands associated with residential, recreational, commercial, and industrial uses (e.g., State and Federal offshore energy development). The goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The CZMA provisions help States develop coastal management programs to manage and balance competing uses of the coastal zone. Federal Agencies must follow the Federal Consistency provisions as delineated in 15 CFR part 930. The CZMA requires that Federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone be consistent with enforceable policies of a State's federally-approved coastal management program. The CZMA acknowledges special natural and scenic characteristics of the coastal environment; however, it is up to the states to effectively exercise their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and esthetic values as well as the needs for compatible economic development.
State of New Jersey		
State Historic Preservation Office	New Jersey State Register of Historic Places	The geographic analysis area contains historic resources that the state has determined are worthy of preservation, but which have either not been determined eligible for inclusion or have not been evaluated for listing in the National Register of Historic Places.
Department of Transportation	Scenic Byways (2018)	One Scenic Byway, the Southern Pinelands Natural Heritage Trail, is located within the ZVI approximately 16.7 miles (26.9 kilometers) from the WTA.
Department of Environmental Protection	State Forests (2020)	Bass River State Forest, located approximately 18.0 miles (29.0 kilometers) from the nearest WTG, is the closest State Forest to the WTA. The forest provides recreational opportunities such as hiking, picnicking, camping, and hunting, as well as swimming, fishing, boating, and canoeing on Lake Absegami. Wharton State Forest is located approximately 23.7 miles (38.1 kilometers) from the WTA. The forest includes rivers and streams for canoeing, hiking trails, unpaved roads for mountain biking and horseback riding, and lakes, ponds, and fields for wildlife viewing. Belleplain State Forest is located approximately 26.7 miles (43.0 kilometers) from the WTA. The forest was established for recreation, wildlife management, timber production, and water conservation and includes Lake Nummy, a popular swimming, boating, and fishing area.

Jurisdiction	Document	Scenic Objectives
Department of Environmental Protection	State Wildlife Management Areas (2021)	There are 16 State Wildlife Management Areas (WMAs) within the geographic analysis area. These state-owned lands are managed to provide wildlife habitat and accommodate wildlife-related recreation (hunting, bird watching, etc.). The closest WMA to the WTGs is the Absecon WMA, located 10.3 miles (16.6 kilometers) from the WTA.
Department of Environmental Protection	State Nature Reserves (2018)	Twelve State Nature Preserves occur within the geographic analysis area. North Brigantine State Natural Area is located 8.9 miles (14.3 kilometers) from the WTA. The natural area is located on the central New Jersey coast and is part of the longest stretch of undeveloped barrier island beach in the state. The natural area provides recreational opportunities such as walking, wildlife viewing, sunbathing, and fishing.
Department of Environmental Protection	State Parks (2020)	Corson's Inlet State Park is located 21.3 miles (34.3 kilometers) from the WTA. This oceanfront park offers hiking, fishing, crabbing, boating, and sunbathing. Island Beach State Park and Barnegat Lighthouse State Park are located 26.9 miles (43.3 kilometers) and 27.2 miles (43.8 kilometers), respectively, from the WTA. Island Beach State Park is a 10-mile-long (16.1-kilometer-long) barrier island between the Atlantic Ocean and Barnegat Bay that offers swimming, picnicking, bicycling, horseback riding, sailboarding, surfing, scuba diving, and hunting. Barnegat Lighthouse State Park features the Barnegat Lighthouse as well as recreational opportunities such as hiking trails, fishing, wildlife viewing, and picnicking.
Department of Environmental Protection	New Jersey Coastal Management Program,	New Jersey's Coastal Management Program (NJCMP) is part of the National Coastal Zone Management Program which addresses sustainable and resilient coastal community planning including energy facilities. New Jersey's coastal zone encompasses tidal and non-tidal waters, waterfronts, and inland areas from the Hudson River to the Delaware Bay and River and includes tidal portions of river tributaries. The seaward coastal zone boundary is the limit of the New Jersey territorial jurisdiction located three nautical miles from the mean high-water line. Section 309 Assessment and Strategy (2021-2025) states: Attain increased opportunities for public access, considering current and future public access needs to coastal areas of recreational, historical, aesthetic, ecological, or cultural value. The Department of Environmental Protection reviews development projects in the coastal zone according to the rules and statutes of the following: the Coastal Area Facility Review Act, the Waterfront Development Law, the Wetland Act of 1970, and the Coastal Zone Management Rules. In addition, the New Jersey Waterfront Development Law states a permit may be issued if the proposed development would result in minimal practicable degradation of unique or irreplaceable land types, historical or archeological areas, and existing public scenic attributes at the site and within the surrounding region.
New Jersey Department of Environmental Protection	Green Acres Program (2023)	The mission of this program is "to achieve, in partnership with others, a system of interconnected open spaces, the protection of which will preserve and enhance New Jersey's natural

Jurisdiction	Document	Scenic Objectives
		environment and its historic, scenic, and recreational resources for public use and enjoyment".
Atlantic County		
Atlantic County	Atlantic County, New Jersey Master Plan (2018) Atlantic County, New Jersey Open Space and Recreation Plan (2018)	The Master Plan includes a goal to preserve and protect resources, environmentally sensitive areas, particularly watersheds, recharge areas, threatened and endangered species habitat, scenic view sheds, and other valuable features. The Pine Barrens Byway, which includes a variety of historic and scenic sites, is partially located within the county. There are no specific provisions of additional planned locations to preserve and protect scenic view sheds from within the community or the ocean/beach areas. The Open Space and Recreation Plan includes goals and objectives that are to be consistent with the state-wide Master Plan open space goals. This plan provides no specific provisions of planned locations to preserve and protect scenic view sheds from within the community or the ocean/beach areas.
Absecon, City of	2016 Reexamination Report (2017)	Objectives or problems identified from previous plans and reports that relate to scenic or visual quality include the need to develop and implement programs and regulatory controls to protect scenic resources. The residential structures along the Shore Road Corridor and adjacent streets are specifically referenced. Efforts taken since 2005 to address protect scenic resources that are identified include a renovation to Howlett Hall. No recommendations for future goals or objectives are made for protection of scenic resources. However, the plan introduces recommendations for historic preservation, which include streetscape improvements and additional historical signage to promote local history and culture, and zoning measures to preserve the architectural character of the Shore Road Corridor. Provisions pertaining to the visual quality in this report mostly address aesthetic standards, as expressed through streetscape and architectural standards. There is no specific mention of the preservation of outward views from within communities, nor ocean/beach views.
Atlantic City	Atlantic City Master Plan (2008) Master Plan Reexamination Report (2016)	The Atlantic City Master Plan (2008): Identifies several provisions pertaining to visual quality or scenic resources, the majority of which occur in the Open Space and Recreation or Conservation Elements. An objective to "[p]reserve and protect open space areas that have scenic views and/or important historical, cultural significance and exceptional ecological value" is identified in the Open Space and Recreation Element. This Element also identifies Gardner's Basin Maritime Park as having scenic quality in the statement, "the Park offers an alternative to the resort's casino industry by allowing non-gambling visitors to seek quiet respite in the City's most scenic park by simply sitting by the water's edge, dining, taking in a boat ride or visiting the Aquarium." The Conservation Element describes the scenic value of wetlands and marshes in the statement, "[t]he flat landscape of tidal marshes provide grand scenic views of Atlantic City's spectacular urban skyline, thus enhancing the tourist experience." The land use section also identifies a development strategy that could create

Jurisdiction	Document	Scenic Objectives
		a "view corridor" extending from Melrose Park south to the Atlantic Ocean, and an improvement to the fishing pier located on West End Avenue that could enhance "beautiful views over the preserved wetlands" from this location. Although these resources are identified as being scenic for the outward views that they offer, no provisions are made to protect or preserve these views. Provisions pertaining to the visual quality in this report mostly address aesthetic standards, as expressed through streetscape, architectural standards, and preservation of historic structures.
Brigantine, City of	2016 Master Plan Re-examination Report (2016)	An objective identified from the previous planning documents includes an intent to "implement programs and regulatory controls designed to protect the scenic resources of the community." Previous actions taken to address this objective include zoning controls such as building height restrictions and setbacks. A "2016 follow-up" within this section of the report identifies public concern for access to scenic resources: "[a]nother aspect of the planning process has been the desire expressed by local residents for scenic views and resources to be protected and accessible to all. The development of the waterfronts, in particular the back bay areas has provided limited public access to street ends and points of access to the bay visually in many locations." It also identifies that there is "…an ongoing concern about visual access and scenic corridors on the Island, and there is a continuing desire to renovate some of the less desirable views…" and a need to promote and preserve access to the Bay and Atlantic Ocean. A general goal "to promote a desirable visual environment through creative development techniques and good civic design and arrangements" is in the 2016 General Goals and Objectives Statement section. Provisions are made in subsequent sections to respond to this objective and improve the visual environment through changes to building setbacks, height restrictions, and similar measures. However, no additional measures intended to protect or enhance visual access and protecting scenic corridors are proposed.
Corbin City	None Identified	
Egg Harbor Township	Egg Harbor Township Master Plan (2002) Master Plan Reexamination Report (2017)	The Great Egg Harbor River and its tributaries are described as a scenic resource in the following statement, "[t]he Great Egg Harbor River and its tributaries contain an abundance of scenic landscapes – lakes, streams, pristine forest areas, and cedar / hardwood swamps. The Pinelands Comprehensive Management Plan designates the lower and middle portions of the river and its tributaries as scenic corridors of "special significance" within the Pinelands." It identifies the need to incorporate resource protection measures and proposes the creation of a River Conservation (RC) overlay zoning district and the establishment of a land use plan that protects river resources. Several possible recommendations for this zoning district are identified, including "adopt design guidelines that include recommendations for… minimizing the visual impacts of development as seen from the River." The River Management Plan provides a model ordinance for what a future RC overlay district could consist of. This includes

Jurisdiction	Document	Scenic Objectives
		zoning controls, such as vegetation buffer requirements, setback and building height requirements, and prohibited land uses. As of the 2017 Reexamination Report, there was no progress in implementing the proposed RC zone overlay; therefore, it is still a recommendation in the zoning section of this plan. No specific provisions or review process that specifically requires minimization of visual impact beyond restrictions is identified.
Estell Manor	None Identified	
Galloway Township	Master Plan Reexamination Report (2020)	An objective identified from the previous planning documents is to preserve and protect open space areas having scenic views and/or important historical, cultural, or agricultural significance. Another identified objective is to maintain continuous networks of open spaces along streams, scenic areas, and critical environmental areas. The plan, however, provides no recommended changes or further initiatives in regard to these objectives that would enhance or protect visual and scenic access.
Linwood, City of	City of Linwood Master Plan (2002) Master Plan Reexamination Report (2018)	The City of Linwood's goals include the provision to preserve Linwood's historic, scenic, and recreational assets. However, there is no specific mention of the preservation of outward views from within the community, nor ocean/beach views. There are no provisions in the reexamination report for the preservation of outward views from within the community, nor ocean/beach views.
Northfield, City of	City of Northfield Master Plan Re-examination (2008)	The objectives identified from previous planning documents include those that promote a desirable visual environment through creative development techniques that respect the environmental qualities and constraints of the City. The report identifies an objective to promote the conservation of historic sites and districts, open space, energy resources, and valuable natural resources in the City to prevent degradation of the environment through improper use of land. There are no provisions in the reexamination report for the preservation of outward views from within the community, nor ocean/beach views.
Pleasantville, City of	Master Plan Elements (2016)	There are no provisions in the Master Plan for scenic assets or the preservation of outward views from within the community, nor ocean/beach views.
Port Republic, City of	None Identified	
Somers Point, City of	Somers Point Master Plan Reexamination (2015)	There are no provisions in the reexamination report for scenic assets or the preservation of outward views from within the community, nor ocean/beach views.
Ventnor City	2016 Master Plan Reexamination (2016)	There are no provisions in the reexamination report for scenic assets or the preservation of outward views from within the community, nor ocean/beach views.
Burlington County	Parks and Open Space Master Plan (2002)	An objective of this plan is to identify and preserve areas of significant scenic beauty. The objective narrative includes "roads that provide visual or physical access to extraordinary scenic, cultural, recreational, or natural features will be submitted to the New Jersey Department of Transportation (NJDOT) for designation

Jurisdiction	Document	Scenic Objectives
		in accordance with the New Jersey Scenic Byways Program." The plan also recommends that the county staff should work with outside agencies to identify, map, and develop viewsheds and areas of significant beauty. As a part of the county's goal to advance the county's cultural character and heritage through development of the county park system, the county has plans to erect interpretative signs to promote historic viewsheds. There are no provisions in the Master Plan for scenic assets or the preservation of outward views from ocean/beach views.
Cape May County	Cape May County Open Space and Recreation Plan (Adopted 2005, Amended 2007) 2021 Comprehensive Plan – Editorial Draft (2021)	The Cape May County Open Space and Recreation Plan was prepared to meet the goal of preserving and protecting natural and scenic resources. There are no provisions in the plan for specific scenic assets or the preservation of outward views from within the community, nor ocean/beach views. There are no provisions in the comprehensive plan report for specific scenic assets or the preservation of outward views from within the community, nor ocean/beach views.
Dennis Township	Natural Resources Inventory (Adopted 2007, Revised 2010) Master Plan – Land Use Plan (Adopted 2009, Revised 2012) Community Forestry Management Plan 2009 – 2014, Updated for 2015-2019 (2014)	While the Natural Resource Inventory lists the scenic assets of the Township, there are no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Town of Dennis Land Use Plan includes a goal to retain a scenic landscape edge along all roads to buffer and to maintain the unique scenic attributes of the Township's environment. However, the plan provides no specific policies or scenic assets to protect for outward views from within the community, nor beach/ocean views. The Township of Dennis Forestry Plan provides no specific policies or scenic assets to protect for outward views from within the community, nor beach/ocean views.
Middle Township	Natural Resources Inventory (Adopted 2007, Revised 2010) Master Plan Reexamination Report (2010) Master Plan – Land Use Plan Updates (2010)	While the Natural Resource Inventory lists the scenic assets of the Township, there are no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Township of Middle Master Plan Reexamination Report includes no specific policies or scenic assets to protect for outward views from within the community, nor beach/ocean views. The Middle Township Master Plan Land Use Update provides no specific policies or scenic assets to protect for outward views from within the community, nor beach/ocean views.
North Wildwood, City of	None Identified	
Ocean City	City of Ocean City Master Plan (Adopted 1988, Revised 2006) Ocean City Open Space & Recreation Plan (2014) Master Plan Reexamination Report (2019)	An objective of the Ocean City Master Plan is to promote a desirable visual environment through creative development techniques with respect to environmental assets and constraints of the overall city and of individual development sites. Another objective is to encourage the preservation and restoration of historically significant buildings and sites within the city in order to maintain the heritage of Ocean City for enjoyment of future generations. There are development provisions for accessory structures in the waterfront neighborhoods of the city to preserve waterfront views. The Ocean City Open Space and Recreation Plan

Jurisdiction	Document	Scenic Objectives
		includes a conservation goal to preserve and maintain the ecological, historical, visual, recreational and scenic resources of the City. The Plan includes guidelines to acquire sites of special scenic value that should be protected to preserve or enhance the character of the community. The Master Plan Reexamination Report includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Sea Isle City	2017 Master Plan Reexamination Report (2017)	While the Master Plan Reexamination Report lists the scenic assets of the City, there are no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Stone Harbor Borough	Stone Harbor Master Plan (2009) Borough of Stone Harbor Master Plan Reexamination Report (2019)	The Land Use Recommendations of the Master Plan include that as the waterfront districts are redeveloped, protected vistas of the bay waters should be incorporated into new development plans and street ends should resolve in terminating vistas of scenic or remarkable landmarks. The recommendations further include architectural standards to maintain views of the bay and waterfront. The Reexamination Report mentions that the Public Use District marina does not provide a sense of place, both form and function are not commensurate with the science qualities of its prime waterfront location. A recommended Marina District Master Plan has not been completed.
Upper Township	Upper Township Master Plan Reexamination Report and Land Use Plan Amendment (2006) Natural Resources Inventory (2006) 2018 Master Plan Reexamination Report (2018) 2020 Master Plan Reexamination Report (2020)	The Master Plan includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. While the Natural Resource Inventory lists the scenic assets of the Township, there are no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Reexamination Reports of 2018 and 2020 include no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Ocean County		
Ocean County	Conservation Plan Element-Environmental Resources and Recreation Inventory 2009 2011 Comprehensive Master Plan (2011) Open Space, Parks & Recreation Plan (2020)	The Comprehensive Master Plan includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Conservation Plan Element's overall goal is to preserve and maintain the ecological, historic, visual, recreational, and scenic resources of the City. However, there are no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Open Space, Parks, and Recreation Plan includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.

