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SouthCoast Wind Project Final Environmental Impact Statement

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SouthCoast Wind Project Environmental Impact Statement

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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 the SouthCoast Wind Project (Project) proposed by SouthCoast Wind Energy LLC (SouthCoast Wind), in its Construction and Operations Plan (COP). The proposed Project described in the COP and this Final EIS would have a capacity of up to 2,400 megawatts (MW) and would be sited offshore Massachusetts, within Commercial Lease OCS-A 0521 (Lease Area). The Project is designed to provide renewable wind energy to the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island.

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). Upon completion of our technical and environmental reviews and other reviews required by federal law, BOEM will approve, disapprove, or approve the COP **with conditions** (30 CFR 585.628).

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Abbreviations and Acronyms

Abbreviation	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
µT	microteslas
AAQS	ambient air quality standards
AC	alternating current
ACHP	Advisory Council on Historic Preservation
ADLS	Aircraft Detection Lighting System
aerial HD	aerial high-definition
AIS	Automatic Identification System
AMAPPS	Atlantic Marine Assessment Program for Protected Species
AMM	avoidance, minimization, and mitigation measure
ANSI	American National Standards Institute
APE	area of potential effect
ASLF	ancient submerged landform feature
ASMFC	Atlantic States Marine Fisheries Commission
AUD INJ	auditory injury
AVEHP	Analysis of Visual Effects to Historic Properties
AVERT	Avoided Emissions and Generation Tool
BA	Biological Assessment
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BUAR	Board of Underwater Archaeological Resources
CAA	Clean Air Act
CCS	Center for Coastal Studies
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHRVEA	Cumulative Historic Resources Visual Effects Assessment
CMECS	Coastal and Marine Ecological Classification Standard
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COBRA	CO-Benefits Risk Assessment
COP	Construction and Operations Plan

Abbreviation	Definition
CPA	closest point of approach
CWA	Clean Water Act
CWIS	cooling water intake system
DAS	Days-At-Sea
dB	decibels
dB re 1 μPa	decibels referenced to a pressure of 1 micropascal
dBA	A-weighted decibel
DC	Direct Current
DMA	Dynamic Management Area
DME	distance measuring equipment
DO	dissolved oxygen
DoD	Department of Defense
DOI	U.S. Department of the Interior
DOJ	U.S. Department of Justice
DPS	distinct population segment
DWT	deadweight tonnage
EA	Environmental Assessment
ECC	export cable corridor
EDCs	electric distribution companies
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJSCREEN	Environmental Justice Screening and Mapping Tool
EMF	electromagnetic field
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FFR	far-field region
FMP	Fishery Management Plan
FOIA	Freedom of Information Act
FOV	field of view
FTE	full-time equivalent
FUDS	Formerly Used Defense Sites
GBS	gravity-based structure
GDP	Gross Domestic Product
GHG	greenhouse gas
GSC HMA	Great South Channel Habitat Management Area
GW	gigawatts
HAP	hazardous air pollutant

Abbreviation	Definition
HAPC	Habitat Areas of Particular Concern
HDD	horizontal directional drilling
HFC	high-frequency cetacean
HPTP	Historic Property Treatment Plan
HRG	High-resolution geophysical
HUC	Hydrologic Unit Code
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
Hz	hertz
IBA	Important Bird Area
IOOS	Integrated Ocean Observing System
IPaC	Information for Planning and Consultation
IPF	impact-producing factor
ISO-NE	ISO New England Inc.
IWG	Interagency Working Group
JBCC	Joint Base Cape Cod
kHz	kilohertz
km^2	square kilometers
KOP	key observation point
kV	kilovolt
lb/gal	pounds per gallon
Lease Area	Commercial Lease OCS-A 0521
LFC	low-frequency cetacean
LiDAR	light detection and ranging
LME	Large Marine Ecosystem
L_{pk}	peak sound pressure level
M-weighted SEL	1 µPa squared per second
m/s	meters per second
MAFMC	Mid-Atlantic Fishery Management Council
MARA	Marine Archaeological Resource Assessment
MARIPARS	Massachusetts and Rhode Island Port Access Route Study
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MassWildlife	Massachusetts Division of Fisheries and Wildlife
MCEC	Massachusetts Clean Energy Center
MDAT	Marine-life Data and Analysis Team
MESA	Massachusetts Endangered Species Act
mG	milligauss

Abbreviation	Definition
mg/L	milligrams per liter
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MW	megawatt
M-weighted SEL	1 µPa squared per second
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NARW	North Atlantic right whale
NAS	noise abatement system
NBFSMN	Narragansett Bay Fixed-Site Monitoring Network
NCCA	National Coastal Condition Assessment
NDBC	National Data Buoy Center
NEAq	New England Aquarium
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NFR	Near-field region
NHL	National Historic Landmark
NHESP	Natural Heritage & Endangered Species Program
NHPA	National Historic Preservation Act
NLPS	Northeast Large Pelagic Survey
nm	nautical miles
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	nitrogen oxides
NPS	U.S. National Park Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSRA	Navigation Safety Risk Assessment
NTU	nephelometric turbidity units
NVD	night vision device
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
O&M	operations and maintenance

Abbreviation	Definition
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSPs	Offshore Substation Platforms
OSRP	Oil Spill Response Plan
PATON	private aids to navigation
PDE	Project Design Envelope
PFAS	polyfluoroalkyl substances
PM_{10}	particulate matter smaller than 10 microns in diameter
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
POI	points-of-interconnection
PPA	power purchase agreement
ppb	parts per billion
Project	SouthCoast Wind Project
PSD	Prevention of Significant Deterioration
PSO	Protected Species Observer
psu	salinity units
PTS	permanent threshold shift
PV	Plan View
RFA	Regional Fisheries Area
RHA	Rivers and Harbors Act of 1899
RIDEM	Rhode Island Department of Environmental Management
RIHPHC	Rhode Island Historical Preservation & Heritage Commission
RIGIS	Rhode Island Geographic Information System
ROD	Record of Decision
RODA	Responsible Offshore Development Alliance
ROV	remotely operated vessel
ROW	right-of-way
RSZ	rotor-swept zone
SAR	search and rescue
SAROPS	Search and Rescue Optimal Planning System
SAV	submerged aquatic vegetation
SC-GHG	social cost of greenhouse gases
SEL	sound exposure level
SF_6	sulfur hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	state historic preservation office
SIL	significant impact levels
SLVIA	seascape, landscape, and visual impact assessment

Abbreviation	Definition
SMA	Seasonal Management Area
SO_2	sulfur dioxide
SouthCoast Wind	SouthCoast Wind Energy LLC
SPCC	Spill Prevention, Control, and Countermeasure
SPI	Sediment Profile Imaging
SPL or L_{rms}	sound pressure level
STSSN	Sea Turtle Stranding and Salvage Network
SWPPP	Stormwater Pollution Prevention Plan
TARA	Terrestrial Archaeological Resources Assessment
TCP	traditional cultural property
TOC	Total organic carbon
TRACON	Terminal Radar Approach Control
TSS	total suspended solids
TTS	temporary threshold shift
UME	Unusual Mortality Event
URI	University of Rhode Island
U.S. Navy	U.S. Department of the Navy
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
VHFC	very high-frequency cetacean
VIA	Visual Impact Assessment
VMS	Vessel Monitoring System
VOC	volatile organic compound
VTR	Vessel Trip Report
WEA	Wind Energy Area
WNS	White Nose Syndrome
WQI	water quality index
WTG	wind turbine generator

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 the SouthCoast Wind Project (Project) proposed by SouthCoast Wind Energy LLC (SouthCoast Wind), in its Construction and Operations Plan (COP) (SouthCoast Wind 2024).[1] 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 conditions, 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, SouthCoast Wind (the Applicant) applied to the 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. In addition, NMFS has an independent responsibility to comply with NEPA and intends to rely on the information and analyses in BOEM's Final EIS, if after independent review and a determination of sufficiency, to fulfill its independent responsibilities under NEPA to support a decision of whether to issue an incidental take authorization to SouthCoast Wind allowing the take of marine mammals. NMFS intends to adopt the Final EIS if, after independent review and analysis, it determines the Final EIS to be sufficient to support the authorization. The U.S. Army Corps of Engineers (USACE) similarly intends to adopt the EIS to meet its responsibilities under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 (RHA).

ES.2 Purpose and Need for the Proposed Action

In Executive Order (EO) 14008, *Tackling the Climate Crisis at Home and Abroad*, issued January 27, 2021, President 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

[1] The SouthCoast Wind Project COP and appendices are available on BOEM's website: https://www.boem.gov/southcoast-wind. On February 1, 2023, Mayflower Wind Energy LLC changed its name to SouthCoast Wind Energy LLC and changed the project name from the Mayflower Wind Project to the SouthCoast Wind Project. While the Final EIS has been updated to reflect the SouthCoast Wind name, certain supporting documents may still refer to Mayflower Wind.

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, SouthCoast Wind was awarded commercial Renewable Energy Lease OCS-A 0521 covering an area offshore Massachusetts (Lease Area). Under the terms of the lease, SouthCoast Wind 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 an up to 2,400-megawatt (MW) offshore wind energy facility in the Lease Area in accordance with BOEM's COP regulations under 30 CFR 585.626–627 (Figure ES-1).

SouthCoast Wind's goal is to develop a commercial-scale offshore wind energy facility in the Lease Area with up to 149 foundation locations to be occupied by a combination of up to 147 wind turbine generators (WTGs) and up to five Offshore Substations Platforms (OSPs). The Project includes one preferred export cable corridor (ECC) making landfall and interconnecting to the ISO New England Inc. (ISO-NE) grid at Brayton Point, in Somerset, Massachusetts and one variant ECC which, if utilized, would make landfall and interconnect to the ISO-NE grid in the town of Falmouth, Massachusetts (Figure ES-1). The Project would provide up to 2,400 MW of clean, renewable wind energy to the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island, which each have existing state offshore wind procurement laws in place as well as decarbonization goals and targets. As an example, Massachusetts, in accordance with Section 83C of the Massachusetts' Green Communities Act, allows Electric Distribution Companies (EDCs) to solicit proposals for offshore wind energy generation (*Chapter 188 of the Acts of 2016, An Act to Promote Energy Diversity*). On September 6, 2024, SouthCoast Wind was awarded 1,287 MW of offshore wind capacity in a multi-state offshore wind solicitation with Massachusetts selecting 1,087 MW and Rhode Island selecting the remaining 200 MW. SouthCoast Wind is actively exploring offtake opportunities in Massachusetts and the New England region for the remaining offshore wind capacity.

Based on BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA) 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;[2] 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 SouthCoast Wind's 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.

[2] 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.: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

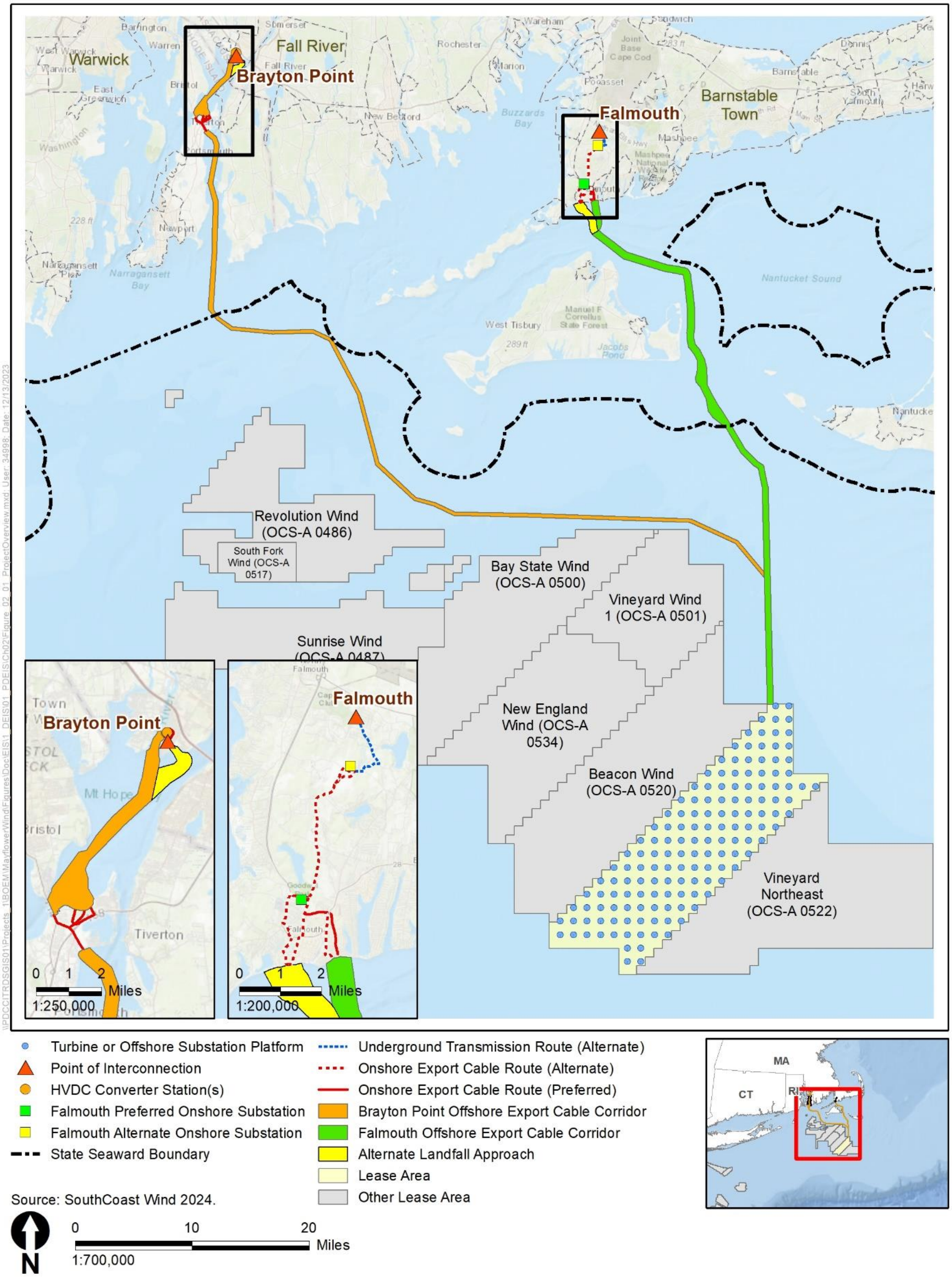

Figure ES-1. SouthCoast Wind Project

BOEM's action is needed to fulfill its duties under the lease, which require BOEM to make a decision on the lessee's plans to construct and operate a commercial-scale offshore wind energy facility within the Lease Area (the Proposed Action) (30 CFR 585.628).

In addition, NMFS received a request for authorization under the MMPA to take marine mammals incidental to construction activities related to the Project. NMFS's issuance of an MMPA incidental take authorization would be a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)). The purpose of the NMFS action—which is a direct outcome of SouthCoast Wind's request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile driving)—is to evaluate SouthCoast Wind's request pursuant to specific requirements of the MMPA and its implementing regulations administered by NMFS, and decide whether to issue the authorization. NMFS needs to render a decision regarding the request for authorization due to NMFS's 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 New England District anticipates requests for authorization of a permit action to be undertaken through authority delegated to the District Engineer by 33 CFR 325.8, under Section 10 of the RHA (33 USC 403) and CWA Section 404 (33 USC 1344). In addition, it is anticipated that a Section 408 permission may be 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 considers issuance of permits/permission under these three delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)). The need for the Project as provided by the Applicant in SouthCoast Wind's COP Volume 1, Section 1.3, and reviewed by USACE for NEPA purposes is to provide a commercially viable offshore wind energy project (up to 2,400 MW) within the Lease Area to help the state of Massachusetts achieve renewable energy goals. The basic Project purpose, as determined by USACE for Section 404(b)(1) guidelines evaluation, is offshore wind energy generation. The overall Project purpose for Section 404(b)(1) guidelines evaluation, as determined by USACE, is the construction and operation of a commercial-scale offshore wind energy project for renewable energy generation in Lease Area OCS-A 0521 and transmission/distribution to the New England energy grid.

The purpose of USACE Section 408 action as determined by Engineer Circular 1165-2-220 is to evaluate the Applicant's request and determine whether the proposed alterations would be injurious to the public interest or would impair the usefulness of the USACE project. USACE Section 408 permission is needed to ensure that congressionally authorized projects continue to provide their intended benefits to the public. 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 and Section 404 of the CWA. 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 to formally document its decision on the Proposed Action.

ES.3 Public Involvement

On November 1, 2021, BOEM issued a Notice of Intent (NOI) to prepare an EIS consistent with NEPA (42 USC 4321 et seq.), initiating a 30-day public scoping period from November 1 to December 1, 2021 (86 *Federal Register* 60270). 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 SouthCoast Wind COP. BOEM held three virtual public scoping meetings on November 10, November 15, and November 18, 2021, to present information on the Project and NEPA process, answer questions from meeting attendees, and to solicit public comments. Scoping comments were received through Regulations.gov on docket number BOEM-2021-0062, via email to a BOEM representative, and through oral testimony at each of the three public scoping meetings. BOEM received 51 comment submissions from federal 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 mitigation and monitoring; marine mammals; planned activities scenario and cumulative impacts; commercial fisheries and for-hire recreational fishing; finfish, invertebrates, and Essential Fish Habitat (EFH); public involvement; alternatives; employment and job creation; benthic resources; and birds. BOEM considered all scoping comments while preparing this Final EIS.

On February 17, 2023, BOEM issued a Notice of Availability of the Draft EIS, initiating a 45-day public comment period from February 17 to April 3, 2023 (88 *Federal Register* 10377). BOEM held three virtual public hearings on March 20, 22, and 27, 2023. On April 4, 2023, BOEM announced a 15-day extension to the comment period, which concluded on April 18, 2023 (88 *Federal Register* 19986). Public comments were received through Regulations.gov on docket number BOEM-2023-0011 via email and through oral testimony at each of the three public hearings. BOEM received a total of 182 comment submissions from federal and state agencies, Tribal governments, local governments, non-governmental organizations, and the general public during the comment period. BOEM assessed and considered all comments received 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 five action alternatives (two of which have sub-alternatives), not including the Preferred Alternative. 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
- Alternative B—Proposed Action
- Alternative C—Fisheries Habitat Impact Minimization
    - Alternative C-1—Aquidneck Island, Rhode Island Route
    - Alternative C-2— Little Compton/Tiverton, Rhode Island Route
- Alternative D—Nantucket Shoals
- Alternative E—Foundation Structures
    - Alternative E-1—Pile Foundations (monopile and piled jacket) only
    - Alternative E-2—Suction Bucket Foundations only
    - Alternative E-3—Gravity-based Foundations only
- Alternative F—Muskeget Channel Cable Modification

The Preferred Alternative analyzed in the Final EIS is Alternative D—Nantucket Shoals. 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 Alternative

Under Alternative A, BOEM would not approve the COP, the Project's construction and installation, O&M, and decommissioning would not occur; and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to the applicant. The current resource condition, trends, and impacts from ongoing activities under the No Action Alternative serves as the existing baseline against which the 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 future activities described in Appendix D, *Planned Activities Scenario*, without the Proposed Action serves as the future baseline for the evaluation of cumulative impacts of all alternatives.

ES.4.2 Alternative B—Proposed Action

The Proposed Action is to construct, operate, maintain, and eventually decommission an up to 2,400-MW wind energy facility on the OCS offshore Massachusetts within the range of design parameters described in Volume 1 of the SouthCoast Wind COP (SouthCoast Wind 2024), subject to applicable mitigation measures. The SouthCoast Wind Project would be developed in two parts or projects: Project 1 refers to the development in the northern portion of the Lease Area and associated interconnection, and Project 2 refers to the development in the southern portion of the Lease Area and associated interconnection. The Project would have a capacity of up to 2,400 MW and would consist of up to 149 structure positions to be occupied by up to 147 WTGs and up to five OSPs connected by interarray cables within the Lease Area, and one preferred offshore export cable ECC making landfall at Brayton Point, Massachusetts with an intermediate landfall on Aquidneck Island, Rhode Island. This preferred ECC to Brayton Point would be used for both Project 1 and Project 2 in the Lease Area, unless technical, logistical, grid interconnection, or other unforeseen challenges arise during the design and engineering phase that prevent Project 2 from making interconnection at Brayton Point, in which case Project 2 would utilize the Falmouth variant ECC and make landfall and interconnect in Falmouth, Massachusetts.