Jurisdiction	Document	Scenic Objectives
Barnegat Township	2011 Barnegat Township Master Plan (2011)	The Master Plan includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Beach Haven Borough	Beach Haven Borough Comprehensive Master Plan (2017)	A goal of the Comprehensive Master Plan within the Public Access Plan Section is to maintain and continue to promote a visually pleasing aesthetic along the waterfront areas. However, there are no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Berkeley Township	Berkeley Township Comprehensive Master Plan (1997) General Reexamination of the Master Plan (2019) Environmental Resources Inventory (2012)	The Township Master Plan and the Reexamination Report include no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Township Environmental Resources Inventory includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Eagleswood Township	None Identified	
Lacey Township	Master Plan (1991) Master Plan Reexamination Report (2012) Lacey Township Master Plan Updated – Revised Land Use Element (2016)	The Township Master Plan includes a townscape objective that states that any and all elements that could be obtrusive to the boating public should be reviewed and specifically addressed through view studies or simulations prior to receiving approvals. The Township Reexamination Report includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views. The Revised Land Use Element also includes no specific provisions for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Little Egg Harbor Township	1999 Master Plan (1999)	The Township Master Plan includes a goal to promote a desirable visual environment through conservation and preservation of valuable natural features. However, it includes no specific provisions or scenic assets for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Long Beach Township	Master Plan Update (2017)	The Comprehensive Master Plan includes no specific provisions or scenic assets for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Ocean Township	Ocean Township Master Plan (1990) 2019 Master Plan Reexamination Report (2019)	The Ocean Township Master Plan includes a conservation goal to identify scenic areas within the Township and provide for their preservation. The Reexamination Report includes no specific provisions or scenic assets for protecting or enhancing the outward views from within the community, nor beach/ocean views.
Stafford Township	Natural Resources Inventory (2016) Township of Toms River Master Plan (2017)	The Master Plan Land Use Element includes no specific provisions for the preservation of outward views from within communities, nor ocean/beach views. The Natural Resource Inventory includes no specific provisions for the preservation of outward views from within communities, nor ocean/beach views.

Jurisdiction	Document	Scenic Objectives
Toms River Township	Natural Resources Inventory (2016) Township of Toms River Master Plan (2017)	The Master Plan Land Use Element includes no specific provisions for the preservation of outward views from within communities, nor ocean/beach views. The Natural Resource Inventory includes no specific provisions for the preservation of outward views from within communities, nor ocean/beach views.
Tuckerton Borough	None Identified	

Figure 3.6.9-3 provides an overview of seascape and landscape in the geographic analysis area, including the key observation point (KOP) locations. Figure 3.6.9-4 shows the extent of visibility of the Offshore Project WTA and onshore substations and/or converter stations.

The geographic analysis area's landforms, water, vegetation, and built environment structures contain common and distinctive landscape features as outlined in Table 3.6.9-2.

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; vegetation community indicator species: beach plum (*Prunus maritime*), sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), poison ivy (*Toxicodendron radicans*), sour gum (*Nyssa sylvatica*), swamp magnolia (*Magnolia virginiana*), red cedar (*Juniperus virginiana*), and red maple (*Acer rubrum*).
Structures	Buildings, plazas, signage, walks, parking, roads, trails, seawalls, jetties, and infrastructure.

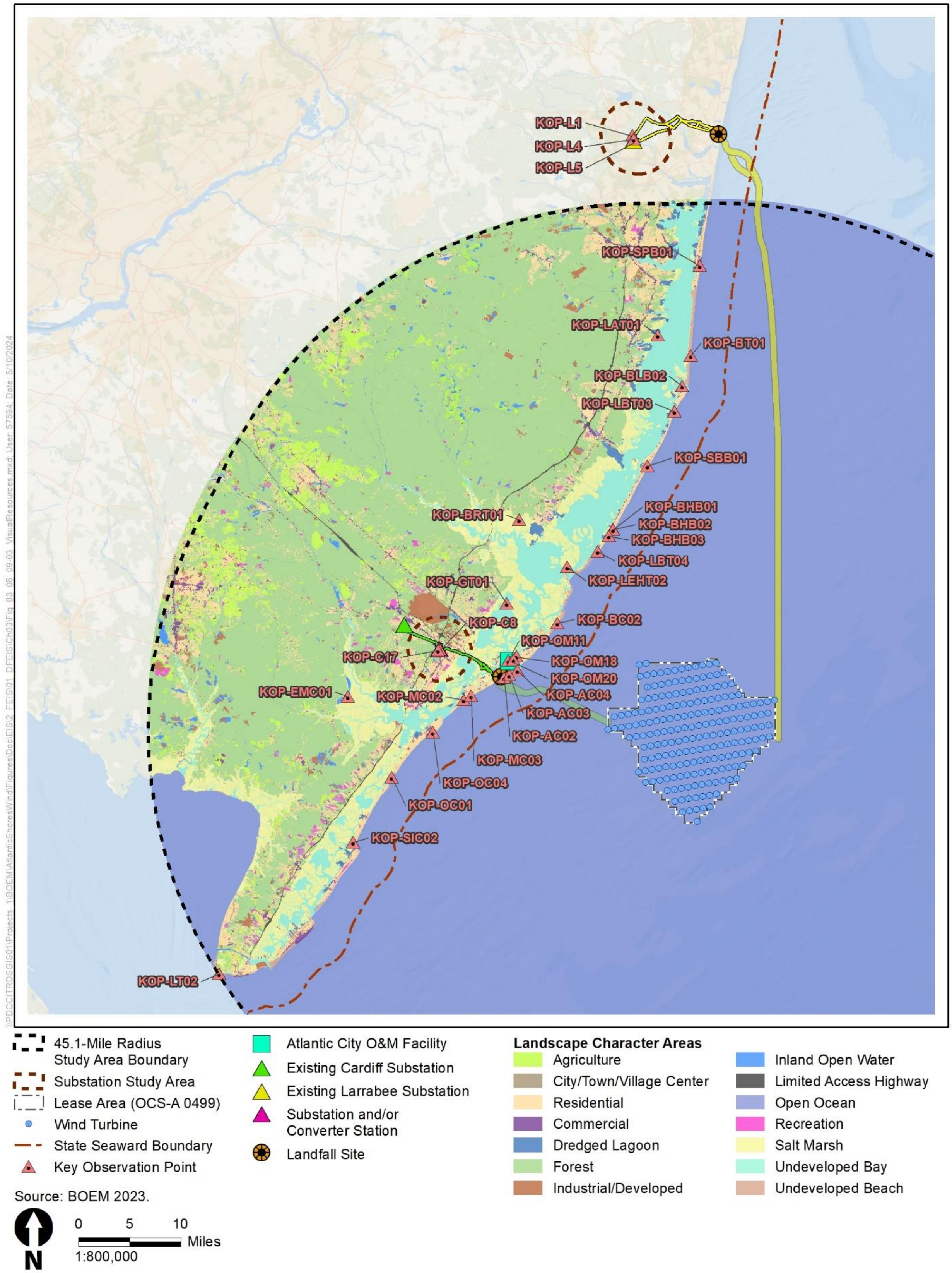

Figure 3.6.9-3. Scenic resources and key observation points

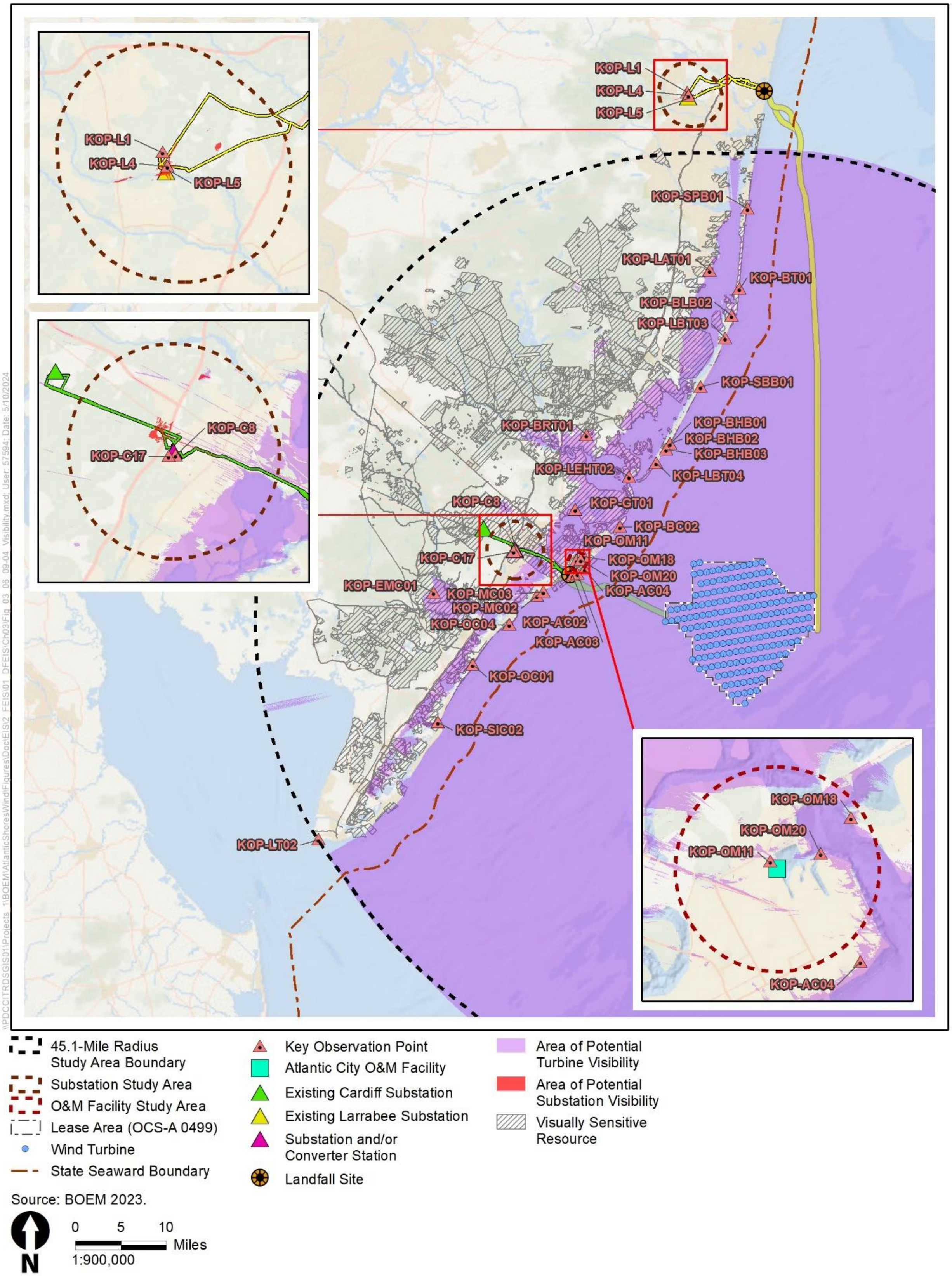

Figure 3.6.9-4. Offshore and onshore facility viewsheds

The visual characteristics of the open ocean, seascape, and landscape in the geographic analysis area, including surroundings of the WTA, landfall sites, offshore and onshore export cable corridors, and onshore substation and/or converter station areas, contain both locally common and regionally distinctive physical features, characters, and experiential views (Table 3.6.9-3).

Table 3.6.9-3. Open ocean, seascape, and landscape conditions

Category	Open Ocean, Seascape, and Landscape Conditions
Seascape	Intervisibility by pedestrians and boaters within coastal and adjacent marine areas (3.45 miles [5.6 kilometers]) within the 45.1-mile (72.6-kilometer) radius geographic analysis area.
Seascape Features	Physical features range from built elements, landscape, dunes, and beaches to flat water and ripples, waves, swells, surf, foam, chop, whitecaps, and breakers.
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	Intervisibility from seagoing vessels within the open ocean (beyond the 3.45-mile [5.6-kilometer] seascape area) within the 45.1-mile (72.6-kilometer) geographic analysis area, including recreational cruising and fishing boats, 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, whitecaps, and breakers.
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	Intervisibility 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.
Landscape Character	Tranquil and pristine natural, to vibrant and ordered, to chaotic and disordered.
Designated Public Places	Barnegat Branch Trail, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Cape May National Wildlife Refuge, Cape May State Park, Corson's Inlet State Park, Crook Horn Creek, Edwin B. Forsythe National Wildlife Refuge,

Category	Open Ocean, Seascape, and Landscape Conditions
	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 State Park, 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.

WMA = Wildlife Management Area

The geographic analysis area's seascape character areas, open ocean character area, and landscape character areas are classified by broadly defined USEPA Level IV Ecoregions (COP Volume II, Appendix II-M1; Atlantic Shores 2024). These areas are based on major features and elements in the characteristic landscape that define the physical character, "feel," and "experiential qualities" of the geographic analysis area and include open ocean, shoreline, coast, marsh and bay, and inland areas. Open ocean, seascape, and landscape character areas provide specific spatial locations and description of the existing area and provide a framework to systematically analyze potential visual effects throughout the geographic analysis area (COP Volume II, Appendix II-M1, Section 1.2.3; Atlantic Shores 2024). The extents of seascape character areas, open ocean character area, and landscape character areas used in this analysis for offshore analysis are summarized in Table 3.6.9-4 and in Table 3.6.9-5 and Table 3.6.9-6 for the onshore facilities.

Table 3.6.9-4. Offshore open ocean, seascape, and landscape character areas

Regional Landscape and Character Area	Square Miles (Square Kilometers) of Open Ocean, Seascape, and Landscape Character Area	Square Miles (Square Kilometers) Within the Zone of Potential Visual Influence	Percentage of Character Area in the Zone of Potential Visual Influence
Open Ocean Character Area			
Open Ocean	6,657.8 (17,243.6)	6,657.8 (17,243.6)	100
Seascape Character Areas			
Atlantic City[1]	3.1 (112.68)	0.2 (0.5)	6.9
Commercial Beachfront	1.4 (3.6)	0.9 (2.3)	68.7
Dredged Lagoon	14.3 (37.0)	3.5 (9.1)	3.3
Recreation[1]	20.2 (52.3)	0.6 (1.6)	3.2
Residential Beachfront	8.2 (21.3	3.1 (7.9)	37.0
Salt Marsh	214.7 (556.1)	112 (290.1)	52.1
Town/Village Center[1]	2.6 (6.7)	<0.1 (<0.3)	0.3
Undeveloped Bay	209.1 (549.7)	155.6 (403.1)	74.4
Undeveloped Beach	7.9 (20.5)	3.05 (7.9)	38.5
Landscape Character Areas			
Agriculture	110.2 (8.0)	<0.1 (<0.1)	<0.1
Bayfront Residential	3.3 (8.5)	0.2 (0.5)	6.1
Commercial Strip Development[1]	29.5 (76.4)	0.4 (1.0)	1.5
Forest	1,273.1 (3,297.3)	2.1 (5.4)	0.2
Industrial Developed	37.8 (97.9)	2.6 (6.7)	6.8

Regional Landscape and Character Area	Square Miles (Square Kilometers) of Open Ocean, Seascape, and Landscape Character Area	Square Miles (Square Kilometers) Within the Zone of Potential Visual Influence	Percentage of Character Area in the Zone of Potential Visual Influence
Inland Open Water	26.6 (68.9)	0.7 (1.8)	2.6
Inland Residential	223.8 (579.6)	1.1 (2.8)	0.5
Limited Access Highway	9.6 (24.9)	0.3 (7.8)	3.6

Source: COP Volume II, Appendix II-M1, Table 1.2-2; Atlantic Shores 2024.
[1] Character area occurs in more than one regional landscape.

Table 3.6.9-5. Onshore converter station and/or substation open ocean, seascape, and landscape character areas

Regional Landscape and Character Area	Square Miles (Square Kilometers) of Open Ocean, Seascape, and Landscape Character Area	Square Miles (Square Kilometers) Within the Zone of Potential Visual Influence	Percentage of Character Area in the Zone of Potential Visual Influence
Onshore Cardiff Area (97.7 acres, 0.15 sq mi, 0.39 sq km)			
Commercial	2.628 (6.806)	0.065 (0.168)	42.9
Forest	9.891 (25.617)	0.025 0.065)	16.4
High Density Residential	1.017 (2.634)	0.025(0.064)	16.2
Industrial	2.103 (5.049	0.020 (0.051)	13.4
Inland Bay	1.497 (3.877)	<0.001 (0.002)	-
Inland Water	0.232 (0.602)	<0.001 (0.002)	<0.1
Low Density Residential	1.018 (2.638)	0.001 (0.003)	0.4
Medium Density Residential	7.732 (20.028)	0.004 (0.011)	2.9
Recreation	0.720 (1.865)	0.002 (0.004)	1.0
Salt Marsh	3.224 (8.351)	0.000 (0.000)	-
Transportation	0.556 (1.441)	0.010 (0.027)	6.8
Onshore Larrabee Brook Road Area (241.4 acres, 0.38 sq mi, 0.98 sq km)			
Agriculture	1.560 (4.041)	0.032 (0.084)	8.6
Commercial	2.505 (6.487)	0.004 (0.011)	1.1
Forest	14.379 (37.243)	0.227 (0.587)	60.1
High Density Residential	2.081 (5.089)	0.001 (0.001)	0.1
Industrial	1.971 (5.104)	0.077 (0.199)	20.4
Inland Water	0.366 (0.949)	0.001 (0.001)	0.1
Low Density Residential	3.251 (8.419)	0.028 (0.073)	7.4
Medium Density Residential	9.426 (24.413)	0.003 (0.008)	0.8
Recreation	1.337 (4.463)	0.005 0.013)	1.3
Transportation	0.377 (0.977)	0.000 (0.000)	-
Onshore Larrabee Randolph Road Area (73.9 acres, 0.12 sq mi, 0.30 sq km)			
Agriculture	1.560 (4.041)	0.004 (0.013)	4.2
Commercial	2.505 (6.487)	0.000 (0.000)	-
Forest	14.379 (37.243)	0.035 (0.091)	30.6
High Density Residential	2.081 (5.089)	0.001 (0.003)	0.9
Industrial	1.971 (5.104)	0.67 (0.174)	58.1

Regional Landscape and Character Area	Square Miles (Square Kilometers) of Open Ocean, Seascape, and Landscape Character Area	Square Miles (Square Kilometers) Within the Zone of Potential Visual Influence	Percentage of Character Area in the Zone of Potential Visual Influence
Inland Water	0.366 (0.949)	<0.001 (<0.001)	0.1
Low Density Residential	3.251 (8.419)	0.006 (0.015)	5.1
Medium Density Residential	9.426 (24.413)	<0.001 (<0.001)	<0.1
Recreation	1.337 (4.463)	0.001 (0.003)	1.0
Transportation	0.377 (0.977)	0.000 (0.000)	-
Onshore Larrabee Lanes Pond Road Area (50.3 acres, 0.08 sq mi, 0.20 sq km)			
Agriculture	1.560 (4.041)	0.019 (0.048)	23.7
Commercial	2.505 (6.487)	0.000 (0.000)	-
Forest	14.379 (37.243)	0.020 (0.052)	25.7
High Density Residential	2.081 (5.089)	<0.001 (<0.001)	0.1
Industrial	1.971 (5.104)	<0.001 <0.001)	13.4
Inland Water	0.366 (0.949)	<0.001 <0.001)	1.2
Low Density Residential	3.251 (8.419)	0.028 (0.072)	35.2
Medium Density Residential	9.426 (24.413)	0.001 (0.001)	0.7
Recreation	1.337 (4.463)	<0.001 (<0.001)	<0.1
Transportation	0.377 (0.977)	0.000 (0.000)	-

Source: COP Volume II, Appendix II-M2 and M3, Tables 2.1-1, Atlantic Shores 2024.