Onshore facilities would include landfall locations, onshore export cables, two high voltage direct current (HVDC) converter stations at Brayton Point, up to one substation if the Falmouth variant is used, underground transmission lines, and the utilities' points of interconnection (POIs). The Proposed Action is summarized in Table ES-1 and Appendix C, *Project Design Envelope and Maximum-Case Scenario*. Refer to Volume 1 of the SouthCoast Wind COP (SouthCoast Wind 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 147 WTGs (up to 85 WTGs for Project 1 and Project 2, individually) • Up to 5 OSPs (likely up to 1 OSP for Project 1 and Project 2, individually) • Up to a total of 149 WTG/OSP positions • 1 nautical mile (nm) x 1 nm (1.9 kilometers x 1.9 kilometers) grid layout with east–west and north–south orientation • Project to be developed in two parts or projects: Project 1 refers to the development in the northern portion of the Lease Area and associated interconnection, and Project 2 refers to the development in the southern portion of the Lease Area and associated interconnection.
Foundations
• Monopile, piled jacket, and/or suction-bucket jacket (suction-bucket jacket foundations for Project 2 only) • Scour protection for up to all foundations • Seabed penetration up to 262.5 feet (80 meters) depth • Foundation piles would be installed using a pile-driving hammer and/or drilling techniques such as using a hydraulic impact hammer, vibratory hammer, or water jetting

Project Parameter Details
Wind Turbine Generators
• Rotor diameter up to 918.6 feet (280 meters) • Blade length up to 452.8 feet (138 meters) • Hub height up to 605.1 feet (184.4 meters) above mean lower low water (MLLW) • Upper blade tip height up to 1,066.3 feet (325 meters) above MLLW • Lowest blade tip height (air gap) 75.5 feet (23 meters) above highest astronomical tide
Offshore Substation Platforms
• Up to five OSPs • OSPs installed atop a monopile, piled jacket, and/or suction-bucket jacket • OSPs may use HVDC) or high voltage alternating current (HVAC) technology. If HVDC technology is selected for both projects there would be a maximum of two HVDC OSPs, one for Project 1 and one for Project 2. A scenario where Project 1 has one HVDC OSP and Project 2 has one HVAC OSP is also possible. • Total OSP structure height up to 344.5 feet (105 meters) above MLLW • Scour protection for all foundations • Maximum length and width of topside structure 360.9 feet by 328.1 feet (110 meters by 100 meters; with ancillary facilities) • Foundation piles to be installed using a pile-driving hammer and/or drilling techniques such as using a hydraulic impact hammer, vibratory hammer, or water jetting. • Each of two HVDC converter OSP will use less than 10 million gallons per day of once-through non-contact cooling water and a maximum end-of-pipe discharge temperature of 86°F (30°C)
Interarray Cables
• Anticipated burial depth of 3.2 to 8.2 feet (1 to 2.5 meters) • Nominal interarray cable voltage: 60 kilovolt (kV) to 72.5 kV • Maximum interarray cable diameter of 1.24 inches (800 millimeter) • Maximum total interarray cable length is 497.1 miles (800 kilometers) • Preliminary layout available; however, final layout pending • Cable lay, installation, and burial: Activities may involve use of a jetting remotely operated vessel (ROV), mechanical cutting ROV system, plowing (pre-cut and mechanical)
Falmouth Offshore Export Cables [a]
• Up to 5 offshore export cables (4 power cables and 1 communications cable) • Nominal export cable voltage: 200 kV to 345 kV HVAC or ±525 kV HVDC • Maximum total export cable corridor length is 87 miles (140 kilometers) • Maximum export cable length is 434.9 miles (700 kilometers) • Anticipated burial depth of 3.2 to 13.1 feet (1 to 4 meters); target burial depth of 6 feet (1.8 meters) • Up to 9 cable/pipeline crossings • Cable lay, installation, and burial: Activities may involve use of a jetting tool (jetting ROV or jetting sled), vertical injection, mechanical cutting ROV system, plowing (pre-cut and mechanical)
Brayton Point Offshore Export Cables
• Up to 6 offshore export cables (2 cable bundles consisting of 2 power cables and 1 communications cable per bundle) • Nominal export cable voltage: ±320 kV HVDC • Maximum total export cable corridor length is 124 miles (200 kilometers) • Maximum export cable length is 744 miles (1,200 kilometers) • Anticipated burial depth of 3.2 to 13.1 feet (1 to 4 meters); target burial depth of 6 feet (1.8 meters) • Up to 16 cable/pipeline crossings

Project Parameter Details
• Cable lay, installation, and burial: Activities may involve use of a jetting tool (jetting ROV or jetting sled), vertical injection, mechanical cutting ROV system, plowing (pre-cut and mechanical)
Falmouth Landfall Site [a]
• Three landfall locations under consideration: Worcester Avenue (preferred), Central Park, and Shore Street
Brayton Point Landfall Site
• Two landfall locations under consideration: the western (preferred) and eastern (alternate) shorelines of Brayton Point • Aquidneck Island, Portsmouth, Rhode Island; several locations under consideration for intermediate landfall across the island
Falmouth Onshore Export Cable Corridor [a]
• Up to 12 onshore export cables and up to five communications cables • Nominal underground onshore export cable voltage: 200 kV to 345 kV HVAC • Maximum onshore export cable length is 6.4 statute miles (10.3 kilometers)
Brayton Point Onshore Export Cable Corridor
• Up to 6 onshore export cables and up to two communications cables • Nominal underground onshore export cable voltage: ±320 kV HVDC • Maximum onshore export cable length is 0.7 mile (1.1 kilometer)
Brayton Point Onshore Export Cable Corridor on Aquidneck Island (intermediate landfall)
• Up to 4 onshore export cables and up to two communications cables • Nominal underground onshore export cable voltage: ±320 kV HVDC • Onshore export cable corridor length is 3 miles (4.8 kilometers) across Aquidneck Island
Falmouth Onshore Substation/Interconnection [a]
• Two locations for a single new Falmouth substation under consideration - Lawrence Lynch (preferred) and Cape Cod Aggregates (alternate) • Up to 26 acres (10.5 hectares) permanent area • New 345-kV overhead (preferred) or underground (alternate) transmission line in existing right-of-way up to 2.1 miles (3.4 kilometers) in length • Transmission line to Falmouth POI would be designed, permitted, and constructed by interconnection transmission owner
Brayton Point Converter Station/Interconnection
• One Brayton Point substation location under consideration – existing National Grid substation • Two new HVDC converter stations • Up to 7.5 acres (3 hectares) permanent area for each converter station • New 345-kV underground transmission route to existing Brayton Point POI, up to 0.2 mile (0.3 kilometer) on Brayton Point property

[a] To be developed only if Falmouth is the selected POI for Project 2.
WTG = wind turbine generator; OSP = offshore substation platform; MLLW = mean lower low water; °C = degrees Celsius; kV = kilovolt; ROV = remotely operated vehicle

ES.4.3 Alternative C – Fisheries Habitat Impact Minimization

Alternative C was developed through the scoping process for the Final EIS in response to comments received from NMFS and other agencies expressing concern with the potential impact of the offshore export cable on fisheries, EFH, and Habitat Areas of Particular Concern in the Sakonnet River. The Sakonnet River supports EFH for several fish and invertebrate species at varying life stages including Habitat Areas of Particular Concern for summer flounder and Atlantic Cod. To address this concern, BOEM developed onshore cable route options that would avoid placing the offshore export cable in the Sakonnet River. Under this alternative, the construction, O&M, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. Alternative C includes two possible onshore export cable routes to Brayton Point:

- **Alternative C-1:** Aquidneck Island, Rhode Island Route
- **Alternative C-2:** Little Compton/Tiverton, Rhode Island Route

ES.4.4 Alternative D – Nantucket Shoals (Preferred Alternative)

Alternative D was developed through the scoping process for the Final EIS to address potential impacts on protected species in the northeastern portion of the Lease Area. Following installation of foundations, a commenter speculated that the presence of WTGs in the northeastern portion of the Lease Area may alter the foraging habitat associated with the physical hydrodynamic features along the western edge of Nantucket Shoals. However, modeling of the full build-out of the entire southern New England lease areas indicates that minor, local changes to the physical hydrodynamic features may occur on the western side of Nantucket Shoals adjacent to the BOEM lease areas (Johnson et al. 2021). In addition, the National Academies of Science Engineering and Medicine recently evaluated the potential of offshore wind farms to alter the hydrodynamic processes that affect prey abundance and availability in the Nantucket Shoals region (NASEM 2024). The study concluded that impacts of offshore wind projects on the North Atlantic right whale (NARW) and the availability of their prey will likely be difficult to distinguish from the significant impacts of climate change and other influences on the ecosystem. Based on best available science, BOEM believes there is a lack of conclusive evidence that the removal of proposed turbine locations in the northeastern portion of the Lease Area would measurably lessen these minor impacts on the hydrodynamic features. If the potential hydrodynamic effects are consistent with the modeling of the southern New England lease areas and other hydrodynamic studies of wind facilities in the North Sea, the effects would be local to the immediate vicinity of the turbine array and not extend to Nantucket Shoals. If the potential hydrodynamic effects are as extensive as potential wind wakes that could extend tens of kilometers under stable conditions (Christiansen et al. 2022), then the removal of turbines would not remove this potential range of effects from extending far enough from the turbine array to overlap with Nantucket Shoals. Nonetheless, Nantucket Shoals is an area of high productivity with higher abundances of amphipods, chlorophyll, birds, and NARW. Nantucket Shoals has high foraging value for several species, including NARW at different times of the year as well as seabirds and seaducks. Consequently, BOEM has developed this alternative to address the environmental concern that wildlife may be subject to increased impacts in this area. Under Alternative D, six WTGs

(AZ-47, BA-47, BB-47, BC-47, BC-48, and BF-49) in the northeastern portion of the Lease Area would be eliminated to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals.

ES.4.5 Alternative E – Foundation Structures

Alternative E was developed through the scoping process for the Final EIS to address options posed in the SouthCoast Wind COP and in response to comments received from multiple commenters on construction noise related to foundation installation. Alternative E addresses the possibility for one or more foundation types to be utilized for WTGs and OSPs and includes three sub-alternatives, which detail the different foundation structures. This alternative assumes the maximum use of piled (monopile and piled jacket), suction bucket, and gravity-based foundation structures to assess the extent of potential impacts from each foundation type. Following the release of the Draft EIS, SouthCoast Wind revised the COP to remove gravity-based foundations as a potential foundation for WTGs and OSPs and restrict possible locations of WTGs and OSPs with suction-bucket jacket foundations to up to 85 positions for Project 2 only. While these foundation options have been removed from or restricted in location under the Proposed Action (Alternative B), BOEM has retained these foundation options for the entire Lease Area under Alternative E for analysis in the Final EIS.

- **Alternative E-1:** Piled Foundations (monopile and piled jacket) only
- **Alternative E-2:** Suction Bucket Foundations only
- **Alternative E-3:** Gravity-based Foundations only

ES.4.6 Alternative F – Muskeget Channel Cable Modification

Alternative F was developed to minimize impacts on complex habitats and reduce seabed disturbance in the Muskeget Channel east of Martha's Vineyard in response to concerns from NMFS. Under Alternative F, the construction, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. However, to minimize seabed disturbance in the Muskeget Channel, the Falmouth offshore export cable route, if used for Project 2, would use ±525kV HVDC cables connected to one HVDC converter OSP in the Lease Area, instead of HVAC cables connected to one or more HVAC OSPs as proposed under the Proposed Action. The OSP design for the offshore export cables connecting to Brayton Point for Project 1 would remain unchanged from the Proposed Action. As a result, there would be two HVDC converter OSPs under Alternative F: one HVDC converter OSP for Brayton Point (Project 1) and one HVDC converter OSP for Falmouth (Project 2). In addition, Alternative F would use up to three offshore export cables to Falmouth, instead of up to five offshore export cables under the Proposed Action.

As stated under the Proposed Action, SouthCoast Wind has proposed the Falmouth ECC as a variant option that would only be used for Project 2 if there are technical, logistical, grid interconnection, or other unforeseen challenges that arise during the design and engineering phase that prevent Project 2 from making interconnection at Brayton Point. Therefore, Alternative F would only be applicable if SouthCoast Wind is unable to use the Brayton Point POI for Project 2 and must use the Falmouth POI.

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 either **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, *Planned Activities Scenario*. 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. The impacts described assume implementation of applicant-committed avoidance, minimization, and mitigation measures Appendix G, *Mitigation and Monitoring,* (Table G-1), but do not include agency-proposed measures (Table G-2). 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 phase and would be temporary. Chapter 4 also describes irreversible and irretrievable commitment of resources by resource area. The most notable such commitments could include effects on habitat or individual members of protected species, as well as potential loss of use of commercial fishing areas.

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[3]

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization [a]	Alternative D Nantucket Shoals	Alternative E Foundation Structures [d]	Alternative F Muskeget Channel Cable Modification
3.4.1 Air Quality						
Alternative Impacts [a]	Minor to moderate adverse	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial
Cumulative Impacts [b]	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial	Minor to moderate adverse; minor to moderate beneficial
3.4.2 Water Quality						
Alternative Impacts [a]	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Cumulative Impacts [b]	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
3.5.1 Bats						
Alternative Impacts [a]	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Cumulative Impacts [b]	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
3.5.2 Benthic Resources						
Alternative Impacts [a]	Moderate adverse	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial
Cumulative Impacts [b]	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial	Moderate adverse; moderate beneficial

[3] 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	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization [a]	Alternative D Nantucket Shoals	Alternative E Foundation Structures [d]	Alternative F Muskeget Channel Cable Modification
3.5.3 Birds						
Alternative Impacts [a]	Minor adverse	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial
Cumulative Impacts [b]	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial
3.5.4 Coastal Habitats and Fauna						
Alternative Impacts [a]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
Cumulative Impacts [b]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
3.5.5 Finfish, Invertebrates, and Essential Fish Habitat						
Alternative Impacts [a]	Moderate adverse	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial
Cumulative Impacts [b]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
3.5.6 Marine Mammals						
Direct and Indirect Impacts (without baseline) [c]	None	Moderate adverse for NARW	Moderate adverse for NARW	Moderate adverse for NARW	Moderate adverse for NARW	Moderate adverse for NARW
		Moderate adverse for other mysticetes, odontocetes, and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds
Alternative Impacts [a]	Major adverse for NARW [e]	Major adverse for NARW [e]	Major adverse for NARW [e]	Major adverse for NARW [e]	Major adverse for NARW [e]	Major adverse for NARW [e]

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization [a]	Alternative D Nantucket Shoals	Alternative E Foundation Structures [d]	Alternative F Muskeget Channel Cable Modification
	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds
Cumulative Impacts [b]	Major adverse for NARW	Major adverse for NARW [c]	Major adverse for NARW [c]	Major adverse for NARW [c]	Major adverse for NARW [c]	Major adverse for NARW [c]
	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds	Moderate adverse for other mysticetes, odontocetes, and pinnipeds
3.5.7 Sea Turtles						
Alternative Impacts [a]	Minor adverse	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial
Cumulative Impacts [b]	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
3.5.8 Wetlands						
Alternative Impacts [a]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
Cumulative Impacts [b]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization [a]	Alternative D Nantucket Shoals	Alternative E Foundation Structures [d]	Alternative F Muskeget Channel Cable Modification
3.6.1 Commercial Fisheries and For-Hire Recreational Fishing						
Alternative Impacts [a]	Minor to major adverse	Minor to major adverse; minor beneficial	Minor to major adverse	Minor to major adverse	Minor to major adverse	Minor to major adverse
Cumulative Impacts [b]	Minor to major adverse; moderate beneficial	Major adverse; minor beneficial	Major adverse	Major adverse	Major adverse	Major adverse
3.6.2 Cultural Resources						
Alternative Impacts [a]	Moderate	Major	Major	Major	Major	Major
Cumulative Impacts [b]	Major	Major	Major	Major	Major	Major
3.6.3 Demographics, Employment, and Economics						
Alternative Impacts [a]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts [b]	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial
3.6.4 Environmental Justice						
Alternative Impacts [a]	Minor adverse	Major adverse; minor beneficial	Major adverse; minor beneficial	Major adverse; minor beneficial	Major adverse; minor beneficial	Major adverse; minor beneficial
Cumulative Impacts [b]	Minor adverse; minor beneficial	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
3.6.5 Land Use and Coastal Infrastructure						
Alternative Impacts [a]	Minor adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial
Cumulative Impacts [a]	Minor adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
3.6.6 Navigation and Vessel Traffic						
Alternative Impacts [a]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization [a]	Alternative D Nantucket Shoals	Alternative E Foundation Structures [d]	Alternative F Muskeget Channel Cable Modification
Cumulative Impacts [b]	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)						
Alternative Impacts [a]	Marine mineral extraction, marine and national security uses, aviation and air traffic, cables and pipelines, radar systems: negligible; Search and rescue: moderate adverse; scientific research and surveys: major adverse	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, radar systems: minor; military and national security: minor for most but moderate for search and rescue activities; search and rescue: moderate adverse; scientific research and surveys: major adverse	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, radar systems: minor; military and national security: minor for most but moderate for search and rescue activities; search and rescue: moderate adverse; scientific research and surveys: major adverse	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, radar systems: minor; military and national security: minor for most but moderate for search and rescue activities; search and rescue: moderate adverse; scientific research and surveys: major adverse	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, radar systems: minor; military and national security: minor for most but moderate for search and rescue activities; search and rescue: moderate adverse; scientific research and surveys: major adverse	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, radar systems: minor; military and national security: minor for most but moderate for search and rescue activities; search and rescue: moderate adverse; scientific research and surveys: major adverse

Resource	Alternative A No Action Alternative	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization [a]	Alternative D Nantucket Shoals	Alternative E Foundation Structures [d]	Alternative F Muskeget Channel Cable Modification
Cumulative Impacts [b]	Marine mineral extraction: negligible; aviation and air traffic, cables and pipelines, military and national security: minor adverse; radar systems and search and rescue: moderate; scientific research and surveys: major	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, military and national security: minor adverse; radar systems and search and rescue: moderate; scientific research and surveys: major	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, military and national security: minor adverse; radar systems and search and rescue: moderate; scientific research and surveys: major	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic, military and national security: minor adverse; radar systems and search and rescue: moderate; scientific research and surveys: major	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic military and national security: minor adverse; radar systems and search and rescue: moderate; scientific research and surveys: major	Marine mineral extraction, cables and pipelines: negligible; aviation and air traffic military and national security: minor adverse; radar systems and search and rescue: moderate; scientific research and surveys: major
3.6.8 Recreation and Tourism						
Alternative Impacts [a]	Minor adverse	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial	Minor adverse; minor beneficial
Cumulative Impacts [b]	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial	Moderate adverse; minor beneficial
3.6.9 Scenic and Visual Resources						
Alternative Impacts [a]	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
Cumulative Impacts [b]	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse

Impact rating colors are as follows: orange = major; yellow = moderate; green = minor. 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.

[a] 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*.

[b] Cumulative impacts represent alternative impacts (with the baseline) plus other foreseeable impacts.

[c] Direct and Indirect Impacts (without baseline) (i.e., alternative impacts without the baseline) were included at NMFS' request to support determinations under the Marine Mammal Protection Act.

[d] Impacts are the same under Alternatives C1 and C2 and Alternatives E1, E2, and E3 unless otherwise noted in the table.

[e] 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 the SouthCoast Wind Project (Project) proposed by SouthCoast Wind Energy LLC (SouthCoast Wind), in its Construction and Operations Plan (COP) (SouthCoast Wind 2024).[1] The proposed Project described in the COP and this Final EIS would be up to 2,400 megawatts (MW) in scale and sited 30 miles (26 nautical miles [nm]) south of Martha's Vineyard, Massachusetts, and 23 miles (20 nm) south of Nantucket, Massachusetts within Lease Area OCS-A 0521 (Lease Area). The SouthCoast Wind COP and all of the volumes and appendices supporting the COP are incorporated into the EIS by reference and are available at https://www.boem.gov/southcoast-wind. The Project is designed to generate renewable energy for the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island.

This Final EIS was prepared following the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321–4370f) and implementing regulations. 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).

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.[2] These implementing regulations, codified in 30 CFR Part 585, provide a framework for BOEM to issue renewable energy leases, easements, and rights-of-way for OCS activities (Section 1.3, *Regulatory Framework*). 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 Massachusetts is summarized in Table 1-1.

[1] The SouthCoast Wind COP is available on BOEM's website: https://www.boem.gov/southcoast-wind. On February 1, 2023, Mayflower Wind Energy LLC changed its name to SouthCoast Wind Energy LLC and changed the project name from the Mayflower Wind Project to the SouthCoast Wind Project. While the Final EIS has been updated to reflect the SouthCoast Wind name, certain supporting documents may still refer to Mayflower Wind.
[2] Public Law No. 109-58, 119 Stat. 594 (2005).

Table 1-1. History of BOEM planning and leasing activities offshore Massachusetts

Year	Milestone
2009	BOEM began evaluating potential OCS wind energy leasing and development offshore Massachusetts in 2009 by establishing an intergovernmental renewable energy task force comprised of elected officials from state, local, and Tribal governments and other Federal agency representatives. After extensive consultation with the task force, BOEM removed areas within 12 nautical miles (nmi) of inhabited coastline from further consideration for offshore wind leasing to reduce visual impacts. In addition, areas beyond the 60-meter water depth contour were removed due to technological limitations.
2010	On December 29, 2010, BOEM published a Request for Interest (RFI) in the *Federal Register* to gage commercial interest in wind energy development offshore Massachusetts (75 *Federal Register* 82055). BOEM also invited the public to comment and provide information on environmental issues and data that should be considered in the development of the area of interest for wind energy development offshore Massachusetts. The public comment period closed on April 18, 2011, and BOEM received 11 indications of interest from 10 companies wishing to obtain a commercial lease for a wind energy project and received approximately 260 public comments. After consideration of public comments and input from BOEM's intergovernmental Massachusetts Renewable Energy Task Force, BOEM modified the area of interest for commercial development offshore Massachusetts.
2012	On February 6, 2012, BOEM published a Call for Information and Nominations (Call) for commercial leasing for wind power on the OCS offshore Massachusetts in the *Federal Register* (77 *Federal Register* 5820). The public comment period for the Call closed on March 22, 2012. In response, BOEM received 32 comments and ten nominations of interest. After considering comments, BOEM excluded an area of high sea duck concentration, as well as an area of high-value fisheries to reduce conflict with commercial and recreational fishing activities.
2012	In May 2012, BOEM identified a wind energy area (WEA) offshore Massachusetts, excluding additional areas from commercial leasing, and addressed comments from the Call.3
2012	On November 2, 2012, BOEM published a notice of availability (NOA) of an EA in accordance with NEPA for potential commercial wind lease issuance and site assessment activities on the OCS offshore Massachusetts for public review and comment (77 Fed. Reg. 66,185).
2014	On June 18, 2014, BOEM published in the *Federal Register* a Notice of Availability of a Revised Environmental Assessment and Finding of No Significant Impact for commercial wind lease issuance and site assessment activities on the Atlantic OCS offshore Massachusetts (79 *Federal Register* 34781).
2014	On June 18, 2014, BOEM published a Proposed Sale Notice (PSN) for Commercial Leasing for Wind Power on the Outer OCS Offshore Massachusetts in the *Federal Register* for Leases OCS-A 0500, OCS-A 0501, OCS-A 0502, and OCS-A 0503 (79 *Federal Register* 34771).
2014/ 2015	On November 26, 2014, BOEM published a Final Sale Notice (FSN) for Commercial Leasing for Wind Power on the OCS Offshore Massachusetts in the *Federal Register* for Atlantic Wind Lease Sale-4 (ATLW-4) that covered the same four lease areas covered by the 2014 PSN (79 *Federal Register* 70545). The sale for ATLW-4 was held on January 29, 2015. Lease areas OCS-A 0502 and OCS-A 0503 went unsold during the lease sale.