Table 3.6.9-6. Onshore O&M facility open ocean, seascape, and landscape character areas

Regional Landscape and Character Area	Acres (Hectares) of Open Ocean, Seascape, and Landscape Character Area	Acres (Hectares) Within the Zone of Potential Visual Influence	Percentage of Character Area[1,2] in the Zone of Potential Visual Influence
Open Ocean Character Area			
Open Ocean	5,358.5 (2,168.5)	2,131.4 [862.5]	33.3
Seascape Character Areas			
Atlantic City	2,012.2 (814.3)	207.2 [83.9]	3.2
Commercial Beachfront	272.0 (110.1)	0.6 [0.2]	<0.1
Dredged Lagoon	64.6 (26.1)	0.3 [0.1]	<0.1
Recreation	48.2 (19.5)	5.9 [2.4]	0.1
Residential Beachfront	564.5 (228.4)	82.8 [335.1]	1.3
Salt Marsh	4,906.5 (1,985.6)	2,010.2 [813.5]	31.4
Town/Village Center	2.8 (1.1)	Not visible	Not visible
Undeveloped Bay	4,215.3 (1,705.9)	1,869.5 [756.5]	29.2
Undeveloped Beach	31.8 (12.9)	14.8 [6.0]	0.2
Landscape Character Areas			
Bayfront Residential	81.7 (33.1)	3.1 [1.3]	3.8
Commercial Strip Development	170.3 (68.9)	6.2 [2.5]	0.1
Forest	4.6 (1.9)	0.7 [0.3]	<0.1
Industrial Developed	198.3 (80.3)	63.8 [25.8]	1.0
Inland Open Water	8.4 (3.4)	0.1 [0.0]	<0.1
Inland Residential	838.0 (339.1)	8.4 [3.4]	0.1

Regional Landscape and Character Area	Acres (Hectares) of Open Ocean, Seascape, and Landscape Character Area	Acres (Hectares) Within the Zone of Potential Visual Influence	Percentage of Character Area[1,2] in the Zone of Potential Visual Influence
Limited Access Highway	37.7 (15.3)	4.1 [1.7]	0.1

Source: COP Volume II, Appendix II-M5, Table 1.2-1, Atlantic Shores 2024.
[1] The calculations used to generate this table were based on unrounded numbers, therefore the rounded results may not add up precisely.
[2] The visual study area is approximately 18,815.3 acres (7,614.3 hectares, 29.5 square miles) and the Zone of Potential Visual Influence (ZFI) is 6,409.6 acres (2,593.9 hectares). The percentage of character area is a fraction of the entire ZFI.

Scenic resource susceptibility, value, and sensitivity analyses document the region's world-renowned views, nature, culture, and history. The Project's affected character area extents are calculated through geographic information system (GIS) visibility studies and calculate the Project's affected resources' extents, verified and augmented by expert onsite analysis (COP Volume II, Appendix II-M1; Atlantic Shores 2024).

Susceptibility is informed by the overall character of a particular seascape or landscape area, or by an individual element and/or feature, or by a particular aesthetic, experiential, and perceptual aspect that contributes to the character of the area. Value stems from the characteristics and qualities of the natural and cultural environments, and the perceptual, experiential, and aesthetic qualities of the potentially affected ocean, seascapes, and landscapes. Sensitivity results from consideration of both susceptibility and value. As is common in NEPA, a higher rating prevails over a lower rating.

The sensitivity of the geographic analysis area's landscape character (LCA) is defined by its innate features and elements, its susceptibility to the Project, and its value to residents and visitors. A higher rating prevails over a lower rating. Sensitivity rating criteria is listed in Table 3.6.9-7.

Table 3.6.9-7. Sensitivity definitions for rating criteria of open ocean, seascape, and landscape

Region	High	Medium	Low
Open ocean is defined by both the susceptibility to impacts from an offshore wind project and its visual resources' scenic and social value.	Pristine, highly distinctive, and highly valued by residents and visitors.	Moderately distinctive and moderately valued by residents and visitors.	Common or with minimal scenic value.
Seascape character is defined by both the susceptibility to impacts from an offshore wind project and its visual resources' scenic and social value.	Distinctive and highly valued by residents and visitors.	Moderately distinctive and moderately valued by residents and visitors.	Common and unimportant to residents and visitors.
Landscape character is defined by both the vulnerability to impacts from an offshore wind project, and the visual resources' scenic and social value.	Highly distinctive, highly valued by residents and visitors, or within a designated scenic or historic landscape.	Moderately distinctive and moderately valued by residents and visitors.	Common or within a landscape of minimal scenic value.

Cultural and historic resources are considered in the SLIA affected environment analysis, because these resources may contribute in important ways to seascape and landscape character. Section 3.6.2, *Cultural Resources*, describes the cultural contexts and associated resources that may occur in the affected environment. Cultural and historic properties and landscapes may occur within the Seascape and Landscape Character Types and contribute to the region's history, which contributes to its landscape character (see Section 3.6.2).

Environmental justice communities are considered in the VIA affected environment analysis to ensure these communities are not unduly affected by the Proposed Project. Section 3.6.4, *Environmental Justice*, describes the environmental justice communities that may be affected by the Project. The locations of these communities are also mapped and described in COP, Volume II, Appendices II-M1, M2, and M5 (Atlantic Shores 2024).

Night skies and natural darkness are also components of seascape and landscape character. The numeric Bortel scale measures the night sky's brightness/darkness. Class 1 represents the darkest skies available on Earth, whereas Class 9 is an urban brilliantly lit sky. Coastal New Jersey has a Class 4–5 Bortle rating for "rural sky to suburban/rural transition," allowing residents and visitors to view the Milky Way on clear moonless summer nights (Go Astronomy n.d.). The U.S. Light Pollution Map (Stare n.d.) indicates the New Jersey shoreline is greatly affected by nearby coastal cities.

Table 3.6.9-8 lists the susceptibility, value, and sensitivity ratings within the OCAs, SCAs, and LCAs. A summary of character descriptions and analysis can be found in Appendix H, and detailed descriptions and photographs can be found in COP Volume II, Appendices II-M1 through M5 (Atlantic Shores 2024).

Table 3.6.9-8. Open ocean, seascape, and landscape sensitivity

Open Ocean, Seascape, and Landscape Character Area	Susceptibility	Value	Sensitivity
Open Ocean Character Area			
Open Ocean	High	High	High
Seascape Character Areas			
Atlantic City	Low	Medium	Medium
Commercial Beachfront	High	High	High
Commercial Strip Development	Low	Low	Low
Dredged Lagoon	High	High	High
Recreation	High	High	High
Residential Beachfront	High	High	High
Town/Village Center	High	High	High
Undeveloped Beach	High	High	High
Landscape Character Areas			
Agriculture	High	High	High
Atlantic City	Low	Medium	Medium
Bayfront Residential	High	High	High
Commercial Strip Development	Low	Low	Low
Forest	Medium	High	High
Industrial Developed	Low	Low	Low

Open Ocean, Seascape, and Landscape Character Area	Susceptibility	Value	Sensitivity
Inland Open Water	High	High	High
Inland Residential	High	High	High
Limited Access Highway	Medium	Medium	Medium
Recreation	High	High	High
Salt Marsh	High	High	High
Town/Village Center	High	High	High
Undeveloped Bay	High	High	High
Cardiff Landscape Character Area			
Commercial	Medium	Medium	Medium
Forest	High	High	High
High Density Residential	Medium	Medium	Medium
Industrial	Low	Low	Low
Inland Bay	High	High	High
Inland Water	High	High	High
Low Density Residential	High	High	High
Medium Density Residential	High	High	High
Recreation	High	High	High
Salt Marsh	High	High	High
Transportation	Medium	Medium	Medium
Larrabee Brooks Road Landscape Character Area			
Agriculture	High	High	High
Commercial	Medium	Medium	Medium
Forest	High	High	High
High Density Residential	Low	Low	Low
Industrial	Low	Low	Low
Inland Water	High	High	High
Low Density Residential	High	High	High
Medium Density Residential	High	High	High
Recreation	High	High	High
Transportation	Medium	Medium	Medium
Larrabee Randolph Road Landscape Character Area			
Agriculture	High	High	High
Commercial	Medium	Medium	Medium
Forest	High	High	High
High Density Residential	Low	Low	Low
Industrial	Low	Low	Low
Inland Water	High	High	High
Low Density Residential	High	High	High
Medium Density Residential	High	High	High
Recreation	High	High	High
Transportation	Medium	Medium	Medium
Larrabee Lanes Pond Road Landscape Character Area			
Agriculture	High	High	High
Commercial	Medium	Medium	Medium

Open Ocean, Seascape, and Landscape Character Area	Susceptibility	Value	Sensitivity
Forest	High	High	High
High Density Residential	Low	Low	Low
Industrial	Low	Low	Low
Inland Water	High	High	High
Low Density Residential	High	High	High
Medium Density Residential	High	High	High
Recreation	High	High	High
Transportation	Medium	Medium	Medium
Operations & Maintenance Facility Character Area[2]			
Open Ocean	High	High	High
Atlantic City	Low	Medium	Medium
Commercial Beachfront	High	High	High
Dredged Lagoon	High	High	High
Recreation	High	High	High
Residential Beachfront	High	High	High
Salt Marsh	High	High	High
Town/Village Center	High	High	High
Undeveloped Bay	Low	High	Medium
Undeveloped Beach	High	High	High
Bayfront Residential	High	High	High
Commercial Strip Development	Low	Low	Low
Forest	Medium	High	High
Industrial Developed	Low	Low	Low
Inland Open Water	High	High	High
Inland Residential	High	High	High
Limited Access Highway	Medium	Medium	Medium

Source: COP Volume II, Appendix II-M1, Table 1.2-2; Atlantic Shores 2024.

[1] Multiple character areas occur in more than one regional landscape.

[2] Character Area susceptibility, value, and sensitivity is based on evaluations of these character areas generally for offshore infrastructure as described in COP Volume II, Appendix II-M1, Atlantic Shores 2024.

OCA, SCA, and LCA susceptibility ratings range within high, medium, and low, depending on their exposure from the Project and on their intrinsic characteristics. Project visibility within SCAs and LCAs is influenced by intervening landforms, structures, and vegetation. Most susceptible to change are the undeveloped beach, beach residential beachfront, and commercial beachfront SCAs due to character-changing exposure. Least susceptible to change are the high density residential, industrial, and forest LCAs.

OCA, SCA, and LCA value ratings range within high, medium, and low, depending primarily on their special designations at national, state, and local levels and individual elements, particular landscape features, or notable aesthetic, perceptual, or experiential qualities. Table 3.6.9-9 lists places with national, state, and local designations and categories of places that are valued by residents and visitors.

Table 3.6.9-9. Seascape and landscape with national, state, and/or local designations

Settings	Conditions
Seascape[1] Ocean shoreline, beach, dune, adjacent areas, and ocean areas within 3.45 statute miles (5.5 kilometers) of the shoreline.	Seascapes with national, state, and/or local designations: Barnegat Branch Trail, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Cape May National Wildlife Refuge, Cape May State Park, Corson's Inlet State Park, 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 State Park, 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. Beaches, seaward boardwalks, jetties, and piers.
Landscape[2] Areas inland of the seascape	Cemeteries, churches, historic sites, lighthouses, scenic overlooks, nature areas, recreation areas, schools, town halls, and residential areas within the geographic analysis area. Landscapes with national, state, local designations or local value: Absecon Bay, Barnegat Bay, Barnegat Branch Trail, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Cape May National Wildlife Refuge, Cape May State Park, Corson's Inlet State Park, 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 Bay, Great Egg Harbor Bay, Great Sound, Island Beach State Park, Lakes Bay, Little Bay, Ludlam Bay, Manahawkin Bay, National Natural Landmark Manahawkin Bottomland Hardwood Forest, Ocean City Boardwalk, Ocean City Park, Peck Bay, Reeds Bay, Sandcastle Park, Southern Pinelands Natural Heritage Trail, Stainton Wildlife Refuge, Stone Harbor Bird Sanctuary, Stites Sound, Townsend Sound, Tuckahoe WMA, Upper Barnegat Bay WMA, Vincent Klune Park, and Wharton State Forest.

[1] Locations also listed under Landscape extend to both Seascape and Landscape.
[2] Locations also listed under Seascape extend to both Landscape and Seascape.
WMA = Wildlife Management Area

Table 3.6.9-10 lists the jurisdictions with ocean beach views and ocean views from an inland landscape, bay, estuary, marsh, pond, or river. The range of conditions, including the contexts of North Brigantine Natural Area, Seaside Park Beach, and Cape May State Park Lighthouse, are portrayed on Figures 3.6.9-5, 3.6.9-6, and 3.6.9-7, respectively.

Table 3.6.9-10. Jurisdictions with ocean views

Ocean View	Jurisdiction
Seascape jurisdictions with an ocean beach	Atlantic City, Barnegat Light Borough, Beach Haven Borough, Berkeley Township, Brigantine, Cape May, Egg Harbor, Galloway Township, Harvey Cedars Borough, Long Beach Township. Longport Borough, Lower Township, Margate City, Ocean City, North Wildwood, Sea Isle City, Seaside Heights Borough, Seaside Park Borough, Ship Bottom Borough, Stone Harbor Borough, Surf City Borough, Toms River Township, Upper Township, Ventnor City, Wildwood, and Wildwood Crest.
Landscape jurisdictions with ocean views from a land area, bay,	Atlantic City, Barnegat Light Borough, Bass River Township, Beach Haven Borough, Berkeley Township, Brick Township, Brigantine, Cape May, Dennis Township, Eagleswood Township, Egg Harbor, Egg Harbor Township, Galloway Township, Harvey Cedars Borough, Howell Township, Lacey Township, Lakewood Township, Little Egg Harbor Township, Long Beach Township. Longport Borough, Lower Township, Manchester Township, Margate

Ocean View	Jurisdiction
estuary, marsh, pond, or river	City, Ocean City, North Wildwood, Sea Isle City, Seaside Heights Borough, Seaside Park Borough, Ship Bottom Borough, Stone Harbor Borough, Surf City Borough, Toms River Township, Upper Township, Ventnor City, Wall Township, Washington Township, Wildwood, and Wildwood Crest.

Figure 3.6.9-5. North Brigantine Natural Area

Figure 3.6.9-6. Seaside Park Beach

Figure 3.6.9-7. Cape May Point State Park Lighthouse

VIA Affected Environment

KOPs represent individuals or groups of people who may be affected by changes in views and visual amenity. Based on higher viewer sensitivity, viewer exposure, and context photography, 26 designated KOPs (Table 3.6.9-11) become the locational bases for detailed analyses of the geographic analysis area's open ocean, seascape, landscape, and viewer experiences (COP Volume II, Appendix II-M1; Atlantic Shores 2024). Offshore viewing receptors include fishing boats, pleasure crafts, and cruise ships that represent marine activities in the area. Daytime and nighttime views range from 0-mile (0-kilometer) to 45.1-mile (72.6-kilometer) distances.

Table 3.6.9-11. Representative offshore analysis area view receptor contexts and key observation points

Context	Key Observation Points
Vantage Point	KOP-AC02 Jim Whelan Boardwalk Hall, Atlantic City Convention Center NHL KOP-AC03 Madison Hotel (Daytime) KOP-AC03 Madison Hotel (Nighttime) KOP-AC04 Ocean Casino Resort – Sky Garden (Daytime) KOP-AC04 Ocean Casino Resort – Sky Garden (Nighttime) KOP-MC02 Lucy the Margate Elephant NHL KOP-OC04 Gillian's Wonderland Amusement Park KOP-SIC02 Townsend Inlet Bridge KOP-BLB01 Barnegat Lighthouse Observation Point
Linear Receptor	KOP-BHB02 Beach Haven, Center Street KOP-BHB03 Beach Haven, Holyoke Avenue KOP-LBT03 Long Beach Island Beach KOP-OO2Representative Cruise Ship and Commercial Shipping Lanes
Historic or Scenic Area	KOP-BC02 North Brigantine Natural Area KOP-BHB01 Beach Haven Historic District (Daytime) KOP-BHB01 Beach Haven Historic District (Nighttime) KOP-BLB02 Barnegat Lighthouse State Park KOP-BRT01 Bass River State Forest KOP-BT01 Island Beach State Park KOP-EMC01 Tuckahoe WMA KOP-GT01 Edwin B. Forsythe NWR, Galloway Township KOP-LAT01 Edwin B. Forsythe National Wildlife Refuge-Woodmansee Estate (Daytime) KOP-LAT01 Edwin B. Forsythe National Wildlife Refuge-Woodmansee Estate (Nighttime) KOP-LBT04 Edwin B. Forsythe NWR, Holyoke KOP-LEHT02 Great Bay Boulevard WMA/Rutgers Field Station KOP-LT02 Cape May Point State Park KOP-MC03 Huntington Park KOP-OC01 Corson's Inlet State Park KOP-OO1 Representative Recreational Fishing, Pleasure, and Tour Boat Area KOP-SBB01 Ship Bottom Borough Municipal Park KOP-SPB01 Seaside Park Borough

KOPs selected for viewer analyses in the substation areas include two locations with existing views of the proposed substation and/or converter station located along the Cardiff onshore route and three locations with existing views of the proposed substation and/or converter station options located along the Larabee onshore route. The two KOPs in the vicinity of the Cardiff onshore substation, three KOPs in the vicinity of Larrabee onshore substation options, and three KOPs in the vicinity of the O&M facility, and their viewing contexts are listed in Table 3.6.9-12.

Table 3.6.9-12. Representative onshore analysis area view receptor contexts and key observation points

Context	Key Observation Points
Vantage Point	KOP-OM18 Cove Beach KOP-OM20 Atlantic City Aquarium
Linear Receptor	KOP-C17 Cardiff Tilton Road KOP-L1 Larrabee Miller Road KOP-L4 Larrabee Randolph Road NE KOP-L5 Larrabee Randolph Road SE KOP-OM11 North Maryland Ave SE
Historic or Scenic Area	KOP-C8 Cardiff Hingston Avenue

The range of sensitivity of view receptors and people viewing the Project is determined by their engagement, view expectations, susceptibility to the Project, and the value of the receptor. The susceptibility of KOP viewers considers both view location and activity: review of relevant designations and the level of policy importance that they signify (such as landscapes designated at national, state, or local levels). Value is rated based on scenic quality, rarity, recreational value, representativeness, conservation interests, perceptual aspects, and artistic associations. Judgments regarding seascape, landscape, and KOP sensitivity are informed by the VIA (COP Volume II, Appendix II-M1, Atlantic Shores 2024). Table 3.6.9-13 lists the sensitivity issues identified for the Seascape and Landscape Impact Assessment (SLIA) and the VIA, as well as the indicators and criteria used to assess impacts for the EIS.

Table 3.6.9-13. View receptor sensitivity ranking criteria

Sensitivity	Sensitivity Criteria
High	Residents with views of the proposed Project from their homes; people with a strong cultural, historic, religious, or spiritual connection to landscape or seascape views; people engaged in outdoor recreation whose attention or interest is focused on the open ocean, seascape, and landscape, and on particular views; visitors to historic or culturally important sites, where views of the surroundings are an important contributor to the experience; people who regard the visual environment as an important asset to their community, churches, schools, cemeteries, public buildings, and parks; and people traveling on scenic highways and roads, or walking on beaches and trails, specifically for enjoyment of views.
Medium	People engaged in outdoor recreation whose attention or interest is unlikely to be focused on the landscape and on particular views because of the type of activity but where views and the aesthetic environment create a more desirable and enjoyable experience; people at their places of livelihood, commerce, and personal needs (inside or outside) whose attention is generally focused on that engagement, not on scenery, but where the seascape and landscape setting adds value to the quality of their activity; and, generally, those commuters and other travelers traversing routes that are not dominated by scenic developments, but the overall visual setting adds value to the experience.
Low	People engaged in outdoor activities whose attention or interest is not focused on the landscape or on particular views because of the type of activity. The setting is inconsequential and adds little or no value to the viewer experience.

Table 3.6.9-14 lists offshore KOP viewer sensitivity ratings, and Table 3.6.9-15 lists onshore KOP viewer sensitivity ratings.

Table 3.6.9-14. Offshore Project area key observation point viewer sensitivity ratings

Key Observation Points	Susceptibility	Value	Sensitivity
High			
KOP-AC02 Jim Whelan Boardwalk Hall, Atlantic City Convention Center NHL	High	High	High
KOP-AC03 Madison Hotel (Daytime)	High	High	High
KOP-AC03 Madison Hotel (Nighttime)	High	High	High
KOP-AC04 Ocean Casino Resort – Sky Garden (Daytime)	High	High	High
KOP-AC04 Ocean Casino Resort – Sky Garden (Nighttime)	High	High	High
KOP-BC02 North Brigantine Natural Area	High	High	High
KOP-BHB01 Beach Haven Historic District (Daytime)	High	High	High
KOP-BHB01 Beach Haven Historic District (Nighttime)	High	High	High
KOP-BHB02 Beach Haven, Center Street	High	High	High
KOP-BHB03 Beach Haven, Holyoke Avenue	High	High	High
KOP-BLB02 Barnegat Lighthouse State Park	High	High	High
KOP-BT01 Island Beach State Park	High	High	High
KOP-GT01 Edwin B. Forsythe NWR, Galloway Township	High	High	High
KOP-LAT01 Edwin B. Forsythe NWR-Woodmansee Estate (Daytime)	High	High	High
KOP-LAT01 Edwin B. Forsythe NWR-Woodmansee Estate (Nighttime)	High	High	High
KOP-LBT03 Long Beach Island Beach	High	High	High
KOP-LBT04 Edwin B. Forsythe NWR, Holyoke	High	High	High
KOP-LEHT02 Great Bay Boulevard WMA/Rutgers Field Station	High	High	High
KOP-LT02 Cape May Point State Park	High	High	High
KOP-MC02 Lucy the Margate Elephant NHL	High	High	High
KOP-MC03 Huntington Park	High	High	High
KOP-OC01 Corson's Inlet State Park	High	High	High
KOP-OC04 Gillian's Wonderland Amusement Park	High	High	High
KOP-OO1 Recreational Fishing, Pleasure, and Tour Boat Area	High	High	High
KOP-OO2 Commercial and Cruise Ship Shipping Lanes	High	High	High
KOP-SBB01 Ship Bottom Borough Municipal Park	High	High	High
KOP-SPB01 Seaside Park Borough	High	High	High
KOP-SIC02 Townsend Inlet Bridge	High	High	High
Medium			
KOP-BRT01 Bass River State Forest	Medium	High	Medium
KOP-EMC01 Tuckahoe WMA	Medium	High	Medium
Low	None		

Table 3.6.9-15. Onshore Project area key observation point viewer sensitivity ratings

Context	Key Observation Points
High	KOP-C8 Cardiff Hingston Ave KOP-C17 Cardiff Tilton Road KOP-L1 Larrabee Miller Road KOP-L4 Larrabee Randolph Road NE KOP-L5 Larrabee Randolph Road SE KOP-OM11 North Maryland Ave SE KOP-OM18 Cove Beach KOP-OM20 Atlantic City Aquarium
Medium	None
Low	None

While not designated as representative KOPs, daytime and nighttime scenic aerial tour viewers, arriving and departing Atlantic City International Airport and Ocean City Municipal Airport, and en-route airport flights traversing the coast, range from foreground to background viewing situations. Aircraft viewers are more frequently affected by view-limiting atmospheric conditions than are land and ocean receptors. The nearest proposed WTG is offshore 7.6 nautical miles (8.7 statute miles [14 kilometers]) from the North Brigantine Natural Area shoreline. Onshore to offshore view conditions vary both daily and monthly. Based on averaged observational visibility conditions, looking towards the Lease Area from shore, visibility is greater than 8 miles (13 kilometers) during 70 percent of daylight hours and greater than 10 miles (16 kilometers) during 60 percent of daylight hours throughout the year. Visibility conditions calculated from Rutgers University Weather Research and Forecasting model data indicate "very clear days" 1 out of 4 or 5 days (23 percent) in the summer; this is defined as visibility greater than 20 miles (32 kilometers) throughout the majority of the onshore and offshore environment (COP Volume II, Appendix II, Attachment H; Atlantic Shores 2024). Visibility from onshore to offshore can decrease as much as 41 percent. Late summer and fall conditions resulted in the highest levels of WTA and met tower visibility, and late spring conditions resulted in the lowest visibility. Mornings trend towards lower visibility and afternoons towards higher visibility throughout the summer and fall due to higher humidity and larger temperature differences between the air masses and ocean surface causing morning haziness and marine clouds. Additional atmospheric data are available, including daily visibility histograms for calendar year 2019 at 13 KOPs, based on ground level visibility measurements, in COP Volume II, Appendix II, Attachment H, *Visibility Modeling Study* (Atlantic Shores 2024). It is noted that elevated positions have greater visibility.

Views from nearer the shoreline are more limited by atmospheric conditions than views from interior mainland areas. Many viewers, particularly recreational users, are more likely to be present on beaches on clearer days, when viewing conditions are better than on rainy, hazy, or foggy days. Therefore, affected environment and visual impact assessments of the Project are based on clear-day and clear-night visibility. Elevated walks and walls afford greater visibility of offshore elements for viewers in tidal beach areas. Nighttime views toward the ocean from the beach and interior island areas may be diminished by ambient light levels and glare of developments.

Ocean receptors include the people on recreational and fishing boats, pleasure craft, tour boats, and commercial fishing boats with WTA visibility out to 42.5 miles (68.4 kilometers), and cruise ships with elevated 63-foot (19.2-meter) visibility out to 49.3 miles (79.3 kilometers).

The Cardiff onshore substation and/or converter station would occupy portions of previously developed industrial facilities. The Larrabee onshore substation and/or converter station would occupy portions of both developed industrial facilities and undeveloped landscape.

3.6.9.2 Impact Level Definitions for Scenic Resources and Viewer Experience

Definitions of impact levels are provided in Table 3.6.9-16. There are no beneficial impacts on scenic and visual resources.

Table 3.6.9-16. Impact level definitions for scenic and visual resources

Impact Level	Impact Type	Definition
Negligible	Adverse	SLIA: Very little or no effect on seascape/landscape unit character, features, elements, or key qualities either because unit 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	Adverse	SLIA: The Project would introduce features that may have low to medium levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The project features may introduce a visual character that is slightly inconsistent with the character of the unit, which may have minor to medium negative effects on the unit's features, elements, or key qualities, but the unit'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, then evaluate the nature of the sensitivity to determine if elevating the impact to the next level is justified. For instance, a KOP with a low magnitude of change, but that has a high level of viewer concern (combination of susceptibility/value) may justify adjusting to a moderate level of impact.
Moderate	Adverse	SLIA: The Project would introduce features that would have medium to large levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The Project would introduce a visual character that is inconsistent with the character of the unit, which may have a moderate negative effect on the unit's features, elements, or the qualities. In areas affected by large magnitudes of change, the unit's features, elements, or key qualities have low susceptibility and/or value. VIA: The visibility of the Project would introduce a moderate to large level of change to the view's character; may have a 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;

Impact Level	Impact Type	Definition
		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, then evaluate the nature of the sensitivity to determine if elevating the impact to the next level is justified.
Major	Adverse	SLIA: The Project would introduce features that would have dominant levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The Project would introduce a visual character that is inconsistent with the character of the unit, which may have a major negative effect on the unit's features, elements, or key qualities. The concern for change (combination of susceptibility/value) to the character unit is high. VIA: The visibility of the Project would introduce a major level of character change to the view; will 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, then evaluate the nature of the sensitivity 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, then evaluate the nature of the sensitivity to determine if lowering the impact to moderate is justified.

3.6.9.3 Impacts of Alternative A – No Action on Scenic and Visual Resources

When analyzing the impacts of the No Action Alternative on scenic and visual resources, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for scenic and visual resources. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Ongoing and Planned Activities Scenario*.

Impacts of Alternative A – No Action

Under the No Action Alternative, baseline conditions for open ocean, seascape, landscape, and viewers described in Section 3.6.9.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. Ongoing activities that contribute to impacts on scenic and visual resources in the geographic analysis area primarily involve onshore development and construction activities, offshore vessel traffic, and offshore wind. These activities have the potential to contribute to new structures, traffic congestion, and nighttime light impacts. See Appendix D, Table D.A1-22 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for scenic and visual resources. There are two ongoing offshore wind projects within the geographic analysis area for scenic and visual resources: Ocean Wind 1 (OCS-A 0498), and Empire Wind (OCS-A 0512).

Cumulative Impacts of the No Action Alternative

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

Planned non-offshore wind activities in the geographic analysis area that contribute to impacts on open ocean, seascape, 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; marine transportation; and onshore development activities (see Appendix D for a description of planned activities in the geographic analysis area). Planned activities have the potential to affect open ocean character, seascape character, landscape character, and viewer experience because of the introduction of structures, light, land disturbance, traffic, air emissions, and accidental releases to the landscape or seascape.

Tables H-28 to H-32 in Appendix H consider effects on open ocean, seascape, landscape, and viewers of offshore wind development without the Proposed Action and in combination with the Proposed Action.

The discussion that follows summarizes the potential impacts of ongoing and planned offshore wind activities on scenic and visual resources during construction and installation, O&M, and decommissioning of the projects. Planned offshore wind projects other than the Proposed Action that contribute to impacts on scenic and visual resources include the following eight projects within the geographic analysis area: Atlantic Shores North (OCS-A 0549), Ocean Wind 2 (OCS-A 0532), Attentive Energy (OCS-A 0538), Community Offshore Wind (OCS-A 0539), Atlantic Shores Offshore Wind Bight (OCS-A 0541), Invenergy Wind Offshore (OCS-A 0542), and GSOE I (OCS-A 0482); and an additional three within the cumulative impacts analysis area: Bluepoint Wind (OCS-A 0537), Skipjack (OCS-A 0519), and US Wind/Maryland Offshore Wind (OCS-A 0490) (Appendix D, Table D.A2-1). The cumulative simulations (Appendix H, Attachment H-1) are based on known WTG location and height information as of July 2022. The information regarding WTG heights is based on the best available information about commercially available WTGs at this time. The cumulative simulations estimate these projects (inclusive of the ongoing Ocean Wind 1 and Empire Wind projects) to collectively install 2,216 WTGs between 2023 and 2030.

BOEM expects planned offshore wind activities to affect visual and scenic resources through the following primary IPFs.

Accidental releases: Accidental releases during construction and installation, O&M, and decommissioning of offshore wind projects (excluding the Proposed Action) could affect nearby open ocean character, seascape 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 viewer experience of affected seascapes, open ocean area, and landscapes. The potential for accidental releases would be greatest during construction and installation and decommissioning of offshore wind projects, and would be lower but continuous during O&M. Accidental releases would cause short-term negligible to minor impacts.

Land disturbance: Other offshore wind development would require installation of onshore export cables, onshore substations and/or converter stations, 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 installation 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, BOEM anticipates these projects would generally have localized, short-term, negligible to minor impacts on scenic and visual resources during construction and installation, O&M, or decommissioning due to land disturbance.

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 2,216 WTGs within the geographic analysis area (excluding the Proposed Action). Depending on the distance between the viewer and the Project, minor to major impacts at night may occur during construction because of artificial nighttime lighting required to illuminate the construction zone for safe construction activity. The impact of vessel lighting on scenic and visual resources during construction and installation would be localized and short term (less than 5 years). Visual impacts of nighttime lighting on vessels would continue during O&M of planned offshore wind facilities, and the impact on open ocean character, seascape character, nighttime viewer experience, and valued scenery from vessel lighting would be intermittent and long term.

Permanent aviation warning lighting required on the WTGs would be visible from beaches and coastlines in the geographic analysis area and would have major impacts on scenic and visual resources. During construction, FAA hazard lighting systems would be affixed to the wind turbines as they rise over 200 feet above sea level to provide for safe nighttime aviation. Once affixed, the aviation warning lights would remain in the on position throughout the construction period and for the duration of O&M. The cumulative effect of these WTGs and associated synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and one at the top of each WTG nacelle in the offshore wind lease areas would have long-term, minor to major 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 implementation of ADLS would activate the hazard lighting system in response to detection of nearby aircraft. The synchronized flashing of the navigational lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the open ocean, seascape, landscape, and viewers. The shorter-duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at night compared to the standard continuous, medium-intensity red strobe FAA warning system due to the reduced duration of activation. Based on recent studies (Atlantic Shores 2024), the reduced time of FAA hazard lighting with an ADLS is expected to reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without an ADLS.

However, ADLS cannot be initiated until construction is completed and the ADLS is installed, tested, and approved for operation.

Presence of structures: The placement of 2,216 WTGs from other offshore wind projects in the geographic analysis area would contribute to adverse impacts on scenic and visual resources. Appendix H provides simulations of offshore wind development without the Proposed Action from eight KOPs with views to the south, southwest, and west. In the geographic analysis area, all lease areas would have the potential to be seen within the same viewshed as the Project from ground-level coastal KOPs. The total number of WTGs that would be visible from any single KOP would be less than the 2,216 WTGs considered under the ongoing and planned activities scenario. For example, a total of 250 WTGs would be theoretically visible from KOP-BC02 North Brigantine Natural Area and a total of 411 WTGs would be theoretically visible from KOP-OC04 Gillian's Wonderland Amusement Park (COP Volume II, Appendix II-M1 VIA; Atlantic Shores 2024). The presence of structures associated with offshore wind development would affect open ocean character, seascape character, landscape character, and viewer experience, as simulated from sensitive onshore receptors (Appendix H). The open ocean character, seascape character, and landscape character would reach the maximum level of change to its features and characters from formerly undeveloped ocean to dominant wind farm character and from onshore facilities by approximately 2030 and would result in major impacts.