[3] BOEM works with its Federal, state, local, and Tribal partners to identify WEAs of the OCS that appear most suitable for commercial wind energy activities, while presenting the fewest apparent environmental and user conflicts (BOEM 2022). After WEAs are identified, BOEM prepares an Environmental Assessment (EA) under NEPA to determine potential impacts associated with activities reasonably expected to follow the issuance of one or more leases within a WEA. BOEM may then move forward with steps to hold a competitive lease sale for commercial wind development within the WEAs. The Project is located in BOEM Lease Area OCS-A 0534, which is located in the RI/MA WEA. The RI/MA WEA is adjacent to and west of the MA WEA. More information on BOEM WEAs, including maps, are found at https://www.boem.gov/renewable-energy/state-activities.

Year	Milestone
2018	On April 11, 2018, BOEM published a PSN requesting public comments on the proposal to auction Leases OCS-A 0502 and OCS-A 0503 offshore Massachusetts for commercial wind energy development, the same lease areas unsold during the ATLW-4 lease sale (83 *Federal Register* 15618).
2018	On October 19, 2018, BOEM published an FSN in the *Federal Register*, which stated a commercial lease sale would be held December 13, 2018, for the Wind Energy Area offshore Massachusetts (83 *Federal Register* 53089). BOEM offered three leases, including OCS-A 0521, which are located within the former Leases OCS-A 0502 and OCS-A 0503 that were unsold during the ATLW-4 sale on January 29, 2015. Mayflower Wind Energy LLC was the winner of Lease OCS- A 0521; the lessee later changed its name n 2023[4].
2019	On April 1, 2019, BOEM and SouthCoast Wind executed the lease agreement for Lease OCS-A 0521.
2019	On July 29, 2019, SouthCoast Wind submitted a Site Assessment Plan for commercial wind Lease OCS-A 0521, which was subsequently revised with a complete Site Assessment Plan submitted on December 12, 2019. BOEM approved the Site Assessment Plan on May 26, 2020.
2021	On February 15, 2021, SouthCoast Wind submitted its COP for the construction, operations, and conceptual decommissioning of the Project within the Lease Area. SouthCoast Wind submitted two updated versions of the COP in 2021, one on August 30 and another on October 28.
2021	On November 1, 2021, BOEM published a Notice of Intent to Prepare an EIS for SouthCoast Wind's Proposed Wind Energy Facility Offshore Massachusetts (86 *Federal Register* 60270).
2022	On March 16, 2022 and December 22, 2022, SouthCoast Wind submitted updated versions of the COP.
2023	On February 17, 2023, BOEM published a Notice of Availability of a Draft EIS. On September 19, 2023, SouthCoast Wind submitted an updated version of the COP.
2024	On July 31, 2024, SouthCoast Wind submitted an updated version of the COP.
2024	On November 15, 2024, BOEM published a Notice of Approval 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.

1.2 Purpose and Need of 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; 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, SouthCoast Wind was awarded the Commercial Lease Area offshore Massachusetts. SouthCoast Wind 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 an offshore wind energy facility in the Lease Area (the Project).

[4] On March 17, 2023, Mayflower Wind Energy, LLC changed its name to SouthCoast Wind Energy LLC (SouthCoast Wind), and retained 127,388 acres from the original lease.

SouthCoast Wind's goal is to develop a commercial-scale offshore wind energy facility in the Lease Area with up to 149 total foundation locations to be occupied by a combination of up to 147 wind turbine generators (WTGs) and up to five offshore substation platforms (OSPs). The Project includes one preferred export cable corridor (ECC) making landfall and interconnecting to the ISO New England Inc. (ISO-NE) grid at Brayton Point, in Somerset, Massachusetts and one variant ECC which, if used, would make landfall and interconnect to the ISO-NE grid in the town of Falmouth, Massachusetts (Figure 1-1). The Project would provide up to 2,400 MW of clean, renewable wind energy to the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island, which each have existing state offshore wind procurement laws in place, as well as decarbonization goals and targets. As an example, Massachusetts, in accordance with Section 83C of the Massachusetts' Green Communities Act, allows Electric Distribution Companies (EDCs) to solicit proposals for offshore wind energy generation (*Chapter 188 of the Acts of 2016, An Act to Promote Energy Diversity*). On September 10, 2024, SouthCoast Wind was awarded 1,287 MW of offshore wind capacity in a multi-state offshore wind solicitation with Massachusetts selecting 1,087 MW and Rhode Island the remaining 200 MW. SouthCoast Wind is actively exploring offtake opportunities in Massachusetts and the New England region for the remaining wind capacity.

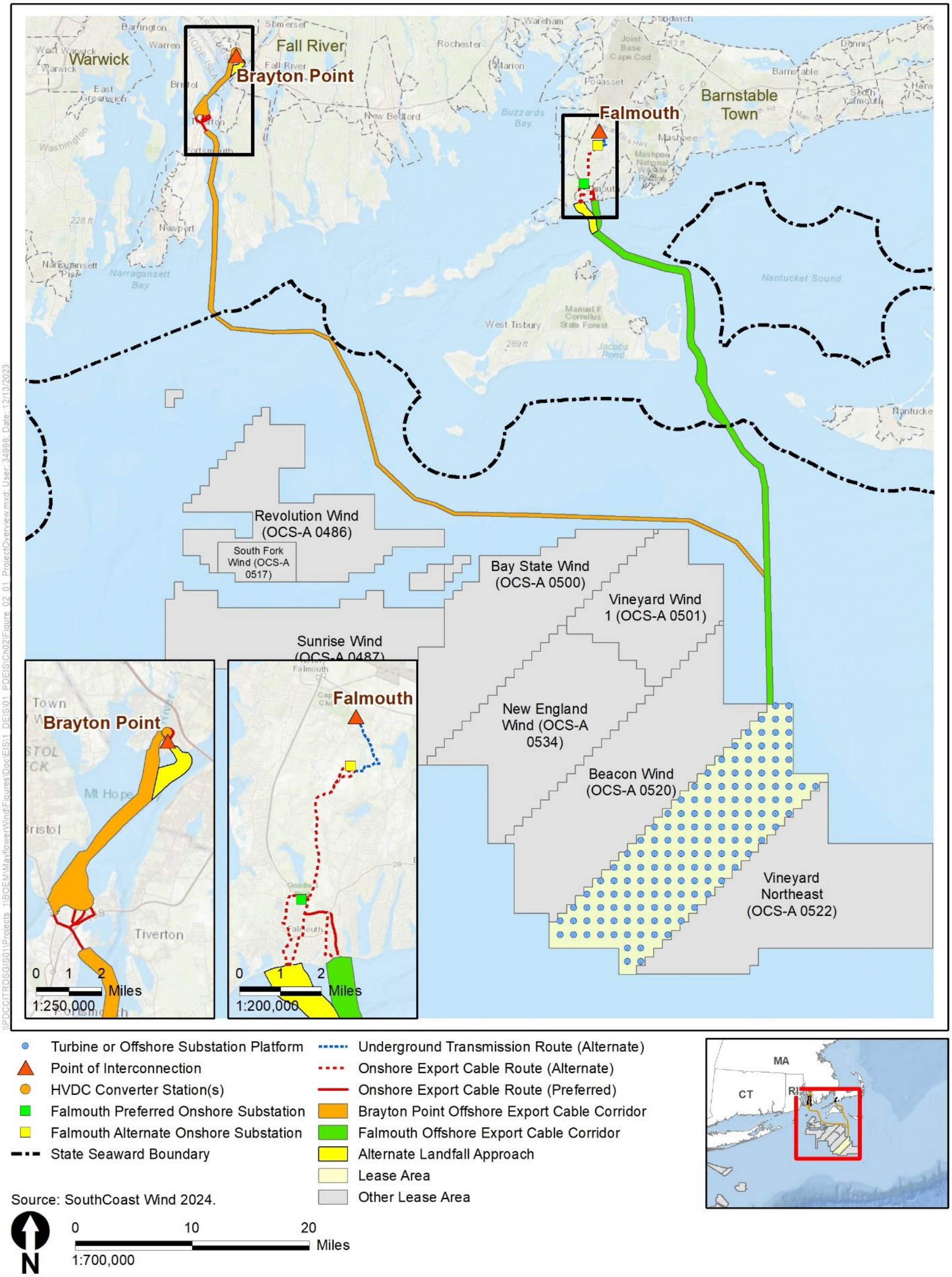

Figure 1-1. SouthCoast Wind Project area

Based on BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA)[5] to authorize renewable energy activities on the 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,[6] 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 SouthCoast Wind's 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, which requires BOEM to make a decision on the lessee's plan to construct and operate a commercial-scale, offshore wind energy facility in the Lease Area.

In addition, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) received a request for authorization to take marine mammals incidental to activities related to the Project, which NMFS may authorize under the Marine Mammal Protection Act (MMPA). NMFS's 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 1501.3(b)).[7] The purpose of the NMFS action—which is a direct outcome of SouthCoast Wind's request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile driving)—is to evaluate SouthCoast Wind's 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's 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 fulfill its NEPA requirements.

The U.S. Army Corps of Engineers (USACE) New England District received a complete Department of the Army (DA) permit application from SouthCoast Wind Energy, LLC (then Mayflower Wind Energy, LLC) on February 2, 2023, for the proposed Project. USACE authorization is required for the Project pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA) (33 USC 403) and Section 404 of the Clean Water Act (CWA) (33 USC 1344). Authority under these acts has been delegated to the District Engineer by 33 CFR 325.8. USACE considers issuance of a DA permit under these delegated authorities to be a major federal action connected to BOEM's action (40 CFR 1501.3(b)). The need for the Project as provided by the applicant in a November 10, 2023 letter to and reviewed by USACE for NEPA purposes is to provide approximately 2,400 MW of clean, renewable wind energy to the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island, which each have existing state offshore wind

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[5] 43 USC 1331 et seq.

[6] 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/

[7] Under the MMPA, *take* means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 USC 1362).

procurement laws in place as well as decarbonization goals and targets. The basic Project purpose as determined by USACE for Section 404(b)(1) guidelines evaluation, is offshore wind energy generation. The overall Project purpose for Section 404(b)(1) guidelines evaluation, as determined by USACE, is the construction and operation of a commercial-scale offshore wind energy project for renewable energy generation in Lease Area OCS-A 0521 and transmission/distribution to the New England energy grid. Appendix F, *Analysis of Alternatives to Inform the USACE's 404(b)(1) Alternatives Analysis*, contains USACE's Section 404(b)(1) alternatives analysis information.

USACE intends to adopt BOEM's EIS to support its decision on SouthCoast Wind Energy, LLC's DA permit application. 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 Framework

The Energy Policy Act of 2005 amended OCSLA (43 USC 1331 et seq.)[8] by adding a new subsection 8(p) that authorizes the Secretary of the Interior to issue leases, easements, and rights-of-way (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 (BSEE) and became BSEE provisions in 30 CFR 285.10. The regulations retained by BOEM prescribe BOEM's responsibility for determining whether to approve, approve with conditions, or disapprove SouthCoast's COP.[9]

Section 2 of BOEM's Renewable Energy Lease OCS-A 0521 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 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 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 conditions, 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*.

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

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

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 in February 2021, and later updated with new information on August 30, 2021, October 28, 2021, March 17, 2022, December 22, 2022, September 19, 2023, and July 31 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 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 documents were used to inform the preparation of this Final EIS and are incorporated in their entirety by reference.

- *Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf*, OCS EIS/EA MMS 2007-046 (MMS 2007)—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 Massachusetts Revised Environmental Assessment*, OCS EIS/EA BOEM 2014-603 (BOEM 2014)—BOEM prepared this Environmental Assessment (EA) to determine whether issuance of leases and approval of Site Assessment Plans within areas offshore Massachusetts would have a significant effect on the environment and, thus, whether an EIS should be prepared before a lease is issued.
- *SouthCoast Wind Project Biological Assessment for the United States Fish and Wildlife Service* (BOEM 2023)—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).
- *SouthCoast Wind Project Biological Assessment for National Marine Fisheries Service* (BOEM 2024a)—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.
- *SouthCoast Wind Project Essential Fish Habitat Assessment for National Marine Fisheries Service* (BOEM 2024b)—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.

- *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement* (BOEM 2021a)—BOEM prepared this document for the Vineyard Wind Offshore Wind Energy Project 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* (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.

Additional environmental studies performed to support decisions concerning offshore wind energy development are available on BOEM's website at https://www.boem.gov/renewable-energy-research-completed-studies.

1.5 Methodology for Assessing the Project Design Envelope

SouthCoast Wind proposes to develop the Project using the Project Design Envelope (PDE) concept. This concept allows SouthCoast Wind 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 OSPs.

This Final EIS assesses the impacts of the PDE that are described in the SouthCoast Wind 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 alternative using the maximum-case scenario to assess the design parameters or combination of parameters for each environmental resource.[10] 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 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)

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[10] 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.

marine minerals use and ocean-dredged material disposal; (5) military use; (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, *Planned Activities Scenario,* describes the actions that BOEM has identified as 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,[11] Empire Wind,[12] Revolution Wind, Coastal Virginia Offshore Wind-Commercial (CVOW-C), New England Wind, Sunrise Wind, and Atlantic Shores South) 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 represents the existing baseline condition for impact analysis. Other factors currently affecting the resource, including climate change, are also acknowledged for that resource and are included in the impact-level conclusion.

1.6.2 Planned Activities

It is reasonable to predict that future activities may occur over time, and that cumulatively, those activities would impact 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 conditions 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.

[11] On October 31, 2023, Orsted publicly announced its decision to cease development of Ocean Wind 1 and Ocean Wind 2. However, Ocean Wind LLC (the lessee for Ocean Wind 1) has not withdrawn its COP for lease OCS-A 0498; therefore, BOEM has analyzed the project in this Final EIS as described in the approved COP. On February 29, 2024, pursuant to 30 CFR 585.418, BOEM approved a 2-year suspension of the operations term of Ocean Wind LLC's 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 Outer Continental Shelf Lands Act (OCSLA), 43 USC 1337(p)(5) and BOEM's implementing regulations at 30 CFR 585.416. Orsted North America Inc. (the lessee for Ocean Wind 2) has not relinquished or reassigned lease OCS-A 0532; therefore, BOEM has analyzed development of the Lease Area in this Final EIS consistent with the assumptions identified in Appendix D, *Planned Activities Scenario*.

[12] Empire Offshore Wind, LLC (the lessee for Empire Wind 1 and 2) has not relinquished or reassigned any portion of lease OCS-A 0512. Therefore, BOEM has analyzed development of the Lease Area in this Final EIS as described in the approved COP.

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 alternatives considered but not analyzed in detail; (3) describes the non-routine activities and low-probability events that could occur during construction, O&M, and decommissioning of the proposed Project; and (4) presents a summary and comparison of impacts among alternatives and resource affected.

The CEQ NEPA regulations require the identification of a preferred alternative in the Final EIS. BOEM has identified Alternative D as the Preferred Alternative. 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 an 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.

2.1 Alternatives

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. The alternatives analyzed in detail were carried forward for analysis after being reviewed using BOEM's screening criteria presented in Section 2.2, *Alternatives Considered but Not Analyzed in Detail*. The alternatives carried forward for detailed analysis in this Final EIS are summarized in Table 2-1 and described in detail in Sections 2.1.1 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 OCSLA extends only to the activities on the OCS, alternatives related to addressing nearshore and onshore elements, as well as offshore elements of the Proposed Action are analyzed in the EIS. BOEM's regulations (30 CFR 585.620) require the COP to describe all planned facilities that the lessee would construct and use for the Project, including onshore and support facilities and all anticipated Project easements. As a result, the federal, state, and local agencies with jurisdiction over nearshore and onshore impacts are able to adopt, at their discretion, those portions of BOEM's EIS that support their own permitting decisions. The precise selection of onshore or nearshore routing for any action alternative is under the jurisdiction of USACE and is pursuant to its adoption of this Final EIS and associated consultations, along with USACE's final identification of the Least Environmentally Damaging Practicable Alternative (LEDPA) and route selection for the joint ROD.

The alternatives listed in Table 2-1 are not mutually exclusive. BOEM may "mix and match" multiple listed EIS alternatives to result in the Preferred Alternative identified in Section 2.1.7, *Preferred Alternative*, of this Final EIS provided that (1) the design parameters are compatible; and (2) and the Preferred Alternative still meets the purpose and need.

SouthCoast Wind has committed to avoidance, minimization, and mitigation measures (AMMs) as part of its Project to avoid or minimize impacts on physical, biological, socioeconomic, and cultural resources (SouthCoast COP Volume 2, Table 16-1; SouthCoast Wind 2024). These measures, included in Appendix G, *Mitigation and Monitoring*, Table G-1 and Attachment G-1, are incorporated as part of the Proposed Action and applicable action alternatives in the Final EIS. Additional mitigation and monitoring measures that BOEM may require to further avoid, minimize, or mitigate impacts on environmental resources are listed in Appendix G, Table G-2. Consultations under ESA Section 7 and the MSA, as well as the submission for and issuance of other necessary permits and authorizations under applicable statutes, including the MMPA, may result in additional measures or changes to these measures.

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

Table 2-1. Alternatives considered for analysis

Alternative	Description
Alternative A – No Action Alternative	Under Alternative A, BOEM would not approve the COP; the Project's construction and installation, operations and maintenance, and conceptual decommissioning would not occur; and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action 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 under the MMPA to the applicant. The current resource condition, trends, and impacts from ongoing activities under the No Action Alternative serve as the baseline against which the direct and indirect impacts of 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, *Planned Activities Scenario,* without the Proposed Action serves as the baseline for the evaluation of cumulative impacts.
Alternative B – Proposed Action	Under Alternative B, the construction, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore of Massachusetts would occur within the range of design parameters outlined in the SouthCoast Wind COP (SouthCoast Wind 2024a), subject to applicable mitigation measures. The Project would have a capacity of up to 2,400 MW and would consist of up to 147 WTGs in the Lease Area, up to 5 OSPs and associated export cables. SouthCoast Wind would space WTGs in a 1-by-1-nm offset grid pattern (east–west-by-north–south-gridded layout). The Project would include one preferred ECC, making landfall and interconnecting to the ISO New England Inc. (ISO-NE) power grid at Brayton Point, in Somerset, Massachusetts. The ECC to Brayton Point would have an intermediate landfall on Aquidneck Island, Rhode Island. The Project would also include one variant ECC which, if used, would make landfall and interconnect to the ISO-NE grid in the town of Falmouth, Massachusetts.
Alternative C – Fisheries Habitat Impact Minimization	Under Alternative C, the construction, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. However, the Project would include an onshore export cable route

Alternative	Description
	that would avoid placing the offshore export cable in the Sakonnet River to avoid impacts on fisheries habitats. Alternative C includes two possible onshore export cable routes. • Alternative C-1: Aquidneck Island, Rhode Island Route • Alternative C-2: Little Compton/Tiverton, Rhode Island Route
Alternative D – Nantucket Shoals (Preferred Alternative)	Under Alternative D, the construction, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. However, six WTGs (AZ-47, BA-47, BB-47, BC-47, BC-48, and BF-49) would be eliminated in the northeastern portion of the Lease Area to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals.
Alternative E – Foundation Structures	Under Alternative E, the construction and installation, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore Massachusetts would include a range of foundation types (monopile, piled jacket, suction bucket, and gravity based), subject to applicable mitigation measures. This alternative includes three foundation options, which assume the maximum use of piled (monopile and piled jacket), suction bucket, and gravity-based foundation structures to assess the extent of potential impacts from each foundation type. • Alternative E-1: Piled Foundations (monopile and piled jacket) only • Alternative E-2: Suction Bucket Foundations only • Alternative E-3: Gravity-based Foundations only
Alternative F – Muskeget Channel Cable Modification	Under Alternative F, the construction, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. However, to minimize seabed disturbance in the Muskeget Channel, the Falmouth offshore export cable route would use ±525kV HVDC cables connected to an HVDC converter station, instead of HVAC cables connected to offshore substations, and would only use up to 3 offshore export cables, instead of up to 5 offshore export cables.

HVDC = high voltage direct current; HVAC = high voltage alternating current

2.1.1 Alternative A – No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP. Project construction and installation, O&M, and decommissioning would not occur, and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to the applicant. The current resource condition, trends, and impacts from ongoing activities under the No Action Alternative serve as the existing baseline against which the 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 would be implemented, 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, *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

The Proposed Action is to construct, operate, maintain, and eventually decommission an up to 2,400-MW wind energy facility on the OCS offshore Massachusetts within the range of design parameters described in Volume 1 of the SouthCoast Wind COP (SouthCoast Wind 2024) and summarized in Appendix C, *Project Design Envelope and Maximum-Case Scenario*. The Project would be developed in two parts or projects: Project 1 refers to the development in the northern portion of the Lease Area and associated interconnection, and Project 2 refers to the development in the southern portion of the Lease Area and associated interconnection. The Project would consist of up to 149 structure positions to be occupied by up to 147 WTGs and up to 5 OSPs connected by interarray cables in the Lease Area, and one preferred offshore ECC making landfall at Brayton Point, Massachusetts with an intermediate landfall on Aquidneck Island, Rhode Island. This preferred ECC to Brayton Point would be used for both Project 1 and Project 2 in the Lease Area. The Project would also include one variant ECC which, if used, would make landfall and interconnect to the ISO-NE grid in the town of Falmouth, Massachusetts. In the event that technical, logistical, grid interconnection, or other unforeseen challenges arise during the design and engineering phase that prevent Project 2 from making interconnection at Brayton Point, Project 2 would use the Falmouth variant ECC and make landfall and interconnect in Falmouth, Massachusetts. Onshore facilities would include landfall locations, onshore export cables, up to two converter stations, up to one substation, underground transmission lines, and the utilities' points of interconnection (POI). Figure 2-1 presents the elements of the Proposed Action in the SouthCoast Wind Project area, and a description of construction and installation, O&M, and decommissioning activities to be undertaken for the Proposed Action is provided in Sections 2.1.2.1 through 2.1.2.3. Refer to Volume 1 of the SouthCoast Wind COP (SouthCoast Wind 2024) for additional details on Project design.

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 would begin in Quarter 1 of 2025 and would be completed in Quarter 4 of 2031. SouthCoast Wind anticipates initiating construction with onshore components followed by seabed preparations and concurrent construction of offshore components.