Traffic (vessel): Other offshore wind project construction and installation, decommissioning, and, to a lesser extent, O&M would generate increased vessel traffic that could contribute to adverse moderate to major impacts on scenic and visual resources in the geographic analysis area. The impacts would occur primarily during construction and installation along routes between ports and the offshore wind construction areas. Assuming vessel traffic of other projects is similar to that of the Proposed Action (i.e., approximately 51 vessels operating in the Project area or over the offshore export cable route at any given time [COP Volume II, Section 7.6.2.1; Atlantic Shores 2024]), each project would generate between 15 and 35 vessels operating in the WTA or over the offshore export cable route at any given time during the construction and installation phase (Section 3.6.6, *Navigation and Vessel Traffic)*. Stationary and moving construction vessels would change the daytime and nighttime seascape and open ocean character from open ocean to active waterway.

Onshore and offshore visual impacts would continue because of visible vessel activity related to O&M of offshore wind facilities. Based on the estimates for the nearby ongoing and planned Ocean Wind 1, Ocean Wind 2, and Atlantic Shores North Projects, the offshore wind projects in the geographic analysis area would have approximately 22 vessels operating in the Project area at any given time (Section 3.6.6). During O&M of offshore wind projects (excluding the Proposed Action), vessel traffic would result in long-term, intermittent contrasts to seascape and open ocean character and in the viewer experience of valued scenery. Vessel activity would increase again during decommissioning at the end of the assumed 35-year operating period of each project, with impacts similar to those described for construction and installation.

Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, current regional trends and activities would continue, and scenic and visual resources would continue to be affected by natural and human-caused IPFs. Ongoing non-offshore wind activities would have continuing short- and long-term impacts on open ocean, seascape, landscape, and viewer experience, primarily because of the daytime and nighttime presence of structures, lighting, and vessel traffic. The character of the coastal landscape would change in the short term and long term through natural processes and planned activities that would continue to shape onshore features, character, and viewer experience. 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. The No Action Alternative would result in **negligible** to **major** impacts on scenic and visual resources from ongoing activities.

Cumulative Impacts of Alternative A – No Action. 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 ongoing and planned within the geographic analysis area would lead to the construction of approximately 2,216 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 dominant wind farm character by approximately 2030. The visibility of planned activities would introduce a major level of character change to the view; would attract, hold, and dominate the viewer's attention; and have a moderate to major effect on the viewer's visual experience. The No Action Alternative combined with all other ongoing and planned activities (including other offshore wind activities) would result in **major** impacts on visual and scenic resources within the geographic analysis area due to the 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 Final EIS analyzes the maximum-case scenario; any potential variances in the proposed 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 scenic and visual resources.

- The Project layout, including the number, size, and placement of the WTGs, met tower, and OSSs, and the design of lighting systems for structures.
- The number and type of vessels involved in construction and installation, O&M, and decommissioning, and time of day that construction and installation, O&M, and decommissioning would occur.

- Onshore cable export route options and the size and location of onshore substations.

Variability of the proposed Project design exists as outlined in Appendix C. The following 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 and installation, O&M, and decommissioning activities that involve nighttime lighting would increase visibility at night.
- L**ocation and scale of Onshore Project components:** Installation of larger-scale Onshore Project components in closer proximity to sensitive receptors would have greater impacts.

At distances of 12 miles (19.3 kilometers) or closer, the form of the WTG may be the dominant visual element creating the visual contrast regardless of color. At greater distances, color may become the dominant visual element creating visual contrast under certain visual conditions that give visual definition to the WTG's form and line.

3.6.9.5 Impacts of Alternative B – Proposed Action on Scenic and Visual Resources

This section addresses the impacts associated with construction and installation, O&M, and decommissioning of the Proposed Action on open ocean character, seascape character, and landscape character (SLIA) and on viewer experience (VIA) in the geographic analysis area. The SLIA levels consider the sensitivity of the character areas' physical elements and features and the aesthetic, perceptual, and experiential aspects that make them distinctive. SLIA impacts combine OCA, SCA, and LCA sensitivity and the magnitudes of intervisibility and incompatibility of the character of the Project with the character of the OCA, SCA, and LCA.

The VIA level is judged with reference to the sensitivity of the view receptor and the magnitude of change, which considers the noticeable features; distance and field of view (FOV) effects; view framing and intervening foregrounds; and the form, line, color, and texture contrasts; scale of change; and prominence in the characteristic open ocean, seascape, and landscape.

The degree of adverse effects is determined through application of the following criteria.

- The Proposed Action's characteristics, contrasts, scale of change, prominence, and spatial interactions with the special qualities and extents of the baseline open ocean, seascape, and landscape characters.
- Intervisibility between viewer locations and the Proposed Action's features.
- The sensitivities of viewers.

Viewers or visual receptors in the Proposed Action's zone of theoretical visibility include the following.

- Residents living in coastal communities or individual residences.
- Tourists visiting, staying in, or traveling through the area.
- Recreational users of the seascape, 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 the landscape, including those using landward beaches, golf courses, cycle routes, and footpaths.
- Tourists, workers, visitors, or local people using transport routes.
- People working in the countryside, commerce, or dwellings.
- People working in the marine environment, such as those on fishing vessels and crews of ships.

Onshore to offshore view distances to the Project WTA range from 8.7 miles (14.0 kilometers) to 45 miles (72.4 kilometers). At the 8.7-mile (14.0-kilometer) distance and at the near center of the northwest-facing boundary of the WTA array, the Project would occupy 59.7° (48 percent) of the typical human's 124° horizontal FOV and 1.4° (2.5 percent) of the typical 55° vertical FOV (measured from eye level). This vertical measure also indicates the perceived proportional size and relative height of a WTA. At 40 miles (64.4 kilometers) distance, the Project may appear 0.03° above the horizon and 16° along the horizon, 0.04 percent and 12 percent of the human vertical and horizontal FOV, respectively. WTG, met tower, and OSS visibility would be variable throughout the day depending on specific factors. View angle, sun angle, atmospheric conditions, and distance would affect the visibility and noticeability. Visual contrast of WTGs, met tower, and OSSs would vary throughout daylight hours depending on whether the WTGs, met tower, and OSSs are backlit, side-lit, or front-lit and based on the visual character of the horizon's backdrop. These variations through the course of the day may result in periods of major visual effects, while at other times of day would have moderate, minor, or negligible effects.

Consideration of atmospheric visibility conditions between potential shoreline viewing receptors and the Proposed Action WTGs and met tower concluded that: (1) the first row of Atlantic Shores South WTGs and met tower would be visible from the nearest shoreline KOP (8.7 miles (14.0 kilometers) over approximately 50 percent of the year; (2) the first two rows would be visible over approximately 40 percent of the year; and (3) portions of the nearest four rows could be visible during approximately 25 percent of the year (COP Volume II, Appendix II-M1; Atlantic Shores 2024). Meteorological trends for the Project area are presented in COP Volume II, Appendix II-M1 and Attachment H (Atlantic Shores 2024).

Accidental releases: Accidental releases during construction and installation, O&M, and decommissioning of the Proposed Action could affect nearby open ocean character, seascape character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Near shore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean, and landscapes. The potential for accidental releases would be greatest during construction and installation and decommissioning and would be lower but continuous during O&M, resulting in overall negligible to minor impacts.

Land disturbance: The Proposed Action would require installation of onshore export cables, construction of two onshore substations and/or converter stations, 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 installation and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M. Impacts from the Proposed Action related to land disturbance would be negligible to minor.

Lighting (offshore): Nighttime vessel lighting could result from construction and installation, O&M, and decommissioning 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. The impact of artificial nighttime lighting required to illuminate the construction zone for safe construction activity on scenic and visual resources during construction and installation and decommissioning would be moderate to major, localized and short term (5 years or less). Visual impacts of nighttime lighting on vessels would continue during O&M, but long-term impacts would be less due to the lower number of forecast vessel trips. Nighttime vessel lighting for the Proposed Action in combination with other offshore wind development would affect open ocean character, seascape character, nighttime viewer experience, and valued scenery. This impact would be localized and short term during construction and installation and decommissioning, and intermittent and long term during O&M.

Permanent aviation warning lighting on WTGs and the met tower would be visible from beaches and coastlines in the geographic analysis area and would have impacts on scenic and 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. Aviation warning lights would be affixed to the wind turbines during construction as the turbine towers rise over 200 feet above sea level to provide for safe nighttime aviation. Once affixed, the aviation warning lights would remain in the on position throughout the construction period.

Atlantic Shores, contingent on FAA and BOEM approval, has committed to installing ADLS on WTGs and met towers, which activates the hazard lighting system in response to detection of nearby aircraft (COP Volume II, Appendix II-M1; Atlantic Shores 2024). The synchronized flashing of the navigational lights occurs only when aircraft are present, resulting in shorter-duration night sky impacts on the open ocean, seascape, landscape, and viewers. The shorter-duration synchronized flashing of ADLS is anticipated to have reduced visual impacts at night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation. ADLS hazard lighting would installed during construction but would not be activated until the Project enters the operation phase. Once the system is tested and approved it 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.

Based on estimates from Atlantic Shores, ADLS-controlled obstruction lights would be activated for nearly 9 hours over a 1-year period (COP Volume II, Appendix II-M4; Atlantic Shores 2024). It is estimated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

The OSSs would be lit and marked in accordance with Occupational Safety and Health Administration lighting standards to provide safe working conditions when O&M personnel are present. The OSSs would have nighttime lighting up to 295.3 feet (90.0 meters) above sea level. Due to EC, from eye levels of 5.9 feet (1.8 meters), these lights would become invisible above the ocean surface beyond approximately 23.8 miles (38.3 kilometers). Lights of the OSS, when lit for maintenance, potentially would 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 45.1-mile (72.6-kilometer) geographic analysis area, depending on variable ocean surface, cloud, and atmospheric reflectivity.

Lighting (onshore): Nighttime facility lighting would result from construction and installation, O&M, and decommissioning of the Proposed Action. Facility lighting, depending on the quantity, intensity, and location, could be visible from unobstructed sensitive onshore viewing locations. The impact of lighting on scenic and visual resources during construction and installation and decommissioning would be moderate to major, localized, and short term (5 years or less). Visual impacts of nighttime facility lighting would continue during O&M. Lighting at onshore facilities, including the substation and converter station and O&M facility would be designed and installed using sustainable outdoor lighting specifications to minimize impacts on night skies and offsite lighting using guidance and standards drawn from the National Park Service Sustainable Outdoor Lighting best practices. These measures include use of LEDs, focused task lighting, and fully shielded lights (VIS-10; Appendix G, Table G-1). Onshore lighting impacts would be localized and short term during construction and installation and decommissioning, and long term during O&M.

Presence of structures: The Proposed Action would install up to 200 WTGs extending up to 1,046.6 feet (319.0 meters) AMSL, a single permanent met tower extending up to 590.6 feet (180 meters) AMSL, and up to 10 OSSs ranging from 174.8 – 207.6 feet (53.3 – 63.3 meters) above MLLW in the Lease Area, for a maximum of 211 offshore structures. The WTGs would be color treated white or light gray, no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey. Contrast evaluations in the impact analysis assume the WTGs would be RAL 9010 Pure White representing the most contrasting color of the two options. WTGs color treated with RAL 7035 Light Grey would help reduce potential visibility against the horizon. The presence of structures within the geographic analysis area under the Proposed Action would affect open ocean character, seascape character, landscape character, and 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. COP Volume II, Appendix II-M1(Atlantic Shores 2024) presents WTG and OSS visual simulations from onshore KOPs considered in this analysis.

The onshore Cardiff and Larrabee areas' Proposed action would install substation and/or converter station facilities. The onshore Larabee area has three potential locations under consideration: the Lanes Pond Road Site, the Brook Road Site, or the Randolph Road Site. These sites are in close proximity and have separate KOPs. The proposed aboveground onshore facilities are simulated from Cardiff and Larrabee KOPs. COP Volume II, Appendices II-M2 and II-M3 (Atlantic Shores 2024) present substation and/or converter station visual simulations from KOPs considered in this analysis. The effects analyses involved consideration of those COP VIA clear-day simulations of similar distance, variability of viewer location within KOP vicinity, variability of sun angles throughout the day, and nighttime variability of cloud cover, ocean reflections, and moonlight. The magnitude of onshore substations and/or converter stations are defined by contrast, scale of change, and prominence, correlated against the sensitivity of the receptor.

Onshore Interconnection Cable Routes to connect the Atlantic and Monmouth Landfall sites to the Cardiff and Larrabee substations, respectively, would use underground transmission route options and largely use existing linear infrastructure corridors. The final constructed interconnection cable routes for Cardiff and Larabee would range from approximately 12 to 14 miles (19 to 22.5 kilometers) in length.[1] Construction of the underground interconnection cable route would cause short-term, temporary impacts, similar to typical municipal infrastructure activities, and therefore is not addressed in the COP VIA.

In addition, an O&M facility would be constructed in Atlantic City, New Jersey, on a site previously used for vessel docking or other port activities (see Figure 2.1-7). Construction of the O&M facility would involve construction of a new building and potentially an associated parking structure, repairs to the existing docks, and installation of new dock facilities. The O&M facility may utilize the parking lot on South California Avenue at the Atlantic Landfall Site or other existing surface lots in Atlantic City supported by shuttles to and from the O&M facility. The new O&M facility may include installation of a communication antenna with a height up to 120 feet (36.6 meters). The magnitude of onshore O&M

[1] The final constructed interconnection cable routes for Cardiff and Larabee would range from approximately 12 to 14 miles (19 to 22.5 kilometers) in length. However, the route options being considered in this EIS equate to approximately 12.4 to 22.6 miles (20.0 to 36.4 kilometers) for the Cardiff Onshore Interconnection Cable Route and 9.8 to 23.0 miles (15.8 to 37.0 kilometers) for the Larrabee Onshore Interconnection Cable Route.

facility impacts are defined by the contrast, scale of the change, and prominence, correlated against the sensitivity of the receptor.

Appendix H assesses the Proposed Action's character-changing effects by seascape character area, open ocean character area, and landscape character area. Appendix H assesses the Proposed Action's noticeable elements, distance effects, FOV effects, foreground elements and influence, scale effects, prominence effects, and contrast rating effects by offshore and onshore KOPs. The seascape character units, open ocean character unit, landscape character units, and viewer experiences would be affected by the Proposed Action's noticeable elements (Appendix H, Table H-12), applicable distances (Appendix H, Table H-13), and FOV extents (Appendix H, Table H-14) open views versus view framing or intervening foregrounds (Appendix H, Table H-15); and form, line, color, and texture contrasts in the characteristic open ocean, seascape, and landscape (Appendix H, Table H-16). 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 open ocean, seascape, and landscape, and from high-sensitivity view receptors. Table 3.6.9-17 considers the totality of the Proposed Action's level of impact by seascape character unit, open ocean character unit, and landscape character unit. Table 3.6.9-18 and Table 3.6.9-19 consider the totality of the Proposed Action's level of impact for character units in the onshore substation and/or converter station and O&M facility viewsheds, respectively.

Appendix H, Table H-11 lists the applicable impact level for each KOP based on specific measures of distance, occupied FOV, noticeable facility elements, visual contrasts, scale of change, and prominence.

Table 3.6.9-17. Impact levels from offshore facilities on open ocean character, seascape character, and landscape character

Impact Level	Offshore Open Ocean Character Areas, Seascape Character Areas, and Landscape Character Areas	Overall Character Area (square miles [square kilometers])	Impacted Character Area (square miles [square kilometers])
Major	Atlantic City	3.1 [112.68]	0.12 [.30]
	Bayfront Residential	3.3 [8.5]	0.02 [0.04]
	Commercial Beachfront	1.4 [3.6]	0.26 [0.66]
	Dredged Lagoon	14.3 [37.0]	<0.01 [<0.01]
	Open Ocean	6,657.8 (17,243.6]	1,103.89 [2,859.05]
	Residential Beachfront	8.2 [21.3]	0.68 [1.76]
	Salt Marsh	214.7 [556.1]	8.26 [21.40]
	Town/Village Center	2.6 [6.7]	0.01 [0.03]
	Undeveloped Bay	209.1 [549.7]	4.64 [12.03]
	Undeveloped Beach	7.9 [20.5]	1.30 [3.36]
Moderate	Agriculture	110.2 [8.0]	0.01 [0.03]
	Atlantic City	3.1 [112.68]	0.10 [0.26]
	Bayfront Residential	3.3 [8.5]	0.14 [0.36]
	Commercial Beachfront	1.4 [3.6]	0.22 [0.58]
	Dredged Lagoon	14.3 [37.0]	0.32 [0.83]
	Inland Open Water	26.6 [68.9]	0.06 [0.16]
	Inland Residential	223.8 [579.6]	0.69 [1.79]
	Limited Access Highway	9.6 [24.9]	0.31 [0.80]

Impact Level	Offshore Open Ocean Character Areas, Seascape Character Areas, and Landscape Character Areas	Overall Character Area (square miles [square kilometers])	Impacted Character Area (square miles [square kilometers])
	Open Ocean	6,657.8 [17,243.6]	1,540.14 [3,988.93]
	Recreation	20.2 [52.3]	0.35 [0.90]
	Residential Beachfront	8.2 [21.3]	<0.01 [<0.03]
	Salt Marsh	214.7 [556.1]	76.70 [198.65]
	Undeveloped Bay	209.1 [549.7]	92.58 [239.78]
	Undeveloped Beach	7.9 [20.5]	0.58 [1.51]
Minor	Agriculture	110.2 [8.0]	0.02 [0.04]
	Bayfront Residential	3.3 [8.5]	0.05 [0.12]
	Commercial Beachfront	1.4 [3.6]	0.46 [1.21]
	Commercial Strip Development	29.5 [76.4]	0.09 [0.23]
	Dredged Lagoon	14.3 [37.0]	0.15 [0.38]
	Forest	1,273.1 [3,297.3]	1.65 [4.27]
	Industrial/Developed	37.8 [97.9]	0.38 [0.99]
	Inland Open Water	26.6 [68.9]	0.64 [1.65]
	Inland Residential	223.8 [579.6]	0.09 [0.25]
	Limited Access Highway	9.6 [24.9]	0.03 [0.08]
	Open Ocean	6,657.8 [17,243.6]	3.901.58 [10,105.03]
	Recreation	20.2 [52.3]	0.28 [0.72]
	Residential Beachfront	8.2 [21.3]	2.38 [6.17]
	Salt Marsh	214.7 [556.1]	27.01 [69.95]
	Town/Village Center	2.6 [6.7]	<0.01 [<0.03]
	Undeveloped Bay	209.1 [549.7]	58.43 [151.35]
	Undeveloped Beach	7.9 [20.5]	2.17 [5.63]
Negligible	Unseen Seascape Character Areas and Landscape Character Areas		

Table 3.6.9-18. Impact levels on onshore substation and/or converter station facility landscape character areas

Impact Level	Onshore Landscape Character Areas	Overall Character Area (square miles [square kilometers])	Impacted Character Area (square miles [square kilometers])
Major	**Cardiff Onshore Area**		
	Forest	9.891 [25.617]	0.025 [0.065]
	High Density Residential	1.017 [2.634]	0.025 [0.064]
	Low Density Residential	1.018 [2.638]	0.001 [0.001]
	Medium Density Residential	7.732 [20.028]	0.004 [0.011]
	Recreation	0.720 [1.865]	0.002 [0.004]
	Transportation	0.556 [1.441]	0.010 [0.027]
	Larrabee Brook Road Onshore Area		
	Agriculture	1.560 [4.041]	0.032 [0.084]
	Commercial	2.505 [6.487]	0.004 [0.011]
	Forest	14.379 [37.243]	0.227 [0.587]
	High Density Residential	2.081 [5.089]	0.001 [0.001]
	Industrial	1.971 [5.104])	0.077 [0.199]
	Inland Water	0.366 [0.949]	0.001 [0.001]
	Low Density Residential	3.251 [8.419]	0.028 [0.073]

Impact Level	Onshore Landscape Character Areas	Overall Character Area (square miles [square kilometers])	Impacted Character Area (square miles [square kilometers])
	Medium Density Residential	9.426 [24.413]	0.003 [0.008]
	Recreation	1.337 [4.463]	0.005 [0.013]
	Larrabee Lanes Pond Road Onshore Area		
	Agriculture	1.560 [4.041]	0.019 [0.048]
	Forest	14.379 [37.243]	0.020 [0.052]
	High Density Residential	2.081 [5.089]	<0.001 [<0.001]
	Industrial	1.971 [5.104]	<0.001 [<0.001]
	Inland Water	0.366 [0.949]	<0.001 [<0.001]
	Low Density Residential	3.251 [8.419]	0.028 [0.072]
	Medium Density Residential	9.426 [24.413]	0.001 [0.001]
	Recreation	1.337 [4.463]	<0.001 [<0.001]
Minor	**Cardiff Onshore Area**		
	Commercial	2.628 [6.806]	0.066 [0.169]
	Industrial	2.103 [5.049]	0.020 [0.053]
	Larrabee Randolph Road Onshore Area		
	Agriculture	1.560 [4.041]	0.004 [0.013]
	Forest	14.379 [37.243]	0.035 [0.091]
	High Density Residential	2.081 [5.089]	0.001 [0.003]
	Industrial	1.971 [5.104]	0.67 [0.174]
	Inland Water	0.366 [0.949]	<0.001 [<0.001]
	Low Density Residential	3.251 [8.419]	0.006 [0.015]
	Medium Density Residential	9.426 [24.413]	<0.001 [<0.001]
	Recreation	1.337 [4.463]	0.001 [0.003]

Table 3.6.9-19. Impact levels on onshore O&M facility character areas

Impact Level	Onshore O&M Open Ocean Character Areas, Seascape Character Areas, and Landscape Character Areas	Overall Character Area (acres [hectares])	Impacted Character Area (acres [hectares])
Major	none		
Moderate	Undeveloped Bay	4,215.3 [1,705.9]	1,869.5 [756.6]
Minor	Atlantic City	2,012.2 [814.3]	207.2 [83.9]
	Salt Marsh	4,906.5 [1,985.6]	2,010.2 [813.5]
Negligible	Open Ocean	5,358.5 [2,168.5]	2,131.4 [862.5]
	Commercial Beachfront	272.0 [110.1]	0.6 [0.2]
	Dredged Lagoon	64.6 [26.1]	0.3 [0.1]
	Recreation	48.2 [19.5]	5.9 [2.4]
	Residential Beachfront	564.5 [228.4]	82.8 [33.5]
	Town/Village Center	2.8 [1.1]	Not visible
	Undeveloped Beach	31.8 [12.9]	14.8 [6.0]
	Bayfront Residential	81.7 [33.1]	3.1 [1.3]
	Commercial Strip Development	170.3 [68.9]	6.2 [2.5]
	Forest	4.6 [1.9]	0.7 [0.3]
	Industrial/Developed	198.3 [80.2]	63.8 [25.8]

Impact Level	Onshore O&M Open Ocean Character Areas, Seascape Character Areas, and Landscape Character Areas	Overall Character Area (acres [hectares])	Impacted Character Area (acres [hectares])
	Inland Open Water	8.4 [3.4]	0.1 [0.0]
	Inland Residential	838.0 [330.1]	8.4 [3.4]
	Limited Access Highway	37.7 [15.3]	4.1 [1.7]

Source: COP Volume II, Appendix II-M5, Table 1.2-1, Atlantic Shores 2024.

Table 3.6.9-20 considers the totality of the Proposed Action's level of impact (the Sensitivity Level and Magnitude of Change; BOEM 2021) on offshore and onshore KOPs. All KOPs are rated high sensitivity (Atlantic Shores 2024). Appendix H, Table H-11 lists the applicable impact level for each KOP based on specific measures of distance, occupied FOV, noticeable facility elements, visual contrasts, scale of change, and prominence.

The major impact level results from:

- Wind farm facilities located from 0.0 mile (0.0 kilometer) to 14.4 miles (23.2 kilometers) of the KOP's viewers and onshore facilities located between 0.1 mile (0.2 kilometer) and 0.2 mile (0.3 kilometer) of the KOP's viewers;
- Extensive FOV occupied by the facilities;
- Greater extents of noticeable facility elements in the view;
- Strong-rated visual contrasts between facilities' forms, lines, colors, and textures and the existing viewing condition's forms, lines, colors, and textures;
- Large-rated scale of change by facilities; and
- 5- or 6-rated prominence[2] in the view.

The moderate impact level results from:

- Wind farm facilities located between 13.0 miles (20.9 kilometers) and 32.2 miles (51.8 kilometers) of the KOP's viewers and onshore facilities located at 0.3 mile (0.4 kilometer) of the KOP's viewers;
- Moderate FOV occupied by the facilities;
- Moderate extents of noticeable facility elements in the view;

[2] WTGs and OSS prominence: 0 = Not visible. 1 = Visible only after extended study; otherwise not visible. 2 = Visible when viewing in general direction of the wind farm; otherwise likely to be missed by casual observer. 3 = Visible after brief glance in general direction of the wind farm; unlikely to be missed by casual observer. 4 = Plainly visible; could not be missed by casual observer, but does not strongly attract visual attention or dominate view. 5 = Strongly attracts viewers' attention to the wind farm; moderate to strong contrasts in form, line, color, or texture, luminance, or motion. 6 = Dominates view; strong contrasts in form, line, color, texture, luminance, or motion fill most of the horizontal FOV or vertical FOV (Sullivan 2013)

- Moderate-rated visual contrasts between facilities' forms, lines, colors, and textures and the existing viewing condition's forms, lines, colors, and textures;
- Medium-rated scale of change by facilities; and
- 3- or 4-rated prominence in the view.

The minor impact level results from:

- Wind farm facilities located between 32.0 miles (51.5 kilometers) and 45.0 miles (72.4 kilometers) of the KOP's viewers;
- Minor FOV occupied by the facilities;
- Minor extents of noticeable facility elements in the view;
- Weak-rated visual contrasts between facilities' forms, lines, colors, and textures and the existing viewing condition's forms, lines, colors, and textures;
- Small-rated scale of change by facilities; and
- 1- or 2-rated prominence in the view.

Table 3.6.9-20. Proposed Action impact on viewer experience

Level of Impact	Offshore and Onshore Key Observation Points
Major	KOP-AC02 Jim Whelan Boardwalk Hall, Atlantic City Convention Center NHL KOP-AC03 Madison Hotel (Daytime) – video KOP-AC03 Madison Hotel (Nighttime)[1] - video KOP-AC04 Ocean Casino Resort – Sky Garden (Daytime) KOP-AC04 Ocean Casino Resort – Sky Garden (Nighttime)[1] KOP-BC02 North Brigantine Natural Area KOP-BHB01 Beach Haven Historic District (Daytime) - video KOP-BHB01 Beach Haven Historic District (Nighttime)[1] KOP-BHB02 Beach Haven, Center Street KOP-BHB03 Beach Haven, Holyoke Avenue - video KOP-LBT04 Edwin B. Forsythe NWR, Holyoke KOP-LEHT02 Great Bay Boulevard WMA/Rutgers Field Station KOP-MC02 Lucy the Margate Elephant NHL KOP-MC03 Huntington Park - video KOP-OO1 Recreational Fishing, Pleasure, and Tour Boat Area KOP-OO2 Commercial and Cruise Ship Shipping Lanes KOP-C8 Cardiff Hingston Ave KOP-L1 Larrabee Miller Road KOP-OM11 North Maryland Ave SE
Moderate	KOP-BLB02 Barnegat Lighthouse State Park KOP-BT01 Island Beach State Park KOP-GT01 Edwin B. Forsythe NWR, Galloway Township KOP-LAT01 Edwin B. Forsythe NWR-Woodmansee Estate KOP-OC01 Corson's Inlet State Park

Level of Impact	Offshore and Onshore Key Observation Points
	KOP-OC04 Gillian's Wonderland Amusement Park KOP-SBB01 Ship Bottom Borough Municipal Park KOP-SIC02 Townsend Inlet Bridge KOP-OM20 Atlantic City Aquarium
Minor	KOP-AC03 Madison Hotel (Nighttime)[2] KOP-AC04 Ocean Casino Resort – Sky Garden (Nighttime)[2] KOP-BHB01 Beach Haven Historic District (Nighttime)[2] KOP-BRT01 Bass River State Forest KOP-EMC01 Tuckahoe WMA KOP-LT02 Cape May Point State Park Lighthouse KOP-SPB01 Seaside Park Beach - video KOP-L4 Larrabee Randolph Road NE KOP-L5 Larrabee Randolph Road SE KOP-OM18 Cove Beach
Negligible	KOP-C17 Cardiff Tilton Road

[1] ADLS when activated results in Major impact.
[2] ADLS when not activated reduces impacts from Major to Minor at these elevated KOPs and 13.0-mile (20.9-kilometer) proximity KOP. Minor impact is due to moonlit conditions.
Note: Video simulations are available at https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-south, under the "Visual Simulations" tab.

The Proposed Action would also add two onshore substations and/or converter stations in Atlantic and Monmouth counties. 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 substation sites and the surrounding landscape, and ability to screen the substation sites from public viewpoints, impacts of these Project features on scenic and visual resources would be minor to major. Incorporating neutral colors, treatments, or coatings and integrating vernacular materials on buildings, fences, and specular steel structures, as proposed by Atlantic Shores, would help minimize onshore facilities contrast with the surrounding landscape (VIS-11; Appendix G, Table G-1). Atlantic Shores would also incorporate a vegetative buffer around facilities, in compliance with safety and maintenance regulations, which would screen or soften views of new structures and sensitive receptors and land uses (VIS-08; Appendix G, Table G-1). Construction of the onshore interconnection cables would result in short-term temporary visual impacts caused by materials delivery, excavation/backfill, and construction vehicle activity, and personnel, all of which are like typical disturbance associated with municipal infrastructure improvement activities. All landfall export cable infrastructure would be underground and would not contribute to impacts on scenic and visual resources through the presence of structures IPF.

Traffic (vessel): Construction and installation, O&M, and decommissioning of the Proposed Action would generate increased vessel traffic that could contribute to adverse impacts on scenic and visual resources in the geographic analysis area. The impacts would occur primarily during construction and installation along routes between ports and the offshore wind construction areas. Construction and installation of the Proposed Action is projected to generate 1,745 total vessel trips in the WTA (Section 3.6.6). O&M activities for the Proposed Action are anticipated to generate 1,861 vessel round trips per year between ports and the WTA (Section 3.6.6). Vessel traffic during O&M would result in long-term, intermittent contrasts to open ocean character and in the viewer experience of valued scenery. Vessel activity would increase again during decommissioning at the end of the operating period, with impacts similar to those described for construction and installation. Maintenance activities would cause minor effects on seascape character and open ocean character due to increased O&M vessel traffic to and from the Lease Area. Impacts from the Proposed Action related to vessel traffic would be minor to moderate.

Impacts of the Connected Action

As described in Chapter 2, *Alternatives,* as part of the Proposed Action, an O&M facility would be constructed in Atlantic City, New Jersey, on a site previously used for vessel docking or other port activities. Construction of the O&M facility would involve construction of a new building and potentially an associated parking structure, repairs to the existing docks, and installation of new dock facilities. The bulkhead repair and/or replacement and maintenance dredging activities have been proposed as a connected action under NEPA, per 40 CFR 1501.9(e)(1). The bulkhead site and dredging activities are in-water activities that would be conducted within an approximately 20.6-acre (8.3-hectare) site within Atlantic City's Inlet Marina area. BOEM expects the connected action to affect scenic and visual resources through the *Lighting* and *Traffic (vessel)* IPFs.

Lighting: Nighttime dredging, installation, and maintenance equipment lighting and vessel lighting could become visible in the seascape and by viewers 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 viewing locations based on viewer distance and atmospheric conditions. The impact of equipment lighting and vessel lighting on scenic and visual resources during installation would be moderate to major, localized, and short term.

Traffic (vessel): Construction and installation and O&M activities would generate increased vessel traffic that could contribute to adverse impacts on scenic and visual resources in the viewshed. The impacts would occur primarily during installation along routes between ports and the Inlet Marina. Activities related to the connected action of the Proposed Action would be minor, localized, short term, and infrequent relative to the life of the Project.

Cumulative Impacts of Alternative B – Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. Appendix H provides cumulative effects simulations of the Proposed Action from eight KOPs with views to the south, southeast, and southwest (Appendix H, Attachment H-2).

Accidental releases: Accidental releases during construction and installation, O&M, and decommissioning of planned offshore wind projects including the Proposed Action could affect nearby open ocean character, seascape character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Near-shore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean, and landscapes. The potential for accidental releases would be greatest during construction and installation and decommissioning of offshore wind projects, and would be lower but continuous during O&M. The combined accidental release impacts from the Proposed Action and other ongoing and planned activities would be negligible to minor.

Land disturbance: Planned offshore wind development including the Proposed Action would require installation of onshore export cables, 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 installation 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 planned offshore wind energy projects; however, the Proposed Action in combination with other planned offshore wind development would generally have localized, short-term, negligible to minor impacts on scenic and visual resources during construction and installation and O&M due to land disturbance.

Lighting: Lighting from the Proposed Action in combination with other offshore wind projects would have minor to major, long-term cumulative impacts on scenic and visual resources. This range in impacts from lighting is due to variable distances from visually sensitive viewing locations and potential use of ADLS. The recreational and commercial fishing, pleasure, and tour boating community would experience major adverse effects in foreground views. If ADLS is implemented across all offshore wind projects in the geographic analysis area, then impacts from lighting would be reduced to negligible when the lights are in the off mode during O&M. The impact would be more adverse during construction until the ADLS is operable and if other projects do not commit to using ADLS, or when the lights are in the on mode using ADLS technology.

Presence of structures: The Proposed Action would contribute up to 200 of a combined total of 2,416 WTGs that would be installed in the cumulative impacts analysis area between 2023 and 2030, which accounts for approximately 18 percent of offshore wind development planned for the geographic analysis area. The total number of WTGs that would be visible from any single KOP would be substantially fewer than the 2,416 WTGs considered under the ongoing and planned activities scenario in combination with the Proposed Action. For example, 828 WTGs would be theoretically visible from KOP-AC04 Ocean Casino Resort – Sky Garden and 370 WTGs would be theoretically visible from KOP-SPB01 Seaside Park Beach (Appendix H, Attachment H-2). The presence of structures associated with offshore wind development in combination with the Proposed Action would have major open ocean character, seascape character, landscape character, and viewer experience impacts, as simulated from sensitive onshore receptors (Appendix H). Table 3.6.9-21 shows incremental magnitude of change to viewer experience of all WTAs in order of year constructed, WTA distances, and horizontal FOVs. The first row of each KOP lists incremental visibility for each individual WTA. The second row is cumulative: it adds visible WTGs and broadens the FOV with each WTA constructed. The cumulative visibility analysis are based on the other offshore wind development projects' anticipated WTG height and may change based on final project decisions.