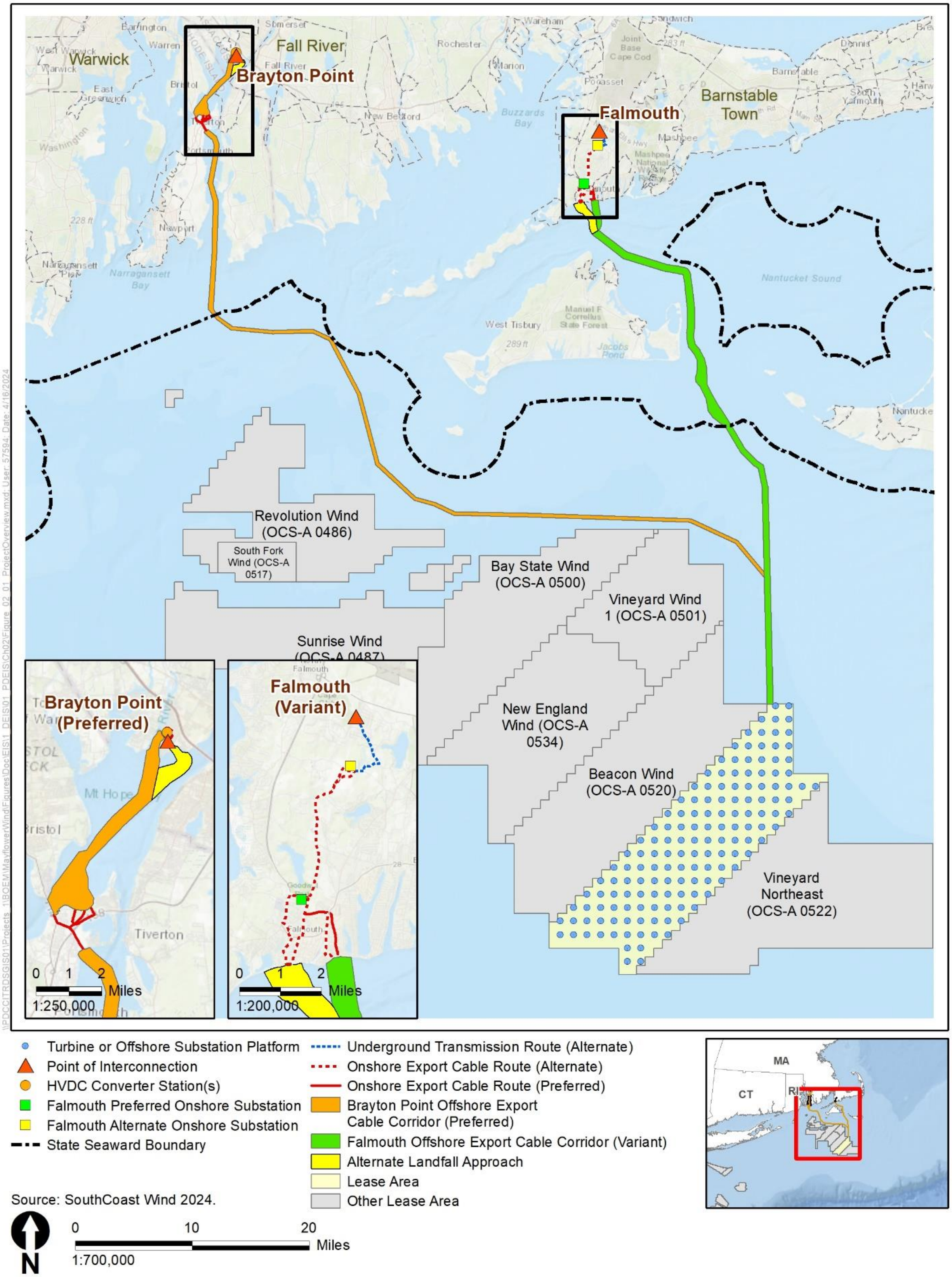


Figure 2-1. SouthCoast Wind Project area

An indicative project schedule that shows the timeline for construction activities for onshore and offshore project components is included in the SouthCoast COP Volume 1, Chapter 3.2, Figure 3-6 (SouthCoast Wind 2024) and is summarized below.

Onshore Converter Station/Substation	Q1 of 2025 to Q3 of 2029
OSP Installation and Commissioning	Q2 of 2026 to Q4 of 2030
Foundation Scour Protection and Seabed Preparation	Q1 of 2027 to Q3 of 2029
Foundation Installation	Q2 of 2028 to Q4 of 2030
Interarray Cable Installation and Commissioning	Q2 of 2028 to Q3 of 2030
Onshore and Offshore Export Cable Installation and Commissioning	Q4 of 2026 to Q4 of 2030
WTG Installation and Commissioning	Q2 of 2029 to Q4 of 2031

Onshore Activities and Facilities

Proposed onshore project elements include the landfall sites, the sea-to-shore transition that connects the offshore export cable to the onshore export cable, onshore export cable routes to the onshore converter stations or substation, and the connection from the onshore converter stations or substation to the existing grid. Appendix C, *Project Design Envelope,* describes the PDE for onshore activities and facilities, and the SouthCoast COP Volume 1, Section 3.3 provides additional details on construction and installation methods (SouthCoast Wind 2024). The onshore elements of the Proposed Action are included in BOEM's analysis in the EIS to support the analysis of a complete project; however, BOEM's authority under OCSLA extends only to the activities on the OCS.

Multiple landfall sites for the Brayton Point (preferred) and Falmouth (variant) offshore ECCs are under consideration as part of the PDE, though only one landfall site would be needed for each ECC. Landfall at two potential locations at Brayton Point in Somerset, Massachusetts are under consideration. If Falmouth is selected as the POI for Project 2, landfall at three potential locations in Falmouth, Massachusetts are under consideration (Figure 2-2). Appendix B, *Supplemental Information and Additional Figures and Tables*, contains detailed maps of the Proposed Action onshore cable routes. Two locations at Brayton Point in Somerset, Massachusetts, are considered feasible landfall locations for the Brayton Point offshore ECC (Figure 2-3). The Brayton Point Landfall Option A approaches the former Brayton Point Power Station from the west near the Lee River. This landfall occurs on previously disturbed property adjacent to the existing cooling towers and includes an open paved area to the south, which would be used for construction staging. The Brayton Point Landfall Option B approaches the former Brayton Point Power Station from the east near the Taunton River. This landfall would occur on the previously disturbed Brayton Point property at a paved parking lot.

The offshore export cable route to Brayton Point would include an intermediate landfall on Aquidneck Island, Rhode Island, where several potential landfall locations are under consideration. The purpose of the intermediate landfall on Aquidneck Island is to avoid a narrow and highly constrained area of the Sakonnet River at the old Stone Bridge and Sakonnet River Bridge. This area is being avoided because surveying, cable installation, burial, and operation is significantly challenging.

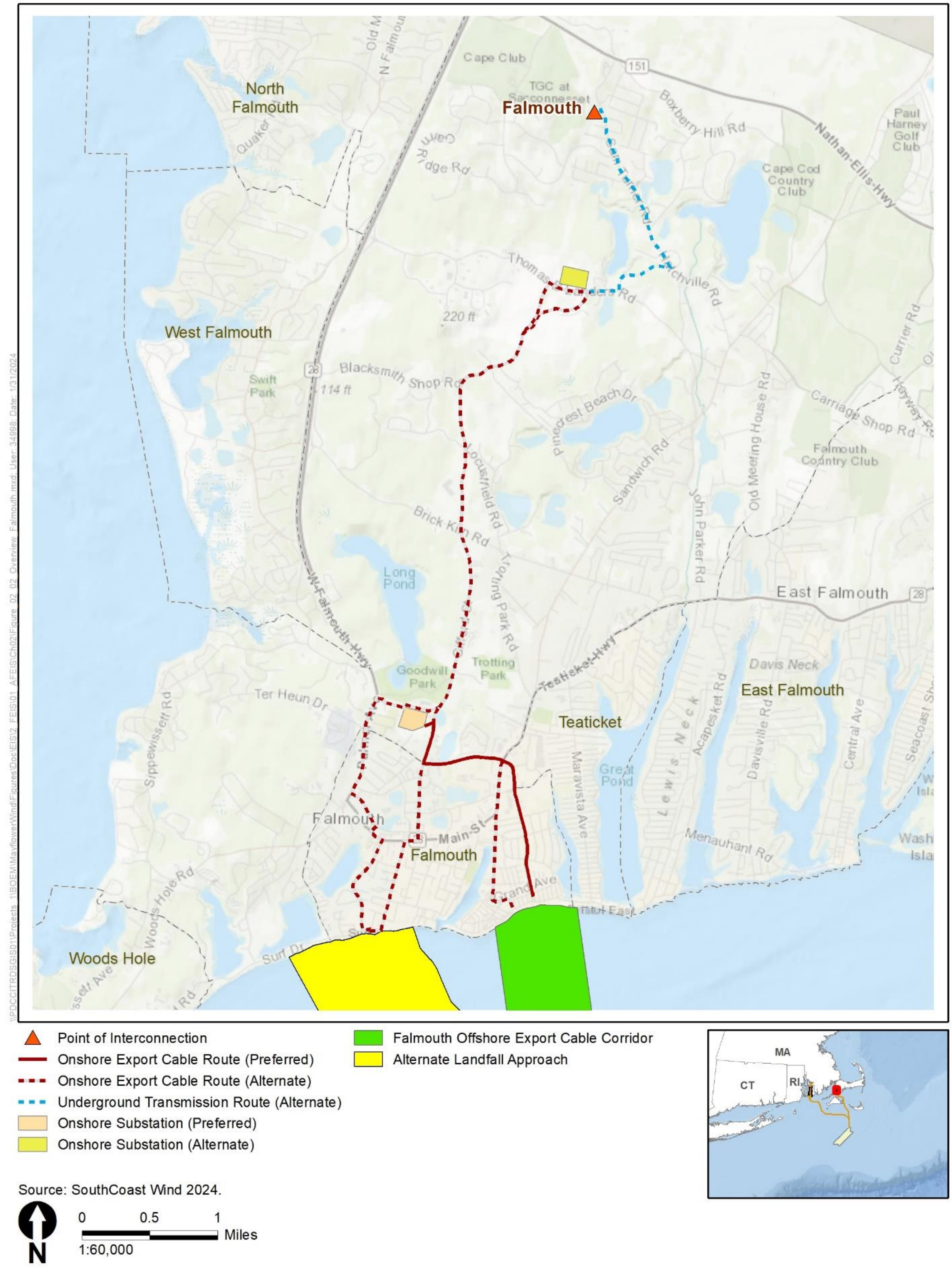


Figure 2-2. Onshore facilities for the proposed Project—Falmouth

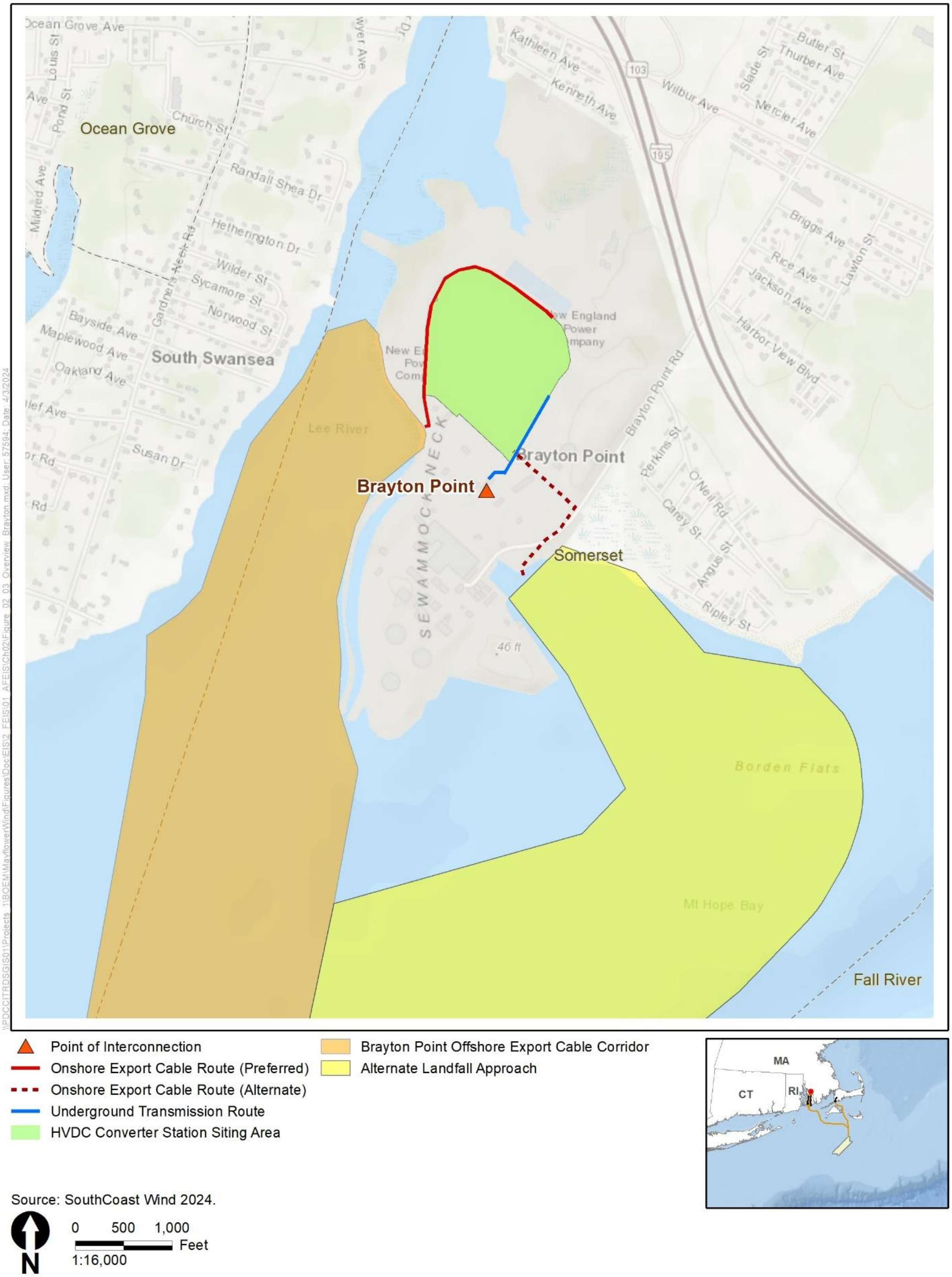


Figure 2-3. Onshore facilities for the proposed Project—Brayton Point

One location at the intersection of Boyds Lane and Park Avenue is being considered for the entry horizontal directional drilling (HDD) to Aquidneck Island. The export cables would exit Aquidneck Island into Mount Hope Bay following one of three cable route options, one of which has two suboptions (Figure 2-4). HDD exit locations under consideration include one location northeast of the Mount Hope Bridge (Route Option 1), one location on Roger Williams University property on Anthony Road (Route Option 2a) or along an existing overhead utility line corridor (Route Option 2b), and one location on the northeastern side of the Montaup Country Club golf course (Route Option 3). After exiting Aquidneck Island into Mount Hope Bay, the Brayton Point offshore ECC would then continue to make final landfall at one of the locations under consideration at Brayton Point in Somerset, Massachusetts.

If used under the Falmouth variant option, three locations in Falmouth, Massachusetts, are considered feasible landfall locations for the Falmouth offshore ECC (Figure 2-2).

- **Worcester Avenue:** This landfall site would be located on a previously disturbed, off-road, grassy median strip known as Worcester Park. This location is protected by a short seawall, a broad beach, and Surf Drive.
- **Central Park:** This landfall site would occur at a public recreational park at Central Park on Falmouth Heights Beach north of Grand Avenue. This landfall site is flanked on the southern side by paved parking spaces, which could be used for construction staging.
- **Shore Street:** This landfall site would be located on Surf Drive Beach at the intersection of Surf Drive and Shore Street. This location involves the potential crossing of two existing submarine cables that make landfall at Shore Street.

The landfall at Aquidneck Island would require HDDs at two locations: one entering and one exiting the island. For the Brayton Point offshore export cable and Falmouth offshore export cable, it is anticipated that the cables would be unbundled at landfall. Each individual power cable would require a separate HDD with an individual bore and conduit for each power cable. If a dedicated communications cable is used, it may be installed within the same bore as a power cable but would likely require a separate conduit.

Once the offshore export cables make landfall, depending on the landfall location, the cables would connect to up to two new high-voltage direct current (HVDC) converter stations at Brayton Point and, if the Falmouth ECC is used, one new onshore substation via the onshore cable route corridors shown on Figure 2-2 and Figure 2-3. One of the two Brayton Point onshore export cable routes and one of the three Falmouth onshore export cable routes (if the Falmouth ECC is used) would be used based on the landfall site selected. The Brayton Point onshore export cable would be no longer than 0.7 mile (1.1 kilometers) because of the proximity of the landfall site to the location of the new HVDC converter stations. Depending on the landfall site selected and the onshore substation chosen, the Falmouth onshore export cable would be between 1.9 miles (3.0 kilometers) and 6.4 miles (10.3 kilometers).

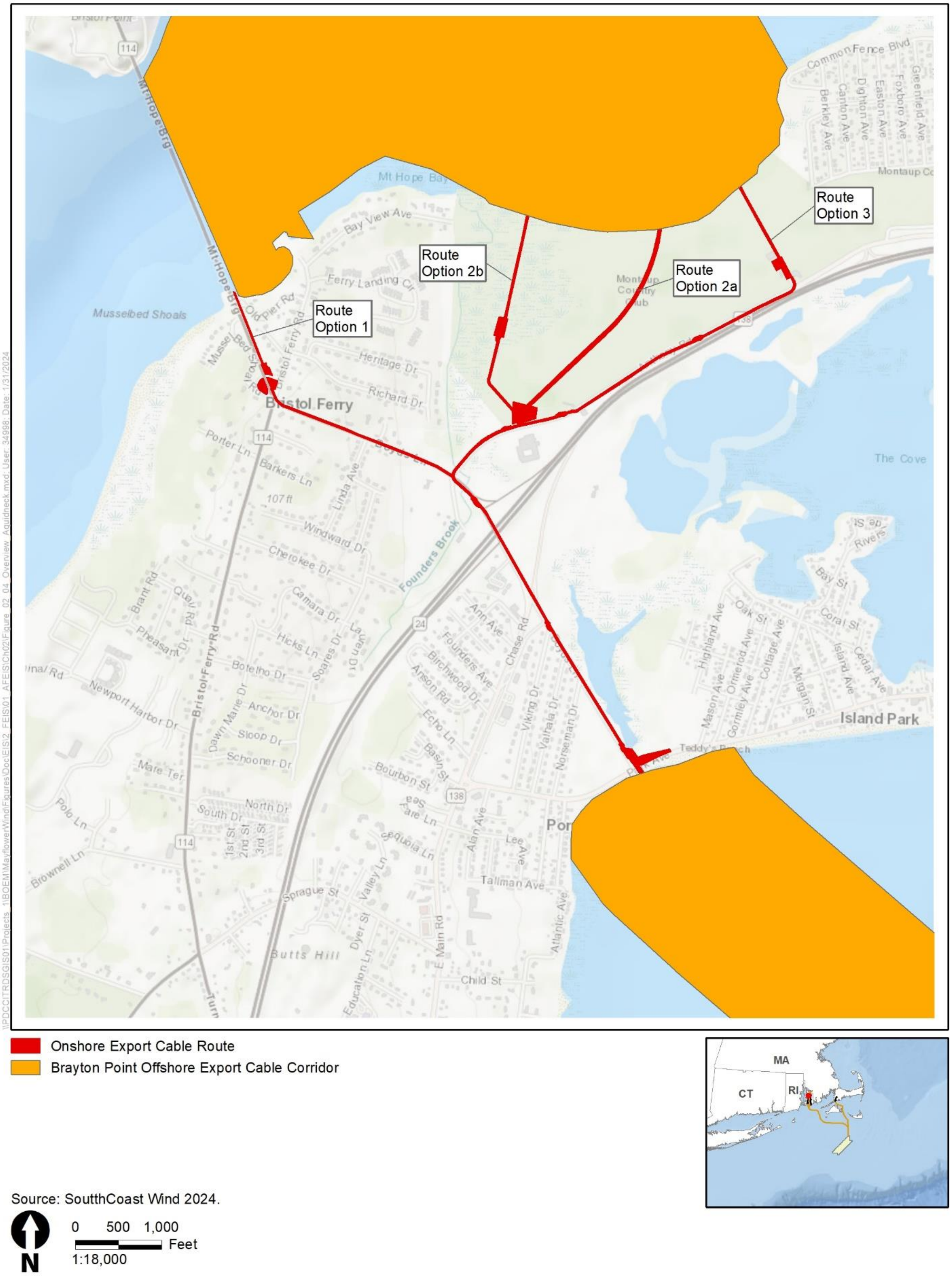


Figure 2-4. Onshore facilities for the proposed Project—Aquidneck Island

SouthCoast Wind would commission the development of up to two new HVDC converter stations to convert the Projects' HVDC power to 345-kilovolt (kV) HVAC for interconnection with the Brayton Point POI. The converter stations would be located on the northern portion of the former Brayton Point Power Station site, a former coal-fired plant that was decommissioned in 2017. The maximum footprint of each converter station site would be up to 7.5 acres (3 hectares). In the event that Falmouth is the selected POI for Project 2, SouthCoast Wind would commission the development of a new onshore substation to transform the underground export cable for interconnection with the Falmouth POI. There are two onshore substation locations under consideration. Onshore Substation Option A (SouthCoast Wind's preferred location) at the Lawrence Lynch site would be located west of Gifford Street and north of Jones Road in Falmouth, Massachusetts, on approximately 27.3 acres (11.05 hectares) of previously disturbed land. Onshore Substation Option B would be on the 33.6-acre (13.6-hectare) Cape Cod Aggregate site at the north end of Blacksmith Shop Road in Falmouth, Massachusetts.

At Brayton Point, an underground transmission route would connect the converter stations to the POI. If significant underground infrastructure from the decommissioned cooling towers prevents a suitable buried path, an overhead line to the POI may be required. In Falmouth, overhead transmission lines would connect the onshore substation to the POI. An alternate underground transmission route is also under consideration in the event overhead transmission lines are not feasible.

Offshore Activities and Facilities

The proposed offshore project components that collectively compose the Offshore Project area include WTGs, OSPs, substructures, scour protection, interarray cables, and offshore export cables. The proposed offshore Project elements are on the OCS as defined in OCSLA, with the exception that offshore export cables within 3 nm of the shore would be in state waters (Figure 2-1). Appendix C describes the PDE for offshore activities and facilities, and the SouthCoast COP Volume 1, Section 3.3 provides additional details on construction and installation methods (SouthCoast Wind 2024).