Table 3.6.9-21. Cumulative WTAs' incremental magnitude of change by year constructed, WTA distances, horizontal FOVs, and impact

		Distance in Miles (Kilometers), FOV degrees (% of 124°), and Impact															
KOP[1]	Incremental and Cumulative Visibility [4]	ASOWS[2] (OCS-A 0499) 2025–2028	OW1[2] (OCS-A 0498) 2026-2030	EW1[2] (OCS-A 0512) 2024–2026	EW2[2] (OCS-A 0512) 2024–2027	SW[2] (OCS-A 0519) 2024	US[2] (OCS-A 0490) 2024	GSOE[2] (OCS-A 05482) 2025–2030	ASOWN[2] (OCS-A 0549) 2026–2028	OW2[2] (OCS-A 0532) 2026–2030	VM[2] (OCS-A 0544) 2026–2030	BW[2] (OCS-A 0537) 2026–2030	AE[2] (OCS-A 0538) 2026–2030	COW[2] (OCS-A 0539) 2026–2030	ASOWB[2] (OCS-A 0541) 2026–2030	IE[2] (OCS-A 0542) 2026–2030	Total Cumulative Visibility
AC04	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	15.0 (24.1) 52.3° (42%) 200 **Major**	13.8 (22.2) 34.7° (28%) 111 **Major**	Not visible	Not visible	Not visible	Not visible	45.3 (72.9) 16.5° (13%) 66 **Negligible**	16.2 (26.1) 53° (43%) 164 **Major**	16.2 (26.1) 62° (50%) 111 **Major**	Not visible	Not visible	Not visible	50.3 (80.9) 15° (12%) 11 **Negligible**	41.4 (66.3) 26° (21%) 95 **Minor**	43.9 (70.6) 19° (15%) 70 **Minor**	
Additive Changes	Visible WTGS[3] Horizontal FOV		311 59.4° (48%)					377 75.9° (61%)	541 140° (112%)	652 160° (129%)				663 160° (129%)	758 160° (129%)	828 160° (129%)	828 160° (129%) **Major**
AC04 Night	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	15.0 (24.1) 52.3° (42%) 200 **Major**	13.8 (22.2) 34.7° (28%) 111 **Major**	Not visible	Not visible	Not visible	Not visible	45.3 (72.9) 66 **Negligible**	16.2 (26.1) 53° (43%) 164 **Major**	16.2 (26.1) 62° (50%) 111 **Major**	Not visible	Not visible	Not visible	50.3 (80.9) 15° (12%) 11 **Negligible**	41.4 (66.3) 26° (21%) 95 **Minor**	43.9 (70.6) 19° (15%) 70 **Minor**	
Additive Changes	Visible WTGS[3] Horizontal FOV		311 59.4° (48%)					377 75.9° (61%)	541 140° (112%)	652 160° (129%)				663 160° (129%)	758 160° (129%)	828 160° (129%)	828 160° (129%) **Major**
BC02	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	9.0 (14.5) 54.2° (44%) 200 **Major**	20.7 (33.3) 29.8° (24%) 111 **Moderate**	Not visible	Not visible	Not visible	Not visible	Not visible	11.3 (18.2) 57.8° (46%) 164 **Major**	20.7 (33.3) 42.2° (34%) 111 **Moderate**	Not visible	Not visible	Not visible	Not visible	37.5 (60.3) 25.8° (20%) 71 **Minor**	41.6 (66.9) 4° (3%) 4 **Negligible**	
Additive Changes	Visible WTGS[3] Horizontal FOV		311 84° (68%)						541 135° (108%)	652 154° (124%)					723 154° (124%)	727 154° (124%)	727 154° (124%) **Major**
BHB03	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	13.0 (20.9) 45.4° (37%) 200 **Major**	23.1 (37.2) 26.3° (21%) 111 **Moderate**	Not visible	Not visible	Not visible	Not visible	Not visible	9.6 (15.5) 56.8° (46%) 164 **Major**	29.9 (48.1) 24.7° (20%) 111 **Minor**	Not visible	Not visible	Not visible	40.3 (64.8) 16° (13%) 32 **Minor**	33.2 (53.4) 28.4° (23%) 95 **Moderate**	41.3 (66.5) 23° (18%) 51 **Minor**	
Additive Changes	Visible WTGS[3] Horizontal FOV		311 58° (47%)						475 133° (107%)	586 143° (115%)				618 143° (115%)	713 143° (115%)	764 143° (115%)	764 143° (115%) **Major**
LEHT02	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	11.9 (19.2) 46.4° (37%) 200 **Major**	20.6 (333.1) 28° (22.5%) 93 **Moderate**	Not visible	Not visible	Not visible	Not visible	Not visible	11.1 (17.9) 56° (45%) 131 **Major**	16.4 (26.4) 32° (26%) 41 **Moderate**	Not visible	Not visible	Not visible	Not visible	36.7 (59.1) 28.4° (23%) 5 **Negligible**	Not visible	
Additive Changes	Visible WTGS[3] Horizontal FOV		293 63° (50%)						424 126° (101%)	465 140° (112%)					470 140° (112%)		470 140° (112%) **Major**

KOP[1]	Incremental and Cumulative Visibility [4]	Distance in Miles (Kilometers), FOV degrees (% of 124°), and Impact															
		ASOWS[2] (OCS-A 0499) 2025–2028	OW1[2] (OCS-A 0498) 2026-2030	EW1[2] (OCS-A 0512) 2024–2026	EW2[2] (OCS-A 0512) 2024–2027	SW[2] (OCS-A 0519) 2024	US[2] (OCS-A 0490) 2024	GSOE[2] (OCS-A 05482) 2025–2030	ASOWN[2] (OCS-A 0549) 2026–2028	OW2[2] (OCS-A 0532) 2026–2030	VM[2] (OCS-A 0544) 2026–2030	BW[2] (OCS-A 0537) 2026–2030	AE[2] (OCS-A 0538) 2026–2030	COW[2] (OCS-A 0539) 2026–2030	ASOWB[2] (OCS-A 0541) 2026–2030	IE[2] (OCS-A 0542) 2026–2030	Total Cumulative Visibility
LT02	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	45.0 (72.4) 18° (14%) 140**Minor**	33.9 (54.6) 18.5° (15%) 105 **Moderate**	Not visible	Not visible	25.7 (41.4) 16° (13%) 33 **Moderate**	32.6 (52.5) 16° (13%) 98 **Minor**	15.9 (25.6) 34.8° (28%) 80 **Major**	55.5 (89.3) 13.4° (10%) 13 **Negligible**	26.0 (41.8) 34.8° (31%) 111 **Moderate**	Not visible	Not visible	Not visible	Not visible	Not visible	Not visible	
Additive Changes	Visible WTGS[3] Horizontal FOV		245 27° (22%)			278 43° (35%)	376 77.8° (63%)	456 62° (50%)	469 81.3° (65%)	580 98.3° (79%)							580 98.3° (79%) **Major**
OC04	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	17.2 (27.7) 50° (40%) 199 **Moderate**	15.6 (25.1) 38° (31%) 111 **Major**	Not visible	Not visible	Not visible	Not visible	37.6 (60.5) 19° (15%) 32 **Minor**	26.1 (42.0) 35.6° (29%) 118 **Moderate**	12.8 (20.6) 55.6° (45%) 111 **Major**	Not visible	Not visible	Not visible	Not visible	Not visible	Not visible	
Additive Changes	Visible WTGS[3] Horizontal FOV		311 67° (54%)					343 86° (69%)	461 108° (87%)	572 137° (110%)							572 137° (110%) **Major**
SIC02	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	27.3 (43.9) 43.6° (35%) 195 **Moderate**	18.5 (29.8) 29.2° (23%) 111 **Moderate**	Not visible	Not visible	35.3 (56.8) 14° (11%) 33 **Minor**	45.2 (72.7) 9.3° (7%) 19 **Negligible**	26.6 (42.8) 25.7° (21%) 62 **Moderate**	37.6 (60.5) 26.4° (21%) 134 **Minor**	12.1 (19.5) 52.7° (42%) 111 **Major**	Not visible	Not visible	Not visible	Not visible	Not visible	Not visible	
Additive Changes	Visible WTGS[3] Horizontal FOV		306 48° (39%)			339 62° (50%)	355 62° (50%)	417 62° (50%)	554 72° (58%)	665 101° (81%)							665 101° (81%) **Major**
SPB01	Nearest WTG Horizontal FOV Visible WTG, OSS[3] Impact	39.0 (62.8) 23.1° (19%) 43 **Minor**	Not visible	39.8 (64.1) 19.4° (16%) 52 **Minor**	44.6 (71.8) 4° (3%) 6 **Negligible**	Not visible	Not visible	Not visible	19.3 (31.1) 24° (19%) 157 **Moderate**	Not visible	Not visible	Not visible	42.4 (68.2) 11.3° (9%) 7 **Minor**	41.8 (67.3) 13.7° (11%) 13 **Minor**	39.5 (63.6) 7.3° (6%) 17 **Minor**	Not visible	
Additive Changes	Visible WTGS[3] Horizontal FOV			95 42.5° (34%)	101 46.5° (37%)				258 57.4° (46%)				265 68.7° (55%)	278 82.4° (66%)	295 89.7° (72%)		295 89.7° (72%) **Moderate**

[1] KOP-OC04S = Ocean Casino Resort-Sky Garden; KOP-BC02 = North Brigantine Natural Area; KOP-BHB03 = Beach Haven, Holyoke Avenue; KOP-LEHT02 = Great Bay Boulevard WMA/Rutgers Field Station; KOP-LT02 = Cape May Point State Park Lighthouse; KOP-OC04 = Gillian's Wonderland Amusement Park; KOP-SIC02 = Townsend Inlet Bridge; and KOP-SPB01 = Seaside Park Beach.
[2] AE = Attentive Energy (previously [COP VIA] Hudson South B) OCS-A 0538; ASOWB = Atlantic Shores Offshore Wind Bight (previously [COP VIA] Hudson South E) OCS-A 0541; ASOWN = Atlantic Shores Offshore Wind North OCS-A 0549; ASOWS = Atlantic Shores Offshore Wind South OCS-A 0499; BW = Bluepoint Wind (previously [COP VIA] Central Bight) OCS-A 0537; COW = Community Offshore Wind (previously [COP VIA] Hudson South C) OCS-A 0539; EW1 = Empire Wind 1 OCS-A 0512; EW2 = Empire Wind 2 OCS-A 0512; GSOE = Garden State Offshore Energy I OCS-A 0482; IE = Invenergy Wind Offshore (previously [COP VIA] Hudson South F) OCS-A 0542; OW1 = Ocean Wind 1 OCS-A-0498; OW2 = Ocean Wind 2 OCS-A532; SW = Skipjack OCS-A 0519; US = US Wind/Maryland Offshore Wind OCS-A 0490; VM = Vineyard Mid-Atlantic (previously [COP VIA] Hudson North) OCS-A 0544
[3] Theoretically visible based on clear sky and EC (see cumulative simulations in Appendix H, Attachment H-1).
[4] The visibility numbers are based on the other offshore wind developments planned WTG height and location at the time of writing. The number of other offshore wind developments visible WTGs may change based on final project approvals and development.

The open ocean character would reach the maximum level of change to its features and characters from formerly undeveloped ocean to dominant wind farm character by approximately 2030 and result in major impacts. Atlantic Shores South's contribution to cumulative seascape character and landscape character impacts would range from 205 of 833 total WTGs visible from KOP-AC04 Ocean Casino Resort – Sky Garden, 25 percent of the total, to 200 of 670 total WTGs visible from KOP-SIC02 Townsend Inlet Bridge, 30 percent of the total (Atlantic Shores 2024). The open ocean, seascape, and landscape are highly valued scenery and rated high susceptibility.

Atlantic Shores South's WTG contribution to cumulative impacts from KOPs are as follows (Atlantic Shores 2024).

- KOP-AC04 Ocean Casino Resort – Sky Garden: 205 of 833 total WTGs visible, 25 percent of the total.
- KOP-BC02 North Brigantine Natural Area: 205 of 732 total WTGs visible, 34 percent of the total.
- KOP-BHB03 Beach Haven, Holyoke Avenue: 205 of 732 total WTGs visible, 28 percent of the total.
- KOP-LEHT02 Great Bay Boulevard WMA/Rutgers Field Station: 205 of 475 total WTGs visible, 43 percent of the total.
- KOP-LT02 Cape May Point State Park Lighthouse: 145 of 585 total WTGs visible, 25 percent of the total.
- KOP-OC04 Gillian's Wonderland Amusement Park: 204 of 576 total WTGs visible, 35 percent of the total.
- KOP-SIC02 Townsend Inlet Bridge: 200 of 670 total WTGs visible, 30 percent of the total.
- KOP-SPB01 Seaside Park Beach: 118 of 370 total WTGs visible, 32 percent of the total.

Traffic (vessel): Planned offshore wind project construction and installation, O&M, and decommissioning would increase vessel traffic in the geographic analysis area beyond what the Proposed Action would generate in isolation. As described in Section 3.6.6, during periods of overlapping construction in 2024–2025, offshore wind projects would generate between 165 and 385 vessel trips daily from Atlantic Coast ports to worksites in the geographic analysis area. During O&M, the Proposed Action and other offshore wind projects would generate up to 39 vessel trips per day in the geographic analysis area. Stationary and moving vessels would change the daytime and nighttime seascape and open ocean characters from open ocean to active waterway. Increases in these vessel movements would be noticeable to onshore and offshore viewers, but are unlikely to have a significant effect.

Conclusions

Impacts of Alternative B – Proposed Action. Proposed Action effects on high- and moderate-sensitivity seascape character units, open ocean character units, and landscape character units would be **negligible**

to **major**, due to view distances (see effects ranges discussion in Appendix H); minor to moderate FOVs; strong, moderate, and weak visual contrasts; clear-day conditions; and nighttime ADLS activation. The seascape character units, open ocean character unit, landscape character units, and viewer experience would be affected during construction and installation, O&M, and decommissioning by the Project's 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 and installation effects. Due to distance, extensive FOVs, strong contrasts, large scale of change, and level of prominence, as well as heretofore undeveloped ocean views, the Proposed Action would have **major** impacts (the magnitude of change per BOEM 2021) on the open ocean character unit and viewer boating and cruise ship experiences. 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 **minor** to **moderate** effects on seascape character and landscape character, and **major** effects on open ocean character.

Onshore, temporary, moderate effects would occur during construction and installation and decommissioning of the landfalls and onshore export cables. Effects during O&M activities would involve temporary vehicular and personnel presence and would be negligible. The context of the onshore substation and/or converter station sites surrounding industrial elements, O&M facility, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be substantial as viewed from the KOPs. The Project's visibility would be prominent from the KOPs, and the value of the view is high, having moderate to high effect on viewers' quality of visual experience. Impacts of the onshore facilities on scenic and visual resources would be **minor** to **major** as detailed in Appendix H, Tables H-20 through H-23.

BOEM expects that the connected action alone would have **minor** to **major** impacts on scenic and visual resources due to lighting and traffic.

Cumulative Impacts of Alternative B – Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on scenic and visual resources would be appreciable. BOEM anticipates that the impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind development would be **major**. Other ongoing and planned offshore wind projects within the geographic analysis area, combined with the Proposed Action, would lead to the construction of approximately 2,216 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 dominant wind farm character by approximately 2030. The visibility of planning activities would introduce a major level of character change to the view; would attract, hold, and dominate the viewer's attention; and would have a moderate to major effect on the viewer's visual experience. 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, E, and F on Scenic and Visual Resources

Impacts of Alternatives C (Habitat Impact Minimization/Fisheries Habitat Impact Minimization), E (Wind Turbine Layout Modification to Establish a Setback Between Atlantic Shores South and Ocean Wind 1), and F (Foundation Structures) would be similar to those of the Proposed Action. Alternative C could install fewer WTGs (up to 29 fewer WTGs) and one fewer offshore substation and associated interarray cables, or microsite them, which would slightly reduce the construction impact footprint and installation period. The removal of these WTGs and OSS would result in a negligible reduction of impacts on scenic resources and viewer experiences compared to the Proposed Action. Alternative E would modify the wind turbine array layout through the exclusion of WTG positions to create a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and Ocean Wind 1 Lease Area (OCS-A 0498). The Alternative C and E modifications to layouts would result in a negligible reduction of impacts on scenic resources and viewer experiences compared to the Proposed Action. Alternative F's foundation structures would not be visible above the ocean surface.

Cumulative Impacts of Alternatives C, E, and F on Scenic and Visual Resources. The incremental impacts contributed by Alternatives C, E, and F to the cumulative impacts on open ocean character, seascape character, landscape character, and viewer experiences would be similar to those described under the Proposed Action, due to the presence of structures, lighting, and vessel traffic.

Conclusions

Impacts of Alternatives C, E, and F. The **negligible** to **major** adverse impacts on open ocean character, seascape character, landscape character, and viewer experience associated with the Proposed Action would not change substantially under Alternatives C and E.

Cumulative Impacts of Alternatives C, E, and F. The incremental impacts contributed by Alternatives C, E, and F to the cumulative impacts on scenic resources and viewer experiences would be the same as under the Proposed Action and would range from **negligible** to **major** adverse impacts due to the presence of structures, lighting, and vessel traffic.

3.6.9.7 Impacts of Alternative D on Scenic and Visual Resources

Impacts of Alternative D. Under Alternative D (No Surface Occupancy at Select Locations to Reduce Visual Impacts), the construction and installation, O&M, and eventual decommissioning of wind energy facilities on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the layout and maximum number of WTGs would be adjusted to reduce visual impacts.