Within the 127,388-acre (51,552-hectare) Wind Farm Area, SouthCoast Wind would construct up to 149 substructures that support a combination of WTGs and OSPs in a 1-by-1-nm-grid layout with east–west and north–south orientation. SouthCoast Wind is considering three types of substructures: monopile, piled jacket, and suction-bucket jacket. Monopile and piled-jacket foundations are the two types primarily under consideration for WTG and OSP use. Suction-bucket jacket foundations may be used as substructures for WTGs and OSPs but would be restricted to up to 85 positions for Project 2 only. Monopile foundations typically consist of a single steel cylindrical pile that is embedded into the seabed and is made up of sections of rolled steel plate welded together. A transition piece is fitted over the monopile and secured via bolts or grout. Monopiles can be used to support both the WTGs and the Option A – Modular OSP. Piled jacket structures are large lattice structures fabricated of steel tubes welded together and consist of three- or four-legged structures to support WTGs and four-to nine-legged structures to support OSPs. Suction-bucket jackets have a similar steel lattice design as the piled jacket structures, but these substructures use suction-bucket jackets instead of piles to secure the structure to the seabed. Renderings of the substructure types are included in the SouthCoast COP Volume 1, Section 3.3.1 (SouthCoast Wind 2024).

For all substructure and foundation types, the seabed may be leveled in preparation for installation. SouthCoast Wind proposes to install substructures using jack-up, dynamic positioning, or semi-submersible vessels. For monopile and piled-jacket substructures, the foundations would be driven to the target seabed penetration depths using a hydraulic impact hammer, vibratory hammer, water jetting, or combinations of all three. Pile installation procedures would use a soft-start method with a gradual increase in hammering energy levels to warn marine and avian animals, allowing them to distance themselves from the construction activity. During the installation of suction-bucket jacket substructures, the open bottom of the bucket would settle on the seabed, then water and air would be pumped out of the bucket to create a negative pressure, which embeds the foundation bucket into the seabed. For all substructure types, scour protection, consisting of rock, concrete mattresses, sandbags, artificial seaweed/reefs/frond mats, or self-deploying umbrella systems (typically used for suction-bucket jackets), may be applied around foundations before or after installation, if required. The type and amount of scour protection used will vary depending on the substructure used. Renderings of the scour protection types are included in the SouthCoast COP Volume 1, Section 3.3.1.8 (SouthCoast Wind 2024).

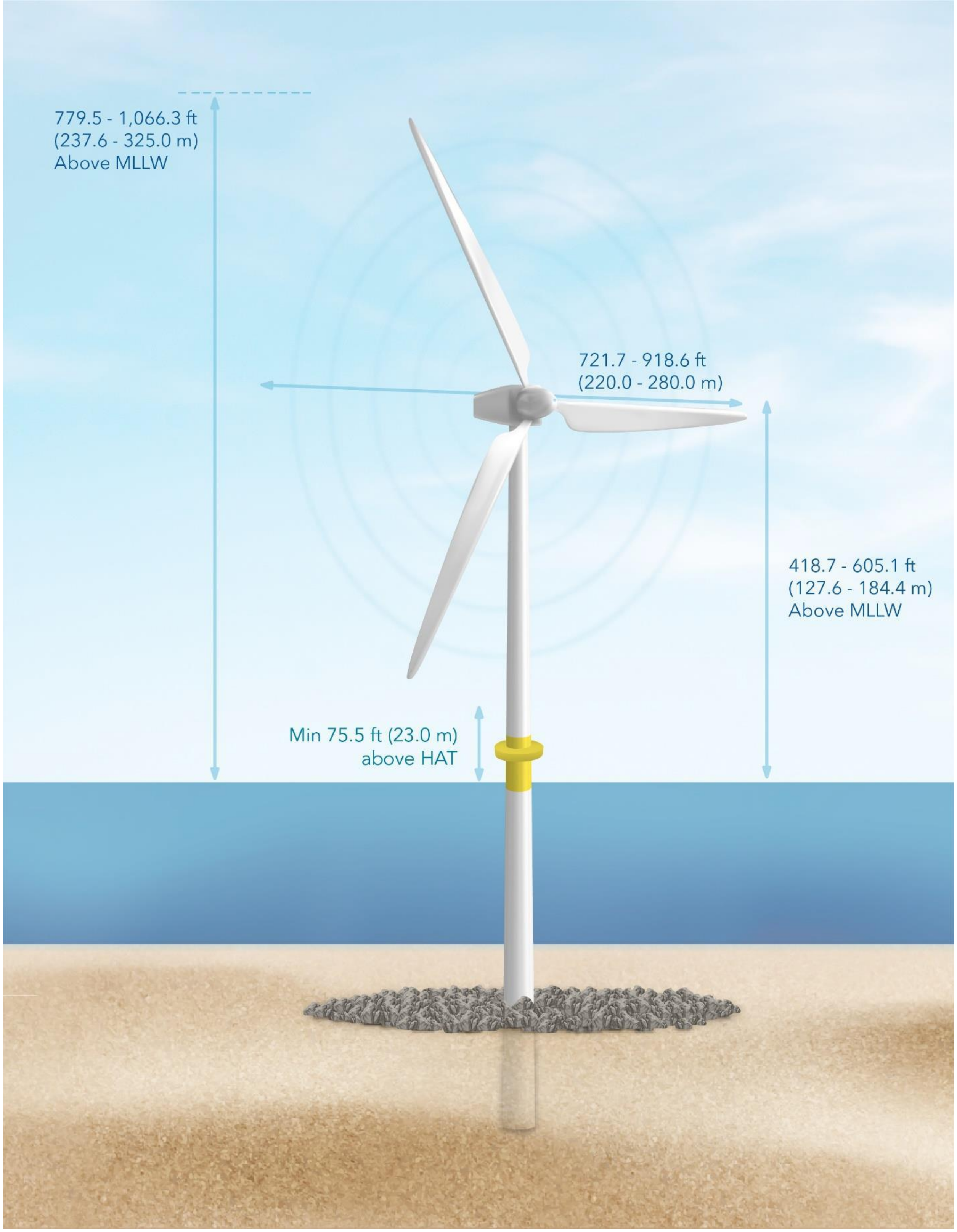
Up to 147 of the 149 substructure positions in the Wind Farm Area would support WTGs. WTGs would extend up to 1,066.3 feet (325.0 meters) at the highest blade tip height with a minimum tip clearance above highest astronomical tide of 75.5 feet (23 meters) (Figure 2-5).

The proposed Project would include up to five OSPs to collect the energy generated by the WTGs and would be located on the same 1-by-1-nm grid layout as the WTGs. OSPs help stabilize and maximize the voltage of power generated offshore, reduce potential electrical losses, and transmit energy to shore. Three OSP designs are under consideration: Option A – Modular, Option B – Integrated, Option C – HVDC Converter. Each OSP design would include a topside that houses electrical equipment and a foundation substructure to support the topside. The smallest topside structure would be Option A – Modular and would likely hold a single alternating current (AC) transformer with a single export cable. It would sit on any type of substructure design considered for the WTGs. Option B – Integrated is also an AC solution but is designed to support a high number of interarray cable connections, as well as multiple export cable connections and would contain multiple transformers in a single topside structure. Depending on the weight of the topside structure and soil conditions, the jacket substructure may have four or six legs and require one to three piles per leg. Because of its larger size, if Option B is selected, a smaller number of OSPs would be required to support the proposed Project. Option C – HVDC Converter would convert electric power from high-voltage alternating current (HVAC) to HVDC for transmission to the onshore grid system and would serve as a gathering platform for interarray cables or be connected to one or more HVAC gathering units, which would be similar to the Modular and Integrated OSP designs. The northernmost HVDC Converter OSP will be located outside of a 6-mile (10-kilometer) buffer from the 98-foot (30-meter) isobath from Nantucket Shoals. Due to its size, the HVDC Converter OSP would be installed on piled jacket substructures. Interarray cables would transfer electrical energy generated by the WTGs to the OSPs.

While the Project includes up to five OSPs, the most likely scenario is two HVDC OSPs, one for Project 1 (Brayton Point) and one for Project 2 (Brayton Point or Falmouth). SouthCoast Wind has selected an

HVDC converter OSP (Option C) for Project 1. If HVDC is selected for Project 2, which is the most likely scenario, there would be one HVDC OSP for Project 2 in addition to the HVDC OSP for Project 1 (for a total of two HVDC OSPs). If HVAC is selected for Project 2, SouthCoast Wind anticipates there would be one HVAC OSP for Project 2, in addition to the HVDC OSP for Project 1 (for a total of two OPSs) (COP Volume I Section 3.3.3; SouthCoast Wind 2024).

The WTGs and OSPs would be lit and marked in accordance with Federal Aviation Administration (FAA) and U.S. Coast Guard (USCG) lighting standards and consistent with BOEM best practices. SouthCoast Wind would implement an Aircraft Detection Lighting System (ADLS) to automatically activate lights when aircraft approach. Lighting would be placed on all structures and would be visible throughout a 360-degree arc from the surface of the water. Tower marking would include unique rows and columns of letters and numbers to maximize charting effectiveness. Reflective paint and lettering materials may be used to provide visibility at night.



Source: SouthCoast Wind 2024

Figure 2-5. Indicative wind turbine generator diagram

As proposed by SouthCoast Wind in the COP, Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2 (Figure 2-1), which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2. The Brayton Point ECC would start from the OSPs within the Lease Area and extend northwest through the Rhode Island Sound to the Sakonnet River. It would then extend northward until making intermediate landfall on Aquidneck Island in Portsmouth, Rhode Island, for a brief underground onshore export cable route section before entering into Mount Hope Bay and finally to the landfall at Brayton Point. The Falmouth ECC, if utilized, would begin from the OSPs in the Lease Area and extend northward through the Muskeget Channel, then turn northwest to the landfall site in Falmouth, Massachusetts. The Brayton Point ECC would use HVDC transmission technology and would use six single-core power cables with a voltage of up to ±320 kilovolt (kV) and up to two associated communications cables. The Falmouth ECC would use either HVAC or HVDC transmission technology and would have transmission export circuits that would consist of up to four power cable circuits and up to one associated communications cable. For HVAC transmission, one end of the transmission system would be the OSPs in the Lease Area that would step up the power from the WTG array to a voltage appropriate for long distance transmission. An HVDC system requires converters at each end of the transmission circuit, with converter station(s) located on the OSPs in the Lease Area and the other converter station(s) located onshore.

Interarray cables and the export cables would be installed similarly. Prior to installation, the area would be surveyed, and the seafloor would be prepared by removing boulders and buried hazards if applicable. Depending on the survey findings and seabed conditions, several preparation and installation methods and equipment may be used including a vertical injector, a jetting sled, jetting remotely operated vessel (ROV), pre-cut plow, mechanical plowing, mechanical cutting ROV system and anchoring. More information on cable installation methods can be found in the SouthCoast COP Volume 1, Section 3.3.5.4 (SouthCoast Wind 2024). Cable protection would be required at any cable crossing locations and for areas where cable burial depth cannot be achieved. Cable protection methods such as the creation of a rock berm, concrete mattress placement, rock placement, and fronded mattresses may be used. Considerations for interarray cables may include offshore physical hazards and economic or recreational use areas. Physical hazards may include shipwrecks, unexploded ordnance (UXO), other existing cables, and sea floor and subsurface obstructions. The primary strategy for UXO avoidance (if UXO is identified) will be microrouting of cables within the ECCs. More information on UXOs can be found in the SouthCoast COP Volume II, Section 4.2.1.7.1 (SouthCoast Wind 2024). Should any UXOs be encountered during preconstruction surveys or construction activities they will be handled in accordance with the best practices described in the U.S. Committee on the Marine Transportation System's National Guidance for Responding to Munitions and Explosives of Concern in Federal Waters. Should any UXOs require transportation for disposal, a Marine Protection, Research, and Sanctuaries Act permit may be required.

2.1.2.2 Operations and Maintenance

The proposed Project is anticipated to have a commercial lifespan of 35 years.[1] The location of the O&M facility has not been finalized; however, SouthCoast Wind is considering facilities at one of the Massachusetts-based marshalling ports used during construction and installation. The O&M facility would have trained staff, office space, and a warehouse for spare parts.

The proposed Project would include a comprehensive maintenance program, including preventative maintenance based on statutory requirements, original equipment manufacturers' guidelines, and industry best practices. SouthCoast Wind would inspect WTGs, OSPs, foundations, interarray cables, submarine and onshore export cables, and other parts of the proposed Projects using methods appropriate for the location and element. Additionally, SouthCoast Wind would maintain an Oil Spill Response Plan (OSRP), an Incident Management Plan, and a Safety Management System and would be expected to comply with U.S. Coast Guard (USCG) and Bureau of Safety and Environmental Enforcement (BSEE) regulations relating to prevention and control of oil spills.

Onshore Activities and Facilities

The onshore converter stations and substation would be designed to serve as unmanned stations and would not have an operator onsite during typical operation. However, the converter stations and substation would be inspected regularly and may require routine maintenance activities such as replacing or updating electrical components or equipment. The onshore export cables and the underground transmission cables would require periodic testing but should not require maintenance unless there is a failure.

Offshore Activities and Facilities

Routine maintenance is expected for WTGs, OSPs, and substructures. SouthCoast Wind would conduct annual maintenance of WTGs, including safety surveys and inspections for signs of wear on WTG components (SouthCoast COP Volume 1, Table 3-9; SouthCoast Wind 2024). Routine inspections and maintenance of switchgear and other equipment would occur annually at OSPs. Substructures would be inspected every 2 years for damage to the substructure, cracks at welds, excessive marine growth, signs of corrosion, and seabed scour. The offshore interarray and export cables would not be expected to require regular maintenance, except for manufacturer-recommended cable testing.

[1] SouthCoast Wind's lease with BOEM (Lease OCS-A 0521) has an operational term of 33 years that commences on the date of COP approval. (https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/MA/Lease-OCS-A-0521.pdf; see also 30 CFR 585.235(a)(3).) SouthCoast Wind would need to request an extension of its operational term from BOEM in order to operate the proposed Projects for 35 years. For the purposes of maximum-case scenario and to ensure NEPA coverage if BOEM grants such an extension, the Final EIS analyzes a 35-year operational term.

SouthCoast Wind would use vessels, remote-sensing equipment, vehicles, and aircraft during the O&M activities described above. The Project would use a variety of vessels to support O&M including crew-transfer vessels, service operation vessels, anchor-handling tugs, and jack-up vessels. In a year, the Proposed Action would generate approximately 100 crew-transfer vessel trips, 1 jack-up vessel trip, and 24 supply vessel trips; and a maximum of 250 helicopter trips (SouthCoast COP Volume 1, Section 3.3.14.2, Table 3-23; SouthCoast Wind 2024). Additional vessels/vehicles may be used as needed (e.g., ROV for inspections/repairs).

2.1.2.3 Decommissioning

Under 30 CFR 285 and commercial Renewable Energy Lease OCS-A 0521, SouthCoast Wind would be required to remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seabed of all obstructions created by the proposed Project. All foundations would need to be removed 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)). Absent permission from BOEM, SouthCoast Wind 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. SouthCoast Wind has submitted a conceptual decommissioning plan as part of the COP, and the final decommissioning application would outline SouthCoast Wind's process for managing waste and recycling proposed Project components (SouthCoast COP Volume 1, Section 3.3.19; SouthCoast Wind 2024). Although the proposed Project is anticipated to have an operational life of 35 years, it is possible that some installations and components may remain fit for continued service after this time. SouthCoast Wind would have to apply for and be granted an extension if it wanted to operate the proposed Project for more than the 33-year operations term stated in its lease.

BOEM would require SouthCoast Wind to submit a decommissioning application upon the earliest of the following dates: 2 years before the expiration of the lease, 90 days after completion of the commercial activities on the commercial lease, or 90 days after cancellation, relinquishment, or other termination of the lease (30 CFR 285.905). Upon completion of the technical and environmental reviews, BOEM may approve, approve with conditions, or disapprove the lessee's decommissioning application. This process would include an opportunity for public comment and consultation with municipal, state, and federal management agencies. SouthCoast Wind would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed 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, SouthCoast Wind would have to submit a bond (or another form of financial assurance) 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 SouthCoast Wind would not be able to decommission the facility.

Onshore Activities and Facilities

At the time of decommissioning, some components of the onshore electrical infrastructure may still have substantial life expectancies. Onshore export and transmission cables would likely be retired in place; however, if removal would be required, the cables would be pulled out of the transition vault and duct banks and sent to repurposing or recycling facilities. Depending on the needs at the time, the onshore facilities would be left in place for possible future use or demolished and materials recycled.

Offshore Activities and Facilities

For both WTGs and OSPs, decommissioning is anticipated to be the reverse of construction and installation, with turbine components or the OSP topside structure removed prior to foundation removal. Foundations that penetrate the seabed would be cut 15.0 feet (4.6 meters) below the mudline in accordance with 30 CFR 295.910 or may be removed completely. SouthCoast Wind would assess the removal of scour protection and select a strategy that minimizes environmental impacts. Decommissioning of the topside structures for WTGs and offshore substations would include removal of all WTG components including removal of the rotor, nacelle, blades and tower and removal of the OSPs' topside structures. Materials would be brought onshore for recycling and disposal. Interarray cables and offshore export cables may be retired in place or extracted from the seabed via dredging vessels.

2.1.3 Alternative C – Fisheries Habitat Impact Minimization

Alternative C was developed through the scoping process for the Final EIS in response to comments received from NMFS and other agencies expressing concern with the potential impact of the offshore export cable on fisheries, Essential Fish Habitat (EFH), and Habitat Areas of Particular Concern (HAPC) in the Sakonnet River. The Sakonnet River supports EFH for several fish and invertebrate species at varying life stages including HAPCs for Summer flounder and Atlantic Cod. To address this concern, BOEM developed onshore cable route options that would avoid placing the Offshore Export Cable in the Sakonnet River. Under this alternative, the construction, O&M, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. BOEM worked with SouthCoast Wind to identify feasible onshore cable routes to avoid the Sakonnet River and identified two onshore route alternatives as described below and shown on Figure 2-6. Appendix B contains detailed maps of the Alternative C onshore cable routes.

Alternative C-1: Aquidneck Island, Rhode Island Route (Figure 2-6). The onshore export cables would generally be located within existing public road ROW along the following described routes. Cable would primarily be placed in road shoulders and medians but may also include off-road areas such as private property and transmission line ROWs, and could involve crossings of streams, wetlands, and other sensitive areas. Alternative C-1 runs the length of Aquidneck Island with two variations, but ultimately traveling along Route 138. Alternative C-1 would make landfall at the Second Beach parking lot in Middletown, Rhode Island, via HDD under the municipal public beach from Sachuest Bay. From the landfall, Alternative C-1 would proceed inland through Middletown via a western variation or eastern variation before reaching Route 138. From landfall, the western variation would proceed along Hanging Rock Road, Paradise Avenue, Berkley Avenue, Wyatt Road, Turner Road and Route 138 (to Mitchell's Lane) (4.1 miles total distance). The eastern variation would proceed along Hanging Rock Road, Third Beach Avenue, and Mitchell's Lane before reaching Route 138 (4 miles total distance). Both segments pass by parks and reserves, and both segments pass through wetlands and natural heritage areas. The eastern variation abuts more reserves and natural heritage areas than the western variation. The roadways along the variants are predominately local, two-lane roads without paved shoulders. The roads are frequently abutted by old stone walls, large trees with canopies overhanging the road, and overhead utility poles. The western variation has slightly wider road widths and more developed surroundings.

The western and eastern variations rejoin at the intersection of Route 138 and Mitchell's Lane, continuing north on Route 138 into Portsmouth (4.5 miles). Route 138 is a four-lane road without paved shoulders, abutted by commercial properties and residences. When the route reaches Boyd's Lane, it follows the same route as the Proposed Action to Brayton Point (Figure 2-4). Alternative C-1 would reduce the total offshore export cable route by 9 miles (14 kilometers) and increase the total onshore export cable route by 9 miles (14 kilometers).

Alternative C-2: Little Compton/Tiverton, Rhode Island Route (Figure 2-6). Alternative C-2 would make landfall on the ocean facing side of Breakwater Point, in the parking lot across from the Sakonnet Harbor. The area is constrained, with the parking lot separated from water by only a narrow strip of riprap coast. The surface grades may not allow for sufficient HDD burial depth in the approach to the onshore entry pit. From Breakwater Point the route follows Route 77 through Little Compton and into Tiverton; once in Tiverton, the route turns east onto Route 177 to Fish Road (12.9 miles total). From this point, Alternative C-2 would follow Fish Road (north) to Souza Road (west), which turns into Schooner Drive (2.9 miles total). Both Route 77 and Route 177 are two-lane roads with minimal paved shoulders. Fish Road and Souza Road are both narrow two-laned roads without paved shoulders. Schooner Drive is the access road to the residential Village at Mount Hope Bay and Boat House Waterfront Dining restaurant. Schooner Drive ends at the bottom of a hill, where there is an open area with a cul-de-sac that could serve as the onshore HDD installation area for cable entrance into Mount Hope Bay. Schooner Drive also includes a bridge over an abandoned railroad right-of-way, which would require a trenchless installation method. Alternative C-2 would reduce the total offshore export cable route by 12 miles (19 kilometers) and increase the total onshore export cable route by 13 miles (21 kilometers). Similar to Alternative C-1, Alternative C-2 would be located mostly in road ROWs but may also cross private property and transmission and railroad ROWs.

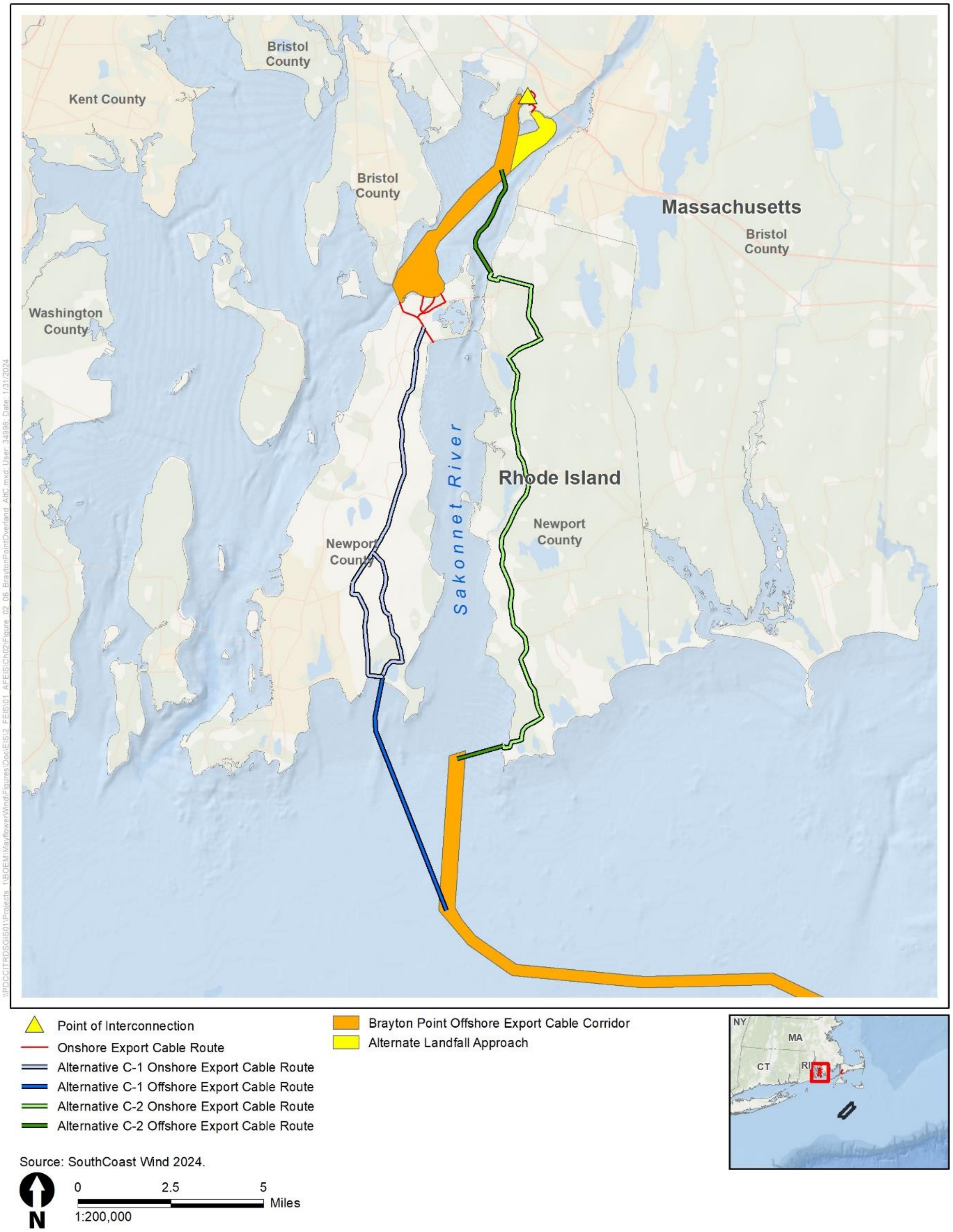


Figure 2-6. Alternative C fisheries habitat impact minimization

2.1.4 Alternative D – Nantucket Shoals

Alternative D was developed through the scoping process to address potential impacts on protected species in the northeastern portion of the Lease Area. Following installation of foundations, a commenter speculated that the presence of WTGs in the northeastern portion of the Lease Area may alter the foraging habitat associated with the physical hydrodynamic features along the western edge of Nantucket Shoals. However, modeling of the full build out of the entire southern New England lease areas indicates that minor, local changes to the physical hydrodynamic features may occur on the western side of Nantucket Shoals adjacent to the BOEM lease areas (Johnson et al. 2021). In addition, the National Academies of Sciences, Engineering, and Medicine recently evaluated the potential of offshore wind farms to alter the hydrodynamic processes that impact prey abundance and availability in the Nantucket Shoals region (NASEM 2024). The NASEM study included the following relevant conclusions: (1) "The paucity of observations and uncertainty of the modeled hydrodynamic effects of wind energy development at the turbine, wind farm, and regional scales make potential ecological impacts of turbines difficult to predict and/or detect." (2) "The hydrodynamic impacts from offshore wind development in the Nantucket Shoals region on zooplankton will be difficult to isolate from the much larger magnitude of variability introduced by natural and other anthropogenic sources (including climate change) in this dynamic and evolving oceanographic and ecological system."

Based on best available science, BOEM believes there is a lack of conclusive evidence that the removal of proposed turbine locations in the northeastern portion of the Lease Area would measurably lessen the minor impacts on the hydrodynamic features. Nonetheless, Nantucket Shoals is an area of high productivity with higher abundances of amphipods, chlorophyll, birds, and North Atlantic right whale (NARW) (Figure 2-7). Nantucket Shoals has high foraging value for several species, including NARW at different times of the year as well as seabirds and seaducks. Consequently, BOEM has developed this alternative to address the environmental concern that wildlife may be subject to increased impacts in this area. Under Alternative D, six WTGs (AZ-47, BA-47, BB-47, BC-47, BC-48, and BF-49) in the northeastern portion of the Lease Area would be eliminated to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals (Figure 2-7).

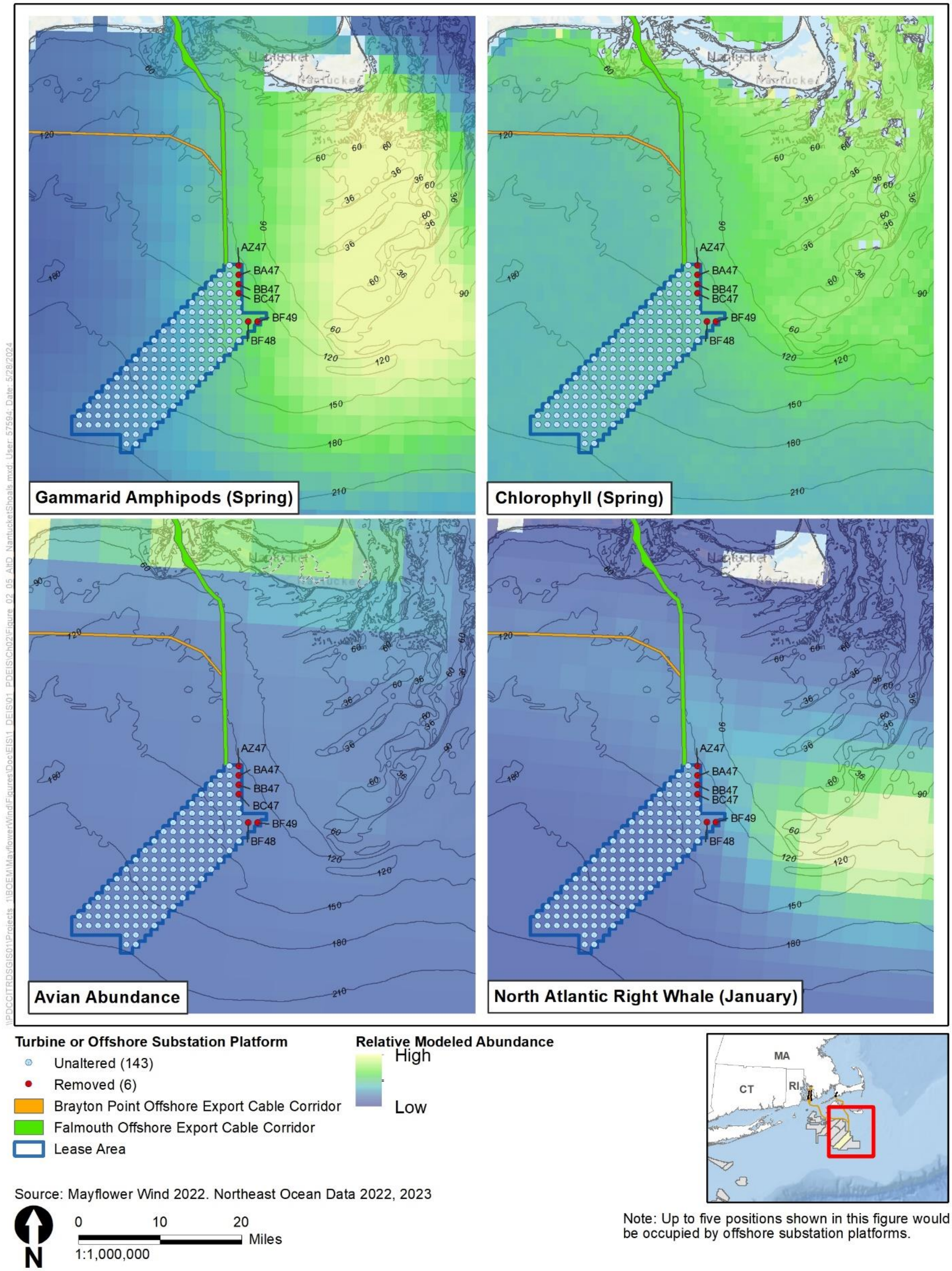


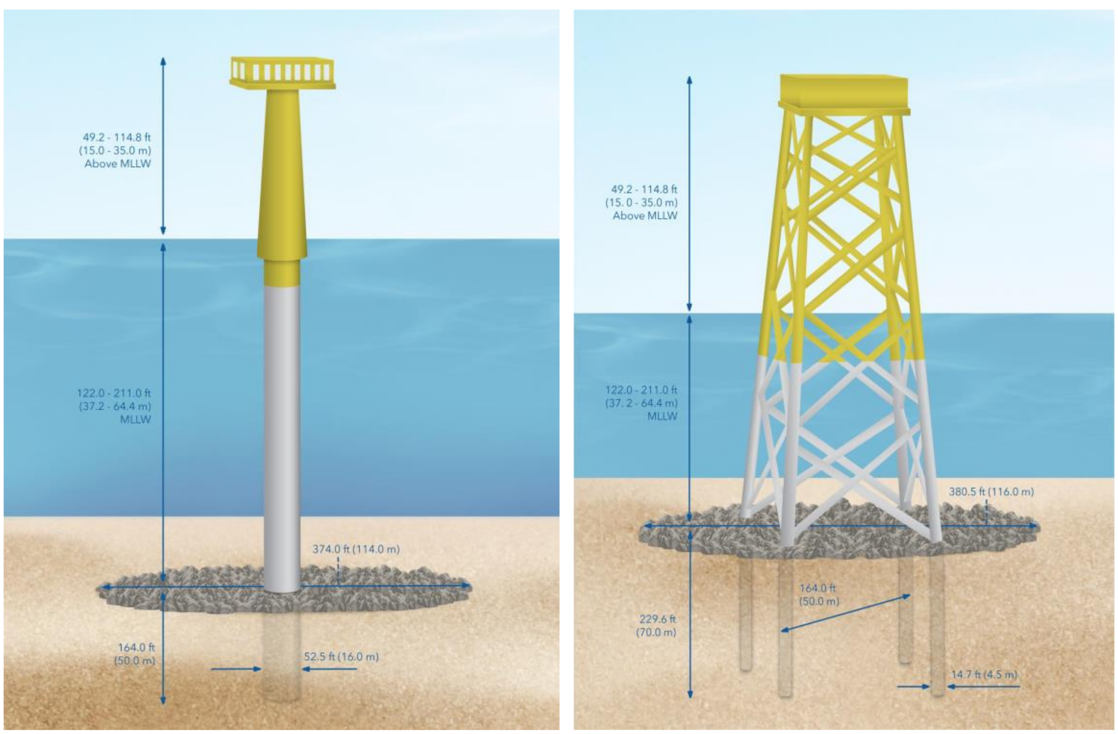
Figure 2-7. Alternative D Nantucket Shoals—elimination of six WTGs

2.1.5 Alternative E – Foundation Structures

Alternative E was developed through the scoping process for the Final EIS to address options posed in the SouthCoast Wind COP and in response to comments received from multiple commenters on construction noise related to foundation installation. Alternative E addresses the possibility for one or more foundation types to be utilized for WTGs and OSPs and includes three sub-alternatives, which detail the different foundation structures. This EIS analyzes the maximum potential impacts on each environmental resource from each type of foundation: piled (monopile and piled jacket), suction bucket, and GBS foundations. Following the release of the Draft EIS, SouthCoast Wind revised the COP to remove GBS as a potential foundation for WTGs and OSPs and restrict possible locations of WTGs and OSPs with suction-bucket jacket foundations to up to 85 positions for Project 2 only. While these foundation options have been removed from or restricted in location under the Proposed Action (Alternative B), BOEM has retained these foundation options for the entire Lease Area under Alternative E for analysis in the Final EIS. A representation of the impacts that could occur given the choice of foundation type per project can be found in Table 2-2. The table looks at the maximum extent of how each foundation type could affect a resource.

2.1.5.1 Alternative E1 – Piled Foundations

Under this alternative, the use of 149 monopile and/or piled jacket foundation structures (Figure 2-8) to support up to 147 turbines and up to 5 OSPs would be analyzed for the extent of impacts.



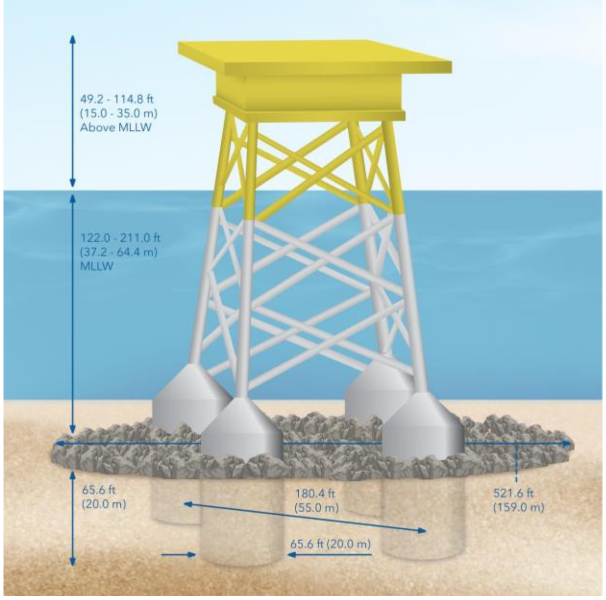
Monopile Foundation　　　　Piled Jacket Foundation

Source: SouthCoast Wind 2024

Figure 2-8. Piled foundations

2.1.5.2 Alternative E2 – Suction Bucket Foundations

Under this alternative, the use of 149 suction bucket foundation structures (Figure 2-9) to support up to 147 turbines and up to five OSPs would be analyzed for the extent of impacts.

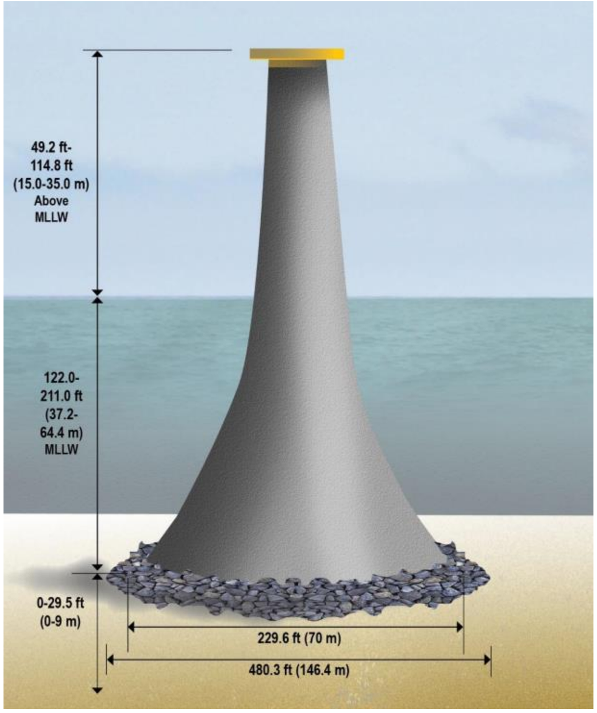


Source: SouthCoast Wind 2024

Figure 2-9. Suction-bucket foundations

2.1.5.3 Alternative E3 – Gravity-Based Structure Foundations

Under this alternative, the use of 149 GBS foundations (Figure 2-10) to support up to 147 turbines and up to five OSPs would be analyzed for the extent of impacts.



Source: Mayflower Wind 2022
Note: Indicative diagram of single-footed GBS Substructure

Figure 2-10. Gravity-based structure foundations

Table 2-2. Resource effects by foundation type

Resource Effect	Foundation Types		
	Monopile and Piled Jacket	Suction Bucket Jackets	Gravity-based Structures
Structures	149 structures (up to 147 WTGs and 5 OSPs)	149 structures (up to 147 WTGs and 5 OSPs)	149 structures (up to 147 WTGs and 5 OSPs)
Habitat Loss: • Species displacement and/or mortality • Soft-bottom habitat loss	Foundations will be positioned to avoid areas of sensitive seafloor and benthic habitat to the extent practicable. However, habitat conversion would occur due to the number of foundations and scour protection. Maximum permanent footprint area (foundation and scour protection) per WTG of 2.61 acres and per OSP of 9.79 acres.	Soft bottoms may be removed during seabed preparation. Maximum permanent footprint area (foundation and scour protection) per WTG or OSP of 4.9 acres.	Greatest area of habitat conversion. Maximum permanent footprint area (foundation and scour protection) per WTG of 11.55 acres and per OSP of 10.9 acres.
Artificial Reefs: • Introduction of organisms that grow on the surfaces of foundations • Increased food source and source of prey	Increased aggregation of fish near structures; more opportunities around piled jackets than monopiles. The amount of scour protection present may also increase aggregation.	Similar to the piled jacket, the suction bucket jacket provides an increased area for aggregation.	Similar to the piled jacket, GBS would provide an increased opportunity for aggregation.
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 foundation and scour protection.	Similar risk to the monopile and piled jacket but with increased surface area associated with foundation legs and area of scour protection.	Larger risk given the increased surface area of the foundations and sour protection.

Resource Effect	Foundation Types		
	Monopile and Piled Jacket	Suction Bucket Jackets	Gravity-based Structures
Wake and Scour: • Increased concentration and/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 permanent footprint area (foundation and scour protection) per WTG of 2.61 acres and per OSP of 9.79 acres.	Maximum permanent footprint area (foundation and scour protection) per WTG or OSP of 4.9 acres.	Maximum permanent footprint area (foundation and scour protection) per WTG of 11.55 acres and per OSP of 10.9 acres.
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	Some seabed preparation may be required especially if seabed is not sufficiently level. In addition to permanent foundation and scour protection, an additional 0.5 acre of temporary seabed disturbance per foundation.	Some seabed preparation may be required especially if seabed is not sufficiently level. In addition to permanent foundation and scour protection, an additional 0.6 acre of temporary seabed disturbance per foundation.	Seabed preparation is required and may include rock layer/scour protection and dredging. In addition to permanent foundation and scour protection, an additional 1.0 acre of temporary seabed disturbance per WTG foundation and 1.5 acre per OSP foundation.
Attraction: • Refuge/resting areas for sheltering from currents and/or predation • Increased prey availability due to artificial reef effect and wake effect • Increased predation rates due to higher predator abundance	Much like the effect of artificial reefs, foundation structures could have a beneficial effect on local bird populations due to consequent increases in fish aggregations near structures.	Similar to the effect of artificial reefs.	Similar to the effect of artificial reefs.

Resource Effect	Foundation Types		
	Monopile and Piled Jacket	Suction Bucket Jackets	Gravity-based Structures
Avoidance Effects: • Displacement of species from the Wind Farm Area • Disruption of migration routes	During installation, there may be temporary displacement of species in the area. See *Acoustic* below for installation timeframes.	Similar to the monopile and piled jacket, but the temporary displacement may be more related to the scour protection installation	Similar to the monopile and piled jacket, but the temporary displacement may be more related to the scour protection installation
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 for piled jacket foundations would occur for 2 hours per foundation with a maximum of 8 piles installed per day. Impact pile driving for monopile would occur for 4 hours per foundation with a maximum of 2 piles installed per day.	Sounds related to the construction, O&M, and decommissioning of the Project are expected to be much less than impulsive pile driving	Sounds related to the construction, O&M, and decommissioning of the Project are expected to be much less than impulsive pile driving.

2.1.6 Alternative F – Muskeget Channel Cable Modification

Alternative F was developed to minimize impacts on complex habitats and reduce seabed disturbance in the Muskeget Channel east of Martha's Vineyard in response to concerns from NMFS. Under Alternative F, the construction, operations and maintenance, and eventual decommissioning of the Project on the OCS offshore Massachusetts would occur within the range of the design parameters outlined in the SouthCoast Wind COP, subject to applicable mitigation measures. However, to minimize seabed disturbance in the Muskeget Channel, the Falmouth offshore export cable route, if used for Project 2, would use ±525kV HVDC cables connected to one HVDC converter OSP in the Lease Area, instead of HVAC cables connected to one or more HVAC OSPs as proposed under the Proposed Action. The OSP design for the offshore export cables connecting to Brayton Point for Project 1 would remain unchanged from the Proposed Action. As a result, there would be two HVDC converter OSPs under Alternative F: one HVDC converter OSP for Brayton Point (Project 1) and one HVDC converter OSP for Falmouth (Project 2). In addition, Alternative F would use up to three offshore export cables to Falmouth, instead of up to five offshore export cables under the Proposed Action.

As stated under the Proposed Action, SouthCoast Wind has proposed the Falmouth ECC as a variant option that would only be used for Project 2 if there are technical, logistical, grid interconnection, or other unforeseen challenges that arise during the design and engineering phase that prevent Project 2 from making interconnection at Brayton Point. Therefore, Alternative F would only be applicable if SouthCoast Wind is unable to use the Brayton Point POI for Project 2 and must utilize the Falmouth POI.

2.2 Alternatives Considered but Not Analyzed in Detail

Under NEPA, a reasonable range of alternatives framed by the purpose and need must be developed for analysis for any major federal action. The alternatives should be "reasonable," which the DOI has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action" (43 CFR 46.420(b). There 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 (43 CFR 46.415(b)). 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 comment received during the public scoping period for the EIS. BOEM then evaluated the alternatives and dismissed from further consideration alternatives that did not meet the purpose and need, the screening criteria, or both, as outlined in BOEM's Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act (BOEM 2022). Table 2-3 lists the alternatives and the rationale for their dismissal. These alternatives are presented with a brief discussion of the reasons for their elimination as prescribed in CEQ regulations at 40 CFR 1502.14(a) and USDOI regulations at 43 CFR 46.420(b)–(c).