Under Alternatives D1, D2, and D3, up to 21 WTGs, 31 WTGs, and 6 WTGs, respectively, would be removed. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum bade tip height of 932 feet (284 meters) AMSL. Appendix H, Tables H-33 and H-35 consider the effects of Alternative D1, D2, and D3 on viewer experience. While a reduction in horizontal and vertical FOV and contrasts would occur, the reduced impacts under Alternatives D1, D2, and D3 would not be sufficient to change the level of impacts as compared with the Proposed Action. The changes presented in Alternatives D1, D2, and D3 soften the Project's visual prominence but do not reach the threshold to shift impacts from major to moderate.

Cumulative Impacts of Alternatives D on Scenic and Visual Resources. The incremental impacts contributed by Alternatives D to the cumulative impacts on open ocean character, seascape character, landscape character, and viewer experiences would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative D. The effects of Alternatives D1, D2, and D3 on open ocean character, seascape character, landscape character, and viewer experience would be similar to the effects of the Proposed Action. Due to distance, extensive FOVs, high view prominence, strong contrasts, and heretofore undeveloped ocean views, Alternatives D1, D2, and D3 would have **major** effects on the seascape and open ocean unit character and viewer boating and cruise ship experiences. Appendix H, Tables H-20 through H-35 contain the alternatives' analyses. Due to view distances, moderate FOVs, moderate and weak visual contrasts, clear-day conditions, and nighttime ADLS activation, effects of Alternatives D1, D2, and D3 on high- and moderate-sensitivity landscape character units would be **negligible** to **major**. The daytime presence of offshore WTGs and OSS and nighttime moonlit conditions would change perception of ocean scenes from natural and undeveloped to a developed wind energy environment characterized by WTGs and OSS. In clear weather, the WTGs and OSS would be an unavoidable presence in views from the coastline, with **negligible** to **major** effects on open ocean character, seascape character, landscape character, and viewer experience.

Cumulative Impacts of Alternative D. BOEM anticipates that the contribution of Alternatives D1, D2, and D3 to the cumulative impacts associated with ongoing and planned activities would be **negligible** to **major**. The main drivers for this impact rating are the impacts associated with the presence of offshore structures in previously undeveloped ocean and substantially increased vessel traffic, presence of structures, and lighting.

3.6.9.8 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-3 and G-4 and summarized and assessed in Table 3.6.9-22. If the measure analyzed below is adopted by BOEM or cooperating agencies, some adverse impacts on scenic and visual resources could be further reduced.

Table 3.6.9-22. Proposed mitigation measures – scenic and visual resources

Measure	Description	Effect
Scenic and Visual Resource Monitoring Plan	Prepare and implement a scenic and visual resource monitoring plan that monitors and compares the visual effects of the Project during construction and O&M phases (daytime and nighttime) to the finding in the VIA (COP, Appendix II-M) and verifies the accuracy of the visual simulations. The plan will include documentation of meteorological influences on actual wind turbine visibility over a duration of time from selected key onshore observation points as determined by BOEM and Atlantic Shores. The plan will also include ADLS monitoring and documentation of effectiveness.	Although this mitigation measure would not reduce the visual impact of the Project, monitoring and documenting the meteorological influences on wind turbine visibility over time will advance the science of accurately simulating and evaluating visual impacts from offshore wind.

Measures Incorporated in the Preferred Alternative

BOEM has identified the following additional measure in Table 3.6.9-22 as incorporated in the Preferred Alternative: scenic and visual resource monitoring plan. The effect of this measure, if adopted, is described in Table 3.6.9-22.

3.6.9.9 Comparison of Alternatives

The impacts of Alternatives C, D, E, and F on open ocean character, seascape character, landscape character, and viewer experience from accidental releases, lighting, presence of structures, and vessel traffic would be similar to those of the Proposed Action, ranging from **negligible** to **major** adverse related to the IPFs for accidental releases, lighting, presence of structures, and vessel traffic.

3.6.9.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of the Proposed Action and Alternatives C4, D3, and E, as well as two agency-proposed mitigation measures, as described in Section 2.1.7. Under the Preferred Alternative, 29 WTGs, 1 OSS, and their associated interarray cables would be microsited outside of the 1,000-foot (305-meter) buffer of the sand ridge and swale features within AOC 1 (Lobster Hole) and AOC 2 (NMFS-identified sand ridge complex); WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and a maximum blade tip height of 932 feet (284 meters); two WTGs would be removed and 1 WTG would be microsited to establish a 0.81 nautical mile (1,500 meter) setback between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area; and no permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. Additionally, one WTG sited approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site) would be removed. The Preferred Alternative would include up to 195 WTGs,[3] up to 10 OSSs, and up to 1 permanent met tower. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

The Preferred Alternative's height restriction and reduction in WTGs would soften overall visibility but would not do so enough to shift the impact level determination from that of the Proposed Action. Thus, anticipated impacts of the Preferred Alternative would be **major** on the open ocean character unit and viewer boating and cruise ship experiences. In clear weather, the WTGs and OSSs would be an unavoidable presence in views from the coastline, with **minor** to **moderate** effects on seascape character and landscape character, and **major** effects on open ocean character.

BOEM anticipates that the cumulative impacts of ongoing and planned activities, including the Preferred Alternative and connected action, would result in similar impacts as the Proposed Action: **major**.

[3] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

Chapter 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 provides a listing of such impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction and installation phase and would be temporary. Chapter 3, *Affected Environment and Environmental Consequences,* provides additional information on the potential impacts listed in the table.

All impacts from planned activities are still expected to occur as described in the No Action Alternative analysis in this Final EIS, regardless of whether the Proposed Action is approved.

Table 4.1-1. Potential unavoidable adverse impacts of the Proposed Action

Resource Area	Potential Unavoidable Adverse Impacts of the Proposed Action
Physical Resources	
Air Quality	• Emissions from engines associated with vessel traffic, construction activities, and equipment operation
Water Quality	• Increase in suspended sediments due to seafloor disturbance during construction and installation, O&M, and decommissioning activities • Potential for accidental releases during construction
Biological Resources	
Bats	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic • Individual mortality due to collisions with operating WTGs
Benthic Resources	• Suspension and re-settling of sediments due to seafloor disturbance • Conversion of soft-bottom habitat to new hard-bottom habitat • Habitat quality impacts, including reduction in certain habitat types as a result of seafloor alterations • Disturbance, displacement, and avoidance behavior due to habitat loss or alteration, equipment activity and noise, and vessel traffic • Individual mortality due to construction activities • Possible temporary loss of seagrass resources within Inner and Great Thorofares due to cable emplacement
Birds	• Displacement and avoidance behavior due to habitat loss or alteration, equipment noise, and vessel traffic • Individual mortality due to collisions with operating WTGs
Coastal Habitat and Fauna	• Habitat alteration and removal of vegetation, including trees • Temporary avoidance behavior by fauna during construction activity and noise-producing activities • Individual fauna mortality due to collisions with vehicles or equipment during clearing and grading activities, particularly species with limited mobility

Resource Area	Potential Unavoidable Adverse Impacts of the Proposed Action
Finfish, Invertebrates, and Essential Fish Habitat	• Temporary loss of seagrass resources within Inner and Great Thorofares due to cable emplacement • Suspension and re-settling of sediments due to seafloor disturbance during construction • Displacement, disturbance, and avoidance behavior due to construction-related impacts, including noise, vessel traffic, increased turbidity, sediment deposition, EMF, and habitat changes • Individual mortality due to construction activities • Changes in habitat and community structure from conversion of soft-bottom habitat to new hard-bottom habitat
Marine Mammals	• Increased risk of injury (TTS or PTS) to individuals due to underwater noise from pile-driving activities during construction • Disturbance (behavioral effects) and acoustic masking due to underwater noise from pile driving, vessel traffic, aircraft, geophysical surveys (HRG surveys) and geotechnical drilling surveys, WTG operation, and dredging during construction and operations • Increased risk of individual injury and mortality due to vessel strikes during construction and installation, O&M, and decommissioning • Increased risk of individual injury and mortality associated with fisheries gear
Sea Turtles	• Increased risk for individual injury and mortality due to vessel strikes during construction and installation, O&M, and decommissioning • Disturbance, displacement, and avoidance behavior due to habitat disturbance and underwater noise during construction • Potential, but minor, EMF effects on migration
Wetlands	• Wetland and surface water alterations, including increased sedimentation deposition and removal of vegetation
Socioeconomic Conditions and Cultural Resources	
Commercial Fisheries and For-Hire Recreational Fishing	• Restriction in harvesting activities during construction of Offshore Project elements and during operations of offshore wind facility • Changes in vessel transit and fishing operation patterns • Changes in risk of gear entanglement, navigational hazards, and space-use conflicts associated with the presence of structures • Changes in the availability of target species because of habitat loss and conversion associated with the presence of structures
Cultural Resources	• Destruction of or damage to ancient submerged landforms • Although unlikely, unanticipated removal or disturbance of previously unidentified marine or terrestrial archaeological resources • Changes to the integrity of aboveground historic resources or visual disruptions to the historic or aesthetic settings from which these resources derive their significance
Demographics, Employment, and Economics	• Disruption of onshore and marine recreational businesses during onshore and offshore construction and cable installation • Potential changes to Ocean Economy sectors due to the long-term presence of the offshore wind facility, including commercial fishing, tourism, and recreation

Resource Area	Potential Unavoidable Adverse Impacts of the Proposed Action
Environmental Justice	• Compounded health issues of local environmental justice communities near ports as a result of air quality impacts from engine emissions associated with vessel traffic, construction activities, and equipment operation • Loss of employment or income due to disruption to commercial fishing, for-hire recreational fishing, or marine recreation businesses • Hindrances to subsistence fishing due to offshore construction and operation of the offshore wind facility
Land Use and Coastal Infrastructure	• Conversion of undeveloped areas for cable maintenance or replacement • Land use disturbance due to construction as well as effects due to noise and travel delays • Potential for accidental releases during construction
Navigation and Vessel Traffic	• Congestion in port channels • Increased navigational complexity, vessel congestion, and allision risk within the WTA • Potential for disruption to marine radar on smaller vessels operating within or in the vicinity of the Project, increasing navigational complexity • Hindrances to SAR missions within the WTA
Other Uses	• Disruption to offshore scientific research and surveys and species monitoring and assessment • Increased navigational complexity for military or national security vessels operating within the WTA through decreased effectiveness of individual radar systems • Changes to aviation and air traffic navigational patterns
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 temporary restriction of in-water recreational activities from construction of Offshore Project elements • Temporary disruption to the marine environment and marine species important to fishing and sightseeing due to turbidity and noise • Hindrances to some types of recreational fishing, sailing, and boating within the area occupied by WTGs during operation
Scenic and Visual Resources	• Alterations to the ocean, seascape, landscape character units' character, and effects on viewer experience by the wind farm, vessel traffic, onshore landing sites, onshore export cable routes, onshore substations, converter stations or both, and electrical connections with the power grid

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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 commitment of resources typically applies to impacts on nonrenewable resources such as marine minerals or cultural resources. The irreversible commitment of resources occurs due to the use or destruction of a specific resource. An irretrievable commitment refers to the use, loss, or consumption of a resource, particularly a renewable resource, for a period of time.

Table 4.2-1 provides a listing of potential irreversible and irretrievable impacts by resource area. Chapter 3, *Affected Environment and Environmental Consequences*, provides additional information on the impacts summarized below.

Table 4.2-1. Irreversible and irretrievable commitment of resources by resource area for the Proposed Action

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Physical Resources			
Air Quality	No	No	BOEM expects air pollutant emissions to comply with permits regulating compliance with air quality standards. Emissions would be temporary during construction activities. To the extent that 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, or major impacts on, existing inland waterbodies or wetlands. Turbidity impacts in marine and coastal environments would be short term.
Biological Resources			
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 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 is likely to occur, and seagrass resource losses may occur, BOEM does not anticipate population-level impacts on benthic organisms; habitat could recover after decommissioning activities.
Birds	Yes	No	Irreversible impacts on birds could occur if one or more individuals were injured or killed; however, implementation

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
			of mitigation measures developed in consultation with USFWS would reduce 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 limited removal of habitat associated with clearing and grading for construction of the onshore cable and substations, converter stations, or both are likely to occur, BOEM does not anticipate population-level impacts on flora or fauna; coastal habitat could recover after construction in some areas, and after decommissioning activities in other areas.
Finfish, Invertebrates, and Essential Fish Habitat	No	No	Although local mortality of finfish and invertebrates, and habitat alteration and temporary loss of seagrass resources could occur, BOEM does not anticipate population-level impacts on finfish, invertebrates, and essential fish habitat. It is expected that the aquatic habitat for finfish and invertebrates would recover following decommissioning activities.
Marine Mammals	No	Yes	Irreversible impacts on marine mammal populations could occur if one or more individuals of an ESA-listed species were injured or killed or if those populations experienced behavioral effects with severe consequences. 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 behavioral effects with severe consequences or be injured or killed would be reduced. No irreversible high-severity behavioral effects from Project activities are anticipated; however, due to the uncertainties resulting from lack of information that are outlined in Appendix E, *Analysis of Incomplete and Unavailable Information*, these effects are still possible. Irretrievable impacts could occur if growth of individuals or populations is retarded as a result of displacement from the Project area.
Sea Turtles	No	Yes	Irreversible impacts on sea turtles could occur if one or more individuals of species listed under the ESA were injured or killed; however, the implementation of mitigation measures, developed in consultation with NMFS, would reduce potential impacts on listed species. Irretrievable impacts could occur if growth of individuals or populations is retarded 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 Project area.
Wetlands	No	No	BOEM does not expect activities to cause loss of, or major impacts on, existing inland waterbodies or wetlands.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Socioeconomic Conditions and Cultural Resources			
Commercial Fisheries and For-Hire Recreational Fishing	No	Yes	Based on the anticipated duration of construction and installation and O&M activities, BOEM does not anticipate irreversible impacts on commercial fisheries. The Project could alter habitat during construction and installation and O&M, limit access to fishing areas during construction and installation, or reduce vessel maneuverability during O&M. However, the conceptual decommissioning of the Project would reverse those impacts. Irretrievable impacts (lost revenue) could occur due to the loss of use of fishing areas at an individual level.
Cultural Resources	Yes	Yes	Impacts on ancient submerged landforms could result in irreversible and irretrievable impacts. Although unlikely, unanticipated removal or disturbance of previously unidentified marine or terrestrial archaeological resources could result in irreversible and irretrievable impacts.
Demographics, Employment, and Economics	No	Yes	Construction activities could temporarily increase contractor needs, housing needs, supply requirements, and demand for local businesses, leading to an irretrievable loss of workers for other projects. These factors could lead to increased 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 O&M would be irretrievable.
Land Use and Coastal Infrastructure	Yes	Yes	Land use required for construction and installation and O&M activities could result in a minor irreversible impact. Construction and installation activities could result in a minor irretrievable impact due to the temporary loss of use of the land for otherwise typical activities. Onshore facilities may or may not be decommissioned. Depending largely on future consultations with state and municipal agencies, onshore facilities (e.g., onshore substations and converter stations and buried duct banks) will either be retired in place or reused for other purposes.
Navigation and Vessel Traffic	No	Yes	Based on the anticipated duration of construction and installation and O&M activities, 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 Uses	No	Yes	Disruption of offshore scientific research and surveys would occur during proposed Project construction and installation,

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
			O&M, and decommissioning activities, constituting irretrievable impacts.
Recreation and Tourism	No	No	Construction and installation activities near the shore could result in a minor, temporary loss of use of the land for recreation and tourism purposes.
Scenic and Visual Resources	No	No	Long-term (until post-decommissioning) seascape unit, open ocean unit, and landscape units' character alterations, and effects on viewer experience, by the wind farm, vessel traffic, onshore landing sites, onshore export cable routes, onshore substations, converter stations or both, and electrical connections with the power grid would occur.

4.3 Relationship Between the Short-term Use of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

CEQ's NEPA-implementation 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 will result in detrimental effects on long-term productivity of the affected areas or resources.

As assessed in Chapter 3, *Affected Environment and Environmental Consequences*, BOEM anticipates that the majority of the potential adverse effects associated with the Proposed Action would occur during construction and installation activities and would be short term in nature and minor to moderate in severity/intensity. These effects would cease after decommissioning activities. In assessing the relationships between short-term use of the environment and the maintenance and enhancement of long-term productivity, it is important to consider the long-term benefits of the Proposed Action, which include:

- Promotion of clean and safe development of domestic energy sources and clean energy job creation;
- Promotion of renewable energy to help ensure geopolitical security, reduce GHG emissions to combat climate change, and provide electricity that is affordable, reliable, safe, secure, and clean;
- Delivery of electric power to the New Jersey electrical grid to contribute to the state's renewable energy requirements; and
- Increased habitat for certain fish species.

Based on the anticipated potential impacts evaluated in this Final EIS that could occur during Proposed Action construction and installation, O&M, and decommissioning, and with the exception of some potential impacts associated with onshore components, BOEM anticipates that the Proposed Action would not result in impacts that would significantly narrow the range of future uses of the environment. Removal or disturbance of habitat associated with onshore activities could create long-term irreversible impacts. For purposes of this analysis, BOEM assumes that the irreversible impacts presented in Table 4.2-1 would be long term. After completion of the Proposed Action's O&M and decommissioning phases, however, BOEM expects the majority of marine and onshore environments to return to normal long-term productivity levels.

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