Table 2-3. Alternatives considered but not analyzed in detail

Alternative Dismissed	Justification for Dismissal
Generating Capacity	
WTG generation capacities that analyze different deployment ranges of WTG MW generation capacities	One commenter requested that BOEM analyze different deployment ranges of WTG MW generation capacities to potentially reduce project impacts. This alternative is not practicable or economically feasible. In light of SouthCoast Wind's selection as a 1,287-MW multistate project by Massachusetts and Rhode Island, selection of WTG design(s) with specific nameplate capacities cannot be deferred until the ROD under the current market conditions (State of Massachusetts 2024). Specifically, waiting until the ROD is issued for the government to decide whether to select a turbine capacity for Project 1 of the Project would undermine the integrity of SouthCoast Wind's bid and a selection of a WTG outside of SouthCoast Wind's PDE would render the project infeasible by invalidating the final contract negotiations for the multistate award, which includes WTG specifications and economic assumptions based on the capacity of the WTG, and creating delays that would prevent the ability for SouthCoast to meet the required 2030 COD for Project 1. Notably, BOEM's analysis of the Project includes a review of the PDE included in the SouthCoast Wind COP, which describes a range of potential design options for WTGs. The EIS assesses the impacts of the reasonable range of designs described using a "maximum-case scenario" that considers the PDE parameters (or combination of parameters) that represent the greatest effect for an individual impact for each environmental resource.
Wind Turbine Array Layout	
Transit lanes through Lease Area for safe and efficient access through the Massachusetts and Rhode Island Wind Energy Areas, including from Long Island ports to fishing grounds	BOEM's navigation subject matter expert considered proposed transit lane alternatives proposed by the New York Department of State and the RODA) and found that transit lanes would cause funneling of vessel traffic and create choke points and intersections, leading to denser traffic with no associated vessel transit or navigational safety benefit. Furthermore, BOEM determined that the presence of these lanes would likely create a conflicting use scenario, regardless of corridor width and layout. Therefore, BOEM did not identify any other alternatives to the proposed lanes proposed by the commenters that would meet the navigational needs identified by the commenters. Additionally, the 1-by-1-nm grid layout included in the SouthCoast Wind COP is consistent with the findings in the USCG *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study* (MARIPARS) and is intended to maximize safety and navigation consistency (USCG 2020). The MARIPARS concluded that "a standard and uniform grid pattern with at least three lines of orientation and standard spacing to accommodate vessel transits, traditional fishing operations, and search and rescue (SAR) operations, throughout the Massachusetts and Rhode Island Wind Energy Areas would allow for safe navigation and continuity of USCG missions through seven adjacent wind farm areas." Finally, transit corridors analyzed as alternatives in the Vineyard Wind 1 and South Fork EISs were not found to measurably increase navigation safety and were ultimately not selected.
Preclude the development of WTGs within a 20-kilometer buffer of the Nantucket	The primary basis for the recommended alternative, as presented by NMFS, is the potential for the presence of WTGs to result in hydrodynamic effects that change zooplankton productivity and aggregations, which may reduce foraging opportunities for the NARW. Based on best available science, BOEM believes there is a lack of

Alternative Dismissed	Justification for Dismissal
Shoals 30-meter isobath	conclusive evidence that the proposed WTG locations within the Lease Area have the potential to result in hydrodynamic effects on NARW foraging in the vicinity of Nantucket Shoals.[2] Best available science suggests that effects are most likely to be localized to the immediate vicinity of the turbine array and to not extend to Nantucket Shoals. Primary studies supporting this position include modeling of the full build-out of the southern New England lease areas (Johnson et al. 2021), hydrodynamic studies of wind facilities in the North Sea (Christiansen et al. 2022), and recent comprehensive literature reviews (NASEM 2024). In particular, the National Academies of Sciences, Engineering, and Medicine (NASEM) study was commissioned to "evaluate the potential for offshore wind farms in the Nantucket Shoals region to affect oceanic physical processes, and, in turn, how those hydrodynamic alterations might affect local regional ecosystems." The study, titled *Potential Hydrodynamic Impacts of Offshore Wind Energy on Nantucket Shoals Regional Ecology: An Evaluation from Wind to Whales,* concluded that "the impacts of offshore wind projects on the NARW and the availability of their prey in the Nantucket Shoals will likely be difficult to distinguish from the significant impacts of climate change and other influences on the ecosystem" (NASEM 2024). Furthermore, the key recommendation from the study is "while wind energy planning and development progresses, the BOEM, NOAA, and others should promote observational studies and modeling that will advance understanding of potential hydrodynamic effects and their consequent impacts on ecology in the Nantucket Shoals region during all phases of wind energy development." Notably, the study did not recommend halting offshore wind development in any of the areas near Nantucket Shoals. BOEM is also supporting additional research on this topic, in accordance with NASEM recommendations. BOEM does not assert there are no effects from wind turbine wake and corresponding wind speed and clarifies that the effects likely would not have a detectable effect on foraging and would not have population-level impacts on important species including NARW. Without impacts on foraging and a reasonable causal connection to population impacts, NMFS' reasoning for this alternative is not justifiable or persuasive. NMFS has not demonstrated its 12.4-mile (20-kilometer) buffer alternative is warranted or provided any new information to support it, and current available peer-reviewed studies and data constituting best available science do not conclude that there would be a reasonable expectation of population-level impacts. Furthermore, BOEM determined this alternative is economically infeasible and not consistent with the Project purpose and need to provide up to 2,400 MW of clean, renewable wind energy to the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island, whom each of which have existing state offshore wind procurement laws in place, as well as decarbonization goals and targets. Under this alternative, a total of 53 WTGs would be eliminated, leaving 94 WTG and 2 OSP positions remaining; 85 WTGs and 1 OSP, out of the remaining 96 positions would be

[2] Two of the primary conclusions from the NASEM 2024 report *Potential Hydrodynamic Impacts of Offshore Wind Energy on Nantucket Shoals Regional Ecology: An Evaluation from Wind to Whales* demonstrate that it is not reasonable to conclude eliminating a large number of WTGs from SouthCoast Wind would have a significant beneficial effect. Specifically, "**Conclusion:** The paucity of observations and uncertainty of the modeled hydrodynamic effects of wind energy development at the turbine, wind farm, and regional scales make potential ecological impacts of turbines difficult to predict and/or detect." and "**Conclusion:** The hydrodynamic impacts from offshore wind development in the Nantucket Shoals region on zooplankton will be difficult to isolate from the much larger magnitude of variability introduced by natural and other anthropogenic sources (including climate change) in this dynamic and evolving oceanographic and ecological system."

Alternative Dismissed	Justification for Dismissal
	needed for Project 1, assuming the use of a 15 MW WTG model. BOEM determined the use of a 15 MW WTG for Project 1 is a reasonable assumption based on the PDE in the COP and RFI responses from SouthCoast Wind. SouthCoast Wind needs the 85 WTGs for Project 1 to achieve the 1,287 MW in planned offtake that SouthCoast Wind was selected for by Massachusetts and Rhode Island (State of Massachusetts 2024b). SouthCoast Wind confirmed that its Project 1 bid includes the shallowest WTG positions in its lease (which also overlap with the positions that are closest to Nantucket Shoals and to shore) because they provide the most cost-competitive rates for consideration for an award. Consequently, if BOEM were to relocate the majority of the WTG positions for Project 1 into deeper waters it would invalidate SouthCoast Wind's bid that was selected by Massachusetts and Rhode Island. In addition, under this alternative, for Project 2 SouthCoast would only have 9 WTGs and 1 OSP left with a total nameplate capacity of 162 MW, assuming 18 MW WTGs were used. BOEM determined the use of an 18 MW WTG for Project 2 is a reasonable assumption based on the PDE in the COP and RFI responses from SouthCoast Wind. The smallest single-state bid that a New England state has sought in a procurement since 2022 is 600 MW for Rhode Island (State of Rhode Island 2022). A 162 MW project falls well below this amount and the multistate solicitations between Rhode Island, Massachusetts and Connecticut are only seeing multistate bids that are around 800 MW and above (State of Massachusetts 2024c). SouthCoast Wind is planning to bid Project 2 into one or more future solicitations competed by New York State, Massachusetts, and Rhode Island, which require between 400 and 1,000 MW of offtake per award. If this alternative was analyzed in detail, it would preclude SouthCoast Wind from competing in any of these upcoming solicitations because it would invalidate any bids over 162 MW. Furthermore, BOEM and NREL conducted technical-economic modeling of SouthCoast Wind Projects 1 and 2 and found this alternative to be economically infeasible due to uneconomical increases in the Levelized Cost of Energy. Consequently, this alternative is not reasonable under NEPA because it is not consistent with the purpose and need, nor SouthCoast Wind's primary goals, and is not economically feasible or practicable and would, therefore, be equivalent to the No Action Alternative. Notably, other reasonable and feasible alternatives and mitigation measures to reduce potential impacts on NARWs and sea ducks are analyzed in detail. For example, Alternative D would remove six WTGs from development that are in areas with the greatest presence of protected species and highly productive habitats for foraging. In addition, BOEM is proposing additional mitigation measures to reduce potential impacts on protected species, most notably NARW, and their food sources (refer to Appendix G, *Mitigation and Monitoring*, Table G-2). Therefore, restricting WTG development within 20-kilometer of the Nantucket Shoals 30-meter isobath was not carried forward.
Eliminate up to 17 WTGs in the northeastern portion of the Lease Area	After determining that the alternative proposed by NMFS to "preclude the development of WTGs within a 20-km buffer of the Nantucket Shoals 30-meter isobath" was infeasible, BOEM reviewed the available information under the COP and designed a potentially feasible alternative that addressed many of the concerns raised by NMFS. This alternative would have eliminated up to 17 WTGs in the northeastern portion of the Lease Area to reduce potential impacts on this important foraging area for protected species, such as NARW and sea ducks. However, after reviewing the results of the NASEM 2024 study and obtaining additional information through RFIs, BOEM has also determined that this alternative is unreasonable and should not be analyzed in detail because it is not justified by best available science; it is inconsistent with

Alternative Dismissed	Justification for Dismissal
	SouthCoast Wind's primary goals; and the alternative is not economically feasible or practicable and would be equivalent to the No Action Alternative. The primary basis for the recommended alternative, as presented by NMFS, is the potential for the presence of WTGs to result in hydrodynamic effects that change zooplankton productivity and aggregations, which may reduce foraging opportunities for NARW. Based on best available science, BOEM believes there is a lack of conclusive evidence that the proposed WTG locations within the Lease Area have the potential to result in hydrodynamic effects on NARW foraging in the vicinity of Nantucket Shoals. [3] Best available science suggests that effects are most likely to be localized to the immediate vicinity of the turbine array and to not extend to Nantucket Shoals. Primary studies supporting this position include modeling of the full build-out of the southern New England lease areas (Johnson et al. 2021), hydrodynamic studies of wind facilities in the North Sea (Christiansen et al. 2022), and recent comprehensive literature reviews (NASEM 2024). In particular, the NASEM study was commissioned to "evaluate the potential for offshore wind farms in the Nantucket Shoals region to affect oceanic physical processes, and, in turn, how those hydrodynamic alterations might affect local regional ecosystems." The study, titled *Potential Hydrodynamic Impacts of Offshore Wind Energy on Nantucket Shoals Regional Ecology: An Evaluation from Wind to Whales,* concluded that "the impacts of offshore wind projects on the NARW and the availability of their prey in the Nantucket Shoals will likely be difficult to distinguish from the significant impacts of climate change and other influences on the ecosystem" (NASEM 2024). Furthermore, the key recommendation from the study is "while wind energy planning and development progresses, the BOEM, NOAA, and others should promote observational studies and modeling that will advance understanding of potential hydrodynamic effects and their consequent impacts on ecology in the Nantucket Shoals region during all phases of wind energy development." Notably, the study did not recommend halting offshore wind development in any of the areas near Nantucket Shoals. BOEM is also supporting additional research on this topic, in accordance with NASEM recommendations. BOEM does not assert there are no effects from wind turbine wake and corresponding wind speed and clarifies that the effects likely would not have a detectable effect on foraging and would not have population-level impacts on important species including NARW. Without impacts on foraging and a reasonable causal connection to population impacts, NMFS's reasoning for this alternative is not justifiable or persuasive. SouthCoast Wind confirmed that its Project 1 bid includes the shallowest WTG positions in its lease (which also overlap with the positions that are closest to Nantucket Shoals and to shore) because they provide the most cost-competitive rates for consideration for an award. Consequently, if BOEM were to relocate 17 of the WTG positions for Project 1 into deeper waters it would invalidate SouthCoast Wind's bid, which was selected by Massachusetts and Rhode Island. Furthermore, under the assumptions that

[3] Two of the primary conclusions from the NASEM 2024 report *Potential Hydrodynamic Impacts of Offshore Wind Energy on Nantucket Shoals Regional Ecology: An Evaluation from Wind to Whales* demonstrate that it is not reasonable to conclude eliminating a large number of WTGs from Beacon Wind would have a significant beneficial effect. Specifically, "**Conclusion:** The paucity of observations and uncertainty of the modeled hydrodynamic effects of wind energy development at the turbine, wind farm, and regional scales make potential ecological impacts of turbines difficult to predict and/or detect." and "**Conclusion:** The hydrodynamic impacts from offshore wind development in the Nantucket Shoals region on zooplankton will be difficult to isolate from the much larger magnitude of variability introduced by natural and other anthropogenic sources (including climate change) in this dynamic and evolving oceanographic and ecological system."

Alternative Dismissed	Justification for Dismissal
	SouthCoast Wind's Project 1 would use 15 MW WTGs and Project 2 would use 18 MW WTGs, the elimination of 17 WTGs under this alternative would only leave 46 positions for 45 WTGs and 1 OSP for Project 2. BOEM and NREL conducted technical-economic modeling of the Projects 1 and 2 and found this alternative to be economically infeasible due to uneconomical increases in the Levelized Cost of Energy for Project 2 specifically that would result from eliminating 17 WTG positions from Project 1. By negating SouthCoast Wind's ability to develop an economical Project 2 within the Lease Area, BOEM determined this alternative is economically infeasible and not consistent with the project purpose and need to provide up to 2,400 MW of clean, renewable wind energy to the northeast United States, including Massachusetts, Connecticut, and/or Rhode Island, whom each of which have existing state offshore wind procurement laws in place as well as decarbonization goals and targets. Notably, other reasonable and feasible alternatives, and mitigation measures, to reduce potential impacts on NARWs and sea ducks have been considered in detail. For example, Alternative D would remove six WTGs from development that are in areas with the greatest presence of protected species and highly productive habitats for foraging. In addition, BOEM is proposing additional mitigation measures to reduce potential impacts on protected species, primarily NARW, and their food sources (refer to Appendix G, Table G-2). Therefore, an alternative eliminating up to 17 WTGs in the northeastern portion of the Lease Area was not carried forward.
Technology Alternatives	
Closed-loop cooling at the offshore HVDC converter station	Commenters recommended that BOEM consider an alternative that would include closed-loop cooling systems within HVDC converter stations to minimize impacts on aquatic habitat and species. BOEM's independent market research (Middleton and Barnhart 2022) found that a closed-loop cooling system for an offshore wind HVDC converter station has not been implemented in any operational projects to date. BOEM further collaborated with NREL in spring 2024 to conduct additional market research on closed-loop HVDC converter station availability and found that while no closed-loop cooling systems are currently installed and operating, plans for procurement of closed-loop *air-cooled* HVDC converter stations were maturing in Germany and the Netherlands. Specifically, the Transmission System Operator for the Netherlands and a portion of Germany, TenneT, has plans titled "The 2GW Program" which would deploy a series of closed-loop, air-cooled, temporarily manned HVDC converter stations between 2029 and 2031 (TenneT 2024a). However, BOEM and NREL further assessed that aspects of the approach taken by TenneT made it economically and technically infeasible as an alternative for U.S. projects that are advanced in design, including SouthCoast Wind. For example, SouthCoast Wind's HVDC converter station is designed to be unmanned, while the air-cooled HVDC converter station design selected by TenneT requires temporary manning for up to 48 people to support necessary commissioning and maintenance activities (TenneT 2024b). Under current industry standards, a design that supports temporary manning leads to larger and more complex structures that include living quarters and additional utility and support systems. The design of offshore HVDC converter stations involves the integration of many different systems and subsystems so that incorporating a closed-loop air-cooled system and temporary manning facilities would require a new platform design. Furthermore, the current offshore wind substation supply chain requires a developer to schedule equipment procurement and installation far in advance so that redesign of the platform could result in extensive project delays. (BOEM and NREL estimated that the TenneT design would not be available to U.S.

Alternative Dismissed	Justification for Dismissal
	developers until the 2030s). Likewise, it may not be cost-effective and may not even be technically feasible to retrofit a closed-loop cooling system into a platform originally designed for an open-loop, once-through seawater system. Finally, BOEM and NREL also evaluated the potential availability of closed-loop *subsea* cooling systems for HVDC converter stations. BOEM and NREL found that there are subsea cooling designs used in offshore gas facilities, but they are not yet adapted to offshore wind. BOEM and NREL also found that there have been efforts to mature novel subsea cooling designs for HVDC converter stations, but they have not be successfully installed and are not yet a proven as a reliable technology. For example, the planned final design and deployment of Future Subsea Controllable Cooler (FSCC) test units in the European Union were both cancelled. Consequently, BOEM and NREL found they are not technically and economically feasible for SouthCoast Wind given the lack of technological maturity and supply chain at present. BOEM will continue to monitor the development of closed-loop HVDC converter station designs for potential use in future offshore wind projects.
Alternative offshore renewable energy technologies, including offshore solar, hydrokinetic energy, and floating offshore wind technologies	One commenter requested that BOEM consider renewable offshore energy alternatives to the Project, including offshore floating solar, hydrokinetic energy, and offshore floating wind. However, none of these would meet the purpose and need for the Proposed Action. Furthermore, the lease allows only the submission of a COP for offshore wind energy development. Development of offshore solar or marine hydrokinetics is not permitted under this lease. The development of floating offshore wind is unlikely to be commercially viable within the time frame of this Project. Additionally, the majority of the SouthCoast Wind Lease Area is in relatively shallow water depths not suitable for floating technology, which could cause challenges with mooring and dynamic cabling.
Export Cables	
Common cable corridor that would use a predetermined corridor, for projects adjacent to each other, in which to run cables, as well as a shared landing point	Commenters requested that BOEM consider an alternative that would use common cable corridors for adjacent projects. One commenter requested that BOEM also consider an alternative where the shared cable corridor would lead to a common landing point at Brayton Point. BOEM cannot dictate that the lessee use a shared cable corridor. As stated in 30 CFR 585.200(b), “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.” While BOEM could require a lessee to use a previously existing shared cable corridor established by a ROW grant (30 CFR 585.112) when the use of the shared cable corridor is a technically and economically practical and feasible alternative for the proposed Project, BOEM cannot limit a lessee’s right to a project easement when such a cable corridor does not exist and there is no way of determining if the use of a future shared cable corridor would be a technically and economically practical and feasible alternative for the proposed Project. Therefore, BOEM cannot require the applicant to use a non-existent shared cable corridor for this proposed Project. Moreover, it would be impractical for SouthCoast Wind’s export cables to share a corridor with the known corridors of other nearby projects because they would connect to the power grid via different onshore interconnection points. These include Vineyard Wind (Barnstable, Massachusetts), South Fork Wind (Suffolk County, New York), New England Wind (Barnstable, Massachusetts), Revolution Wind (North Kingstown, Rhode

Alternative Dismissed	Justification for Dismissal
	Island), or Sunrise Wind (Brookhaven, New York). In addition, a shared cable corridor may not be technically feasible as cable collocation may conflict with industry standards.
Offshore cable corridor to avoid the Sakonnet River by following a western passage around Aquidneck Island	A commenter requested that BOEM consider an in-water routing that follows a western passage to Brayton Point to the west of Aquidneck Island to avoid or minimize impacts on complex benthic habitats in the Sakonnet River. Offshore export cable routes to the west of Aquidneck Island in Narragansett Bay were considered by SouthCoast Wind as part of its route selection process, which included a route west of Conanicut Island (west passage) and a route east of Conanicut Island (east passage). The Rhode Island CRMC expressed concerns with fisheries activities in both the west and east passages, as well as conflicts with U.S. Navy restricted areas in the east passage per 33 CFR 334.80, 334.81, 334.82). In addition, SouthCoast Wind consulted with the Rhode Island CMRC and was advised that an ECC traversing the western passage to Brayton Point would be unfavorable from a regulatory and stakeholder standpoint. Further, BOEM considered an alternative that would approve only the Falmouth POI and remove the Brayton Point POI. However, given the amount of electricity to be generated, the Falmouth POI does not have the capacity to receive all power generated from the proposed Project. At Falmouth specifically, the ISO-NE rules and reliability and planning requirements, in effect, limit a single point of interconnection to no more than 1,200 MW. In response to this limitation, SouthCoast Wind secured interconnection rights at Brayton Point to deliver the energy the Project would generate.
Onshore cable corridor options to avoid the Sakonnet River and Mount Hope Bay by following a primarily overland route to Brayton Point	Commenters requested that BOEM consider an alternative export cable route that would follow an overland route to Brayton Point to avoid the Sakonnet River and Mount Hope Bay. BOEM requested SouthCoast Wind assess the feasibility of an onshore route that would avoid these waterbodies. SouthCoast Wind identified two feasible overland routes that would avoid the Sakonnet River, and BOEM is carrying these routes forward for detailed analysis as Alternatives C-1 and C-2. BOEM and SouthCoast Wind determined there was not a feasible onshore route to avoid Mount Hope Bay. Based on the Massachusetts Department of Transportation (MassDOT) Utility Accommodation Policy on State Highway Right of Way (page 76, Section 12; Mass DOT 2013), a high voltage electric power transmission line (greater than 35kV) on bridge structures is generally not permitted except under extraordinary circumstances, and then only after a detailed analysis of all other construction methods or alternatives are determined not to be practicable. MassDOT reviewed a proposed alternative to hang high-voltage power cables from the Braga and Veterans Memorial bridges across the Taunton River and determined it was not feasible (MassDOT 2022). The Braga and Veterans Memorial bridges are considered critical infrastructure, and MassDOT considers it in its best interest to limit outside parties from accessing the bridge structures based on security considerations. Furthermore, the presence of a high-voltage power cable on the bridges may preclude MassDOT from performing required maintenance activities on both bridges. In addition, SouthCoast Wind has coordinated with the Rhode Island Department of Transportation about bridge use, and it was determined that using a bridge to hang an electrical cable was unfeasible due to various factors including liability, responsibility, and technical challenges. Therefore, placing transmission lines on bridges to avoid Mount Hope Bay was determined not be feasible and was eliminated from further consideration. In addition, a non-bridge option to avoid Mount Hope Bay was evaluated using Taunton River and Westport River submarine/HDD crossings to establish a route passing north

Alternative Dismissed	Justification for Dismissal
	of the bay. However, this option was also deemed infeasible due to the lack of a feasible landfall near Westport Harbor and Westport Point. Therefore, a primarily overland crossing option north of Mount Hope Bay across the Taunton River was determined to not be feasible and was eliminated from further consideration.
Offshore cable route between Martha's Vineyard and Nomans Land that would result in an ECC to Brayton Point that is approximately 10 miles shorter than the proposed route	A commenter requested that BOEM consider alternative ECC routes from the lease area to Brayton Point that would result in an overall shorter cable and suggested that a route cutting between Martha's Vineyard and Nomans Land before connecting with the planned Brayton Point ECC route off the Elizabeth Islands would be a more direct and shorter cable route. The proposed SouthCoast Wind ECC to Brayton Point was determined to be the shortest feasible route from the Lease Area to Brayton Point identified through SouthCoast Wind's corridor selection process. An alternative route that cuts between Martha's Vineyard and Nomans Land Island was not considered to be feasible due to several technical challenges and risk factors, including shallow seabed bathymetry, high seabed mobility, seabed properties that are expected to be rocky with significant boulders, and the risk of encountering unexploded ordnance. In addition, routing the ECC between Martha's Vineyard and Nomans Island would create impacts on submerged ancient landforms within the Vineyard Sound and Moshup's Bridge Traditional Cultural Property.
Falmouth offshore cable route and landfall to avoid eelgrass	NMFS requested that BOEM consider an alternative that would avoid potential eelgrass meadows mapped along the shoreline at the Falmouth landfalls (refer to COP Appendix K, Attachment 1; SouthCoast Wind 2024). BOEM reviewed potential route options that would avoid eelgrass and also requested SouthCoast Wind explore feasible alternate route options. BOEM identified one landing location that avoided eelgrass and that was in reasonable proximity to the Project's onshore facilities (Figure 2-11). This landfall option was identified at the Menauhant Town Beach parking lot in East Falmouth, approximately 2 miles east of the Proposed Action landfall sites. After landfall, this route would follow Menauhant Road west, then north along Davisville Road to Massachusetts State Highway 28, where it would turn west along the highway until connecting back to the Proposed Action's route at Worcester Court. BOEM received input from MassDOT about the placement of the cable along roads in this area and they stated that a large portion is currently under moratorium and final roadway restoration may be extensive, there could be conflict with the Town of Falmouth projects, and there could be conflicts with new gas and sewer lines. BOEM also contacted the Town of Falmouth for input, and they were concerned about the cable landing at Menauhant Road and routing through dense neighborhoods, stating they were not interested in reviewing the alternative route because of these concerns. Furthermore, SouthCoast Wind is proposing HDD at the Falmouth landfall sites under the Proposed Action, which would generally avoid eelgrass because the cable would be bored underneath the eelgrass and the HDD punchout location offshore is deeper than the deepest eelgrass extent. The punchout locations are anticipated to be in water depths of 16.4 feet to 26.3 feet. For these reasons, BOEM eliminated this alternative from further consideration.

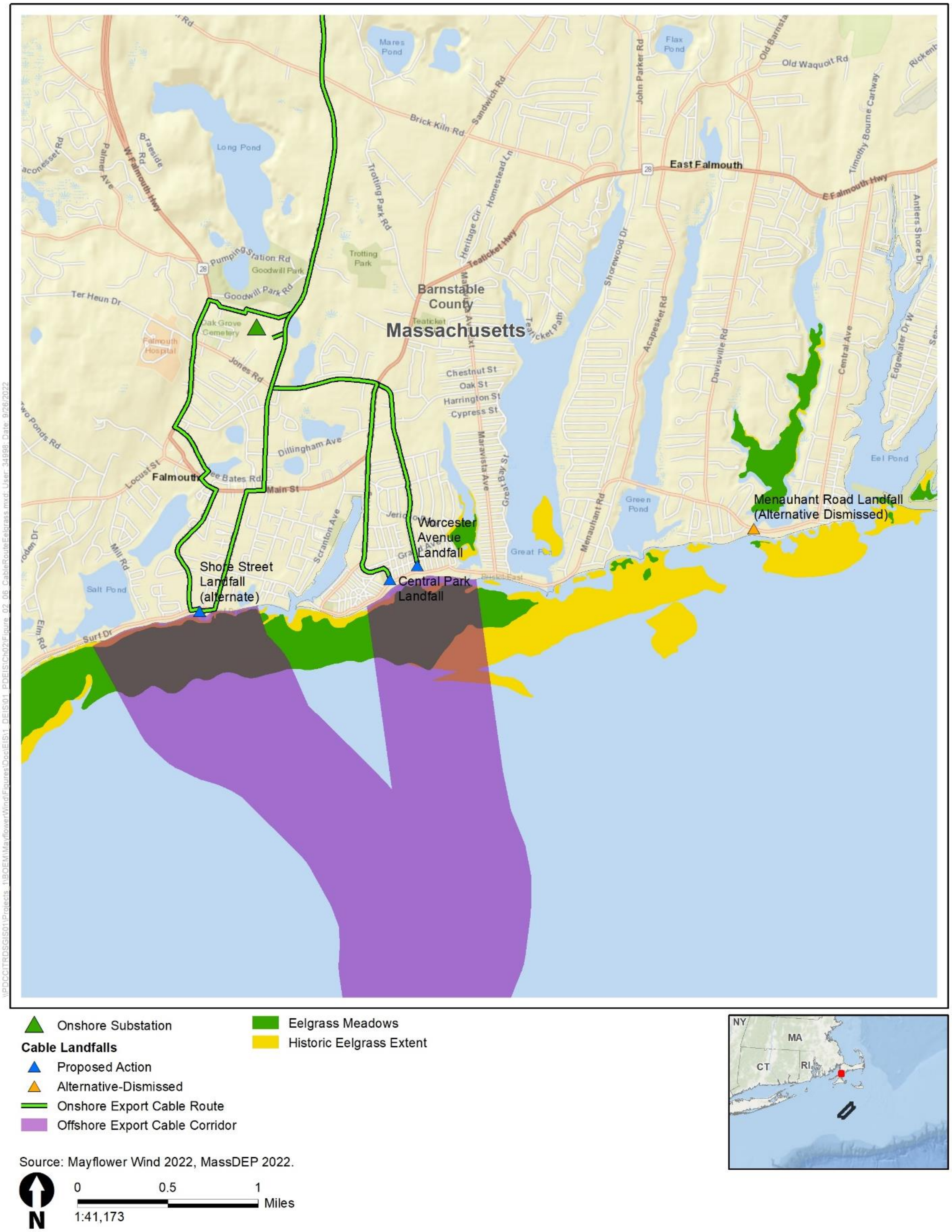


Figure 2-11. Alternative Falmouth Landfall Dismissed – Eelgrass Avoidance

2.3 Non-Routine Activities and Events

Non-routine activities and events 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 OSPs; cable displacement or damage by anchors or fishing gear; chemical spills or releases; severe weather and other natural events; fires; structural failures; 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. Impacts resulting from the accidental release of chemicals and debris from non-routine activities and events are described in Chapter 3, *Affected Environment and Environmental Consequences*, as applicable.

- **Repair or replacement activities:** These activities could be required as a result of other low-probability events, or as a result of unanticipated equipment wear or malfunctions. SouthCoast Wind would stock spare parts and have sufficient workforce available to conduct corrective maintenance activities, if required.
- **Collisions and allisions:** These could result in vessel damage, 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:
    - Adherence to Convention on the International Regulations for Preventing Collisions at Sea and the Inland Navigation Rules.
    - NOAA vessel speed restrictions.
    - The proposed spacing of WTGs and OSPs.
    - The inclusion of proposed Project components on NOAA navigation charts and in informational notices and publications.
- **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 SouthCoast Wind 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's features would be indicated on navigational charts, and the cable would be buried at least 3.2 feet (1 meter) deep or protected with rock berms, concrete mattresses, rock placement fronded mattresses, or half shells.
- **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. In the event of a spill, SouthCoast Wind and its contractors would follow the procedures outlined in the Project OSRP, which defines spill prevention measures, as well as provisions for communication, coordination, containment, removal, and mitigation of a spill. For onshore activities, these may include inadvertent releases from debris, spills from refueling, accidental release from construction equipment, and releases associated with horizontal directional drilling. All onshore waste likely to cause environmental harm would be stored in designated, secure, and bermed locations away from depressions and drainage lines that carry surface water

until collected by the selected waste contractor. To minimize and control spills, spill kits would be provided at all locations where hazardous materials are stored.

- **Severe weather and natural events:** Extratropical storms, including northeasters, are common in the Lease Area from October to April. These storms bring high winds and heavy precipitation, which can lead to severe flooding and storm surges. Hurricanes that travel along the coastline of the eastern U.S. have the potential to affect the Lease Area, which may impose hydrodynamic load and sediment scouring. Between 1982 and 2017, 20 historical storms identified as hurricanes crossed the Lease Area (COP Volume 2, Table 4-10; SouthCoast Wind 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. 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-years return interval event. An additional standard includes withstanding 3-second gusts of a 500-years 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.
- **Seismic activity:** The Lease Area is located in an area with low historical seismicity, and mapped faults in the area are considered to be inactive. Fault rupture hazard is not anticipated to be a hazard, and seismic hazards (e.g., liquefaction, strong ground shaking, lateral spreading) are not deemed to present a hazard to cables in the export cable corridor (COP Section 3.4.8; SouthCoast Wind 2024).
- **Fires:** Malfunction of WTGs or OSPs could potentially cause a fire. An Emergency Response Plan may be prepared by the lessee to provide clear instructions regarding procedures during emergency incident scenarios, which include fires. The impacts from fires would be similar to those assessed for severe weather and natural events.
- **Structural failure:** Failure of WTGs, met tower(s), or OSP(s) could result in safety concerns and potentially release chemicals and gases (e.g., lubricating oils, sulfur hexafluoride (SF_6), coolants, and fuels), which are addressed Section 2.3, *Non-Routine Activities and Events*, under *Chemical spills or releases*, and debris (e.g., fragments of human-made materials) into the marine and coastal environment. Corrective actions may be required and could include recovery of marine and onshore debris, salvage the damaged structure, use of explosives, and repair. These operations would likely require unplanned mobilization and utilization of various vessels and equipment such as cranes and possible damage to the seafloor from retrieval of fallen and sunken debris.
- **Terrorist attacks:** BOEM considers these unlikely, but impacts could vary depending on the magnitude and extent of any such attacks. The actual impacts of this type of activity would be the same as the outcomes listed above for severe weather and natural events. Therefore, terrorist attacks are not analyzed further.

2.4 Summary and Comparison of Impacts by Alternative

Table 2-4 provides a summary and comparison of the impacts under the No Action Alternative and each action alternative assessed in Chapter 3, *Affected Environment and Environmental Consequences*. The impacts described assume implementation of applicant-committed AMMs (Appendix G, *Mitigation and Monitoring,* Table G-1), but do not include agency-proposed measures (Appendix G, Tables G-2 through G-4). 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. Each Chapter 3 resource section provides definitions for **negligible**, **minor**, **moderate**, and **major** impacts.

Table 2-4. Summary and comparison of impacts among alternatives with no agency-proposed mitigation measures

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
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 adverse** 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, and greenhouse gases, mostly released during construction 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:* Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would result in **minor to moderate adverse** impacts and **minor to moderate beneficial** impacts.	*Alternative C:* Increased length of the onshore export cable routes would increase localized air quality impacts compared to the Proposed Action, with Alternative C-2 having the greatest potential for onshore air quality impacts followed by Alternative C-1. 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 other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Alternative D could have slightly lower emissions from offshore construction and operation compared to the Proposed Action due to the installation of six fewer WTGs. Impact magnitude would remain **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 other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Emissions from construction of different foundation types would not differ substantially among Alternatives E-1, E-2, and E-3 and would be similar to the Proposed Action. Impact magnitude would remain **minor adverse** and **minor beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Restricting the number of Falmouth offshore export cables to three may slightly reduce emissions associated with cable-laying activity, but the emissions would not differ substantively from the Proposed Action and would not change the impact magnitude. Impact magnitude would remain **minor adverse** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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 **minor 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 in **minor adverse** impacts because any potential detectable impacts are not anticipated to exceed water quality standards.	*Proposed Action:* The Proposed Action would result in **minor 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 and the resource would recover completely after decommissioning. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **minor adverse** primarily due to short-term, localized effects from increased turbidity and sedimentation.	*Alternative C:* Alternatives C-1 and C-2 would slightly reduce the potential for offshore water quality impacts but would slightly increase the potential for onshore water quality impacts from re-routing the Brayton Point export cables onshore. Because the cables would be installed largely within existing road rights-of-way, Alternative C would have the same **minor adverse** impacts as the Proposed Action. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* The reduced number of structures under Alternative D may slightly reduce localized water quality impacts during construction and operations, but the difference in impacts compared to the Proposed Action would not be materially different and would result in **minor adverse** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* The GBS foundations proposed under Alternative E-3 would require larger disturbance footprints than the piled foundations and suction bucket foundations under Alternatives E-1 and E-2, but the total difference is small and there would be no meaningful change in impacts on water quality and would result in **minor adverse** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* The reduced number of Falmouth offshore export cables may slightly reduce localized water quality impacts during construction. The additional HVDC converter OSP would increase the discharge of warm water, but the difference in impacts compared to the Proposed Action would not be materially different and would result in **minor adverse** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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 **minor adverse** impacts on bats. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts on bats. Primary risks would be from potential onshore removal of habitat and operation of the offshore WTGs. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed	*Alternative C:* Alternative C would have the same **minor adverse** impacts as the Proposed Action. While the longer onshore cable routes would result in more habitat disturbance, the overall affected area would still be small.	*Alternative D:* Alternative D would reduce the number of WTGs and noise impacts compared to the Proposed Action in the northern Lease Area but would have similar overall **minor adverse** impacts on bats.	*Alternative E:* The different foundation types under Alternative E are not expected to change the impacts on bats compared to the Proposed Action; the same **minor adverse** impacts would occur.	*Alternative F:* Alternative F would result in the same **minor adverse** impacts on bats as the Proposed Action. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
	combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts on bats because bats infrequently occur offshore where offshore wind infrastructure would be installed.	Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **minor adverse** primarily through the permanent onshore habitat loss.	*Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities 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 other offshore wind activities 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 other offshore wind activities would be the same as the Proposed Action.	and planned activities including other offshore wind activities would be the same as 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. *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 offshore wind structures that provide new habitat for benthic species.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts from habitat disturbance; permanent habitat conversion; and behavioral changes, injury, and mortality 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 other offshore wind activities would be **moderate adverse** and **moderate beneficial**.	*Alternative C:* Alternative C would reduce the length of the Brayton Point offshore export cable route, thereby reducing total seabed disturbance and associated benthic habitat disturbance, with Alternative C-2 having the greatest reduction followed by Alternative C-1. Impacts would remain **moderate adverse** and **moderate beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Alternative D would install six fewer WTGs than the Proposed Action, which would reduce total long-term seabed disturbance and benthic habitat impacts. Impacts would remain **moderate adverse** and **moderate beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Alternative E-1 would result in similar impacts as the Proposed Action from installing only piled foundations. Alternatives E-2 and E-3 would avoid pile-driving noise impacts from installing GBS and suction-bucket foundations but would result in increased habitat conversion from larger foundations. Impacts would remain **moderate adverse** and **moderate beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Alternative F, which would reduce the number of Falmouth offshore export cables from five to three, would reduce seafloor and benthic habitat disturbance compared to the Proposed Action. The additional HVDC converter OSP would result in increased potential for entrainment of eggs and larval life stages, as well as increased thermal impacts due to heated discharge effluent; however, as a whole the difference in impacts compared to the Proposed Action would not be materially different and would remain **moderate adverse** and **moderate beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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 adverse** impacts on birds. *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 due to increased collision risk from offshore structures and **minor beneficial** impacts from increased foraging opportunities.	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts on birds associated with habitat loss and collision-induced mortality from rotating WTGs. **Minor beneficial** impacts would occur from increased 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 other offshore wind activities would be **moderate adverse** and **minor beneficial**.	*Alternative C:* Alternative C would have the same **minor adverse** and **minor beneficial** impacts as the Proposed Action. While the longer onshore cable routes would result in more habitat disturbance, the overall affected area would still be small. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Alternative D would remove six WTGs nearest to Nantucket Shoals, which may lessen impacts on collision- and displacement-sensitive avian species that frequent this area. The same **minor adverse** and **minor beneficial** impacts on birds are anticipated. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Larger foundations may increase foraging opportunities and foundations that require no pile driving would reduce underwater noise, but these differences would be small and the same **minor adverse** and **minor beneficial** impacts on birds are anticipated. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Alternative F would reduce cable-laying activity, which could slightly lessen impacts on birds, but the same **minor adverse** and **minor beneficial** impacts on birds would occur. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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**	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts because most potential effects associated with habitat	*Alternative C:* Alternative C would result in slightly greater impacts on coastal habitats than the Proposed Action from longer onshore cable	*Alternative D:* Because Alternative D would involve modifications only to offshore components, impacts on coastal habitat and fauna would be	*Alternative E:* Because Alternative E would involve modifications only to offshore components, impacts on coastal habitat and fauna would be	*Alternative F:* Because Alternative F would involve modifications only to offshore components, impacts on coastal habitat and fauna would be

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
	adverse impacts on coastal habitat and fauna. *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 due to onshore coastal construction and climate change.	disturbance would be localized, short-term, and can be minimized with best management practices. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **moderate adverse**.	routes, with Alternative C-2 having the greatest impact followed by Alternative C-1. The overall impact level would be the same as the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	the same as the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	the same as the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	the same as the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.
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 EFH. *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 through cable emplacement and maintenance, noise, presence of structures, regulated fishing efforts, and climate change.	*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 other offshore wind activities would be **moderate adverse**.	*Alternative C:* Avoiding cable installation in the Sakonnet River would reduce impacts on EFH and HAPC for juvenile Atlantic cod from cable laying activity and long-term O&M impacts from presence of cable protection. While impacts would be reduced in the Sakonnet River, overall impact levels would be the same as 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 other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Removal of six WTGs may slightly reduce impacts but would not likely result in a meaningful change in impacts associated with construction (primarily pile-driving noise) or the presence of structures. Impact levels would be the same as 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 other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Alternative E-1 would result in similar impacts as the Proposed Action from all piled foundations. Alternatives E-2 and E-3 would avoid underwater noise impacts. Larger foundations under Alternatives E-2 and E-3 would cause more habitat conversion but also greater beneficial artificial reef effects. Overall impacts would be the same as 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 other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* The reduced number of Falmouth offshore export cables would reduce seafloor and benthic habitat disturbance compared to the Proposed Action. Because cable installation would still occur in the same corridor, the same overall impacts are expected. The additional HVDC converter OSP would increase the potential for entrainment of fish larvae at cooling water intakes and thermal plume discharge impacts. Overall impacts would remain **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.
3.5.6 Marine Mammals	*Direct and Indirect Impacts (without baseline):*[4] *None* *No Action Alternative:* Continuation of 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.	*Direct and Indirect Impacts (without baseline):* **Moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds. *Proposed Action:* The Proposed Action 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. Adverse impacts are expected to result mainly from underwater noise (e.g., impact pile driving). Beneficial	*Direct and Indirect Impacts (without baseline):* **Moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds. *Alternative C:* Routing the Brayton Point export cable onshore may slightly reduce impacts on marine mammals occurring in the Sakonnet River. However, because the presence of most marine mammals in the Sakonnet River is uncommon, and cable installation impacts outside of the river would still occur, BOEM	*Direct and Indirect Impacts (without baseline):* **Moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds. *Alternative D:* The removal of six WTGs may lessen the impacts on marine mammals by providing more area of open ocean nearest to Nantucket Shoals, which provides important foraging habitat for marine mammals. Impacts from noise, EMF, and vessel traffic would also be reduced. However, because Alternative D only represents a	*Direct and Indirect Impacts (without baseline):* **Moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds. *Alternative E:* Alternative E-1 would result in similar impacts as the Proposed Action from all piled foundations. Alternatives E-2 and E-3 would avoid piled foundations, reducing underwater noise impacts and resulting in greater artificial reef effects from larger foundations. The	*Direct and Indirect Impacts (without baseline):* **Moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds. *Alternative F:* The reduced number of Falmouth offshore export cables would reduce seafloor disturbance and vessel activity compared to the Proposed Action. Because cable installation would still occur, the overall impact level would be the same as the Proposed Action.

[4] 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 Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
	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 mysticetes, odontocetes, and pinnipeds, with the exception of the NARW, on which impacts could be **major adverse**. Impacts would primarily result from underwater noise, entanglement, and seabed disturbance associated with offshore wind activities and could include **minor beneficial** impacts for odontocetes and pinnipeds.	impacts are expected to result from the presence of structures. *Cumulative Impacts of the Proposed Action:* The Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would result in **moderate adverse** impacts on mysticetes, odontocetes, and pinnipeds, with the exception of the NARW, on which impacts could be **major adverse**.	anticipates impacts 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 other offshore wind activities would be the same as the Proposed Action.	reduction of six WTGs, impact levels 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 other offshore wind activities would be the same as the Proposed Action.	overall impact level 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 other offshore wind activities would be the same as the Proposed Action.	*Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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 primarily related to the presence of structures and pile-driving noise.	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts on sea turtles from habitat disturbance, noise impacts, water quality degradation, vessel strikes, and potential discharges/spills and trash. **Minor beneficial** impacts would result from the reef effect created by the presence of structures. *Cumulative Impacts of the Proposed Action:* The Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **minor adverse**.	*Alternative C:* Alternative C would lessen impacts on sea turtles in the Sakonnet River by routing the cable onshore. However, sea turtle presence in the Sakonnet River is uncommon and cable emplacement impacts along the rest of the Brayton Point corridor would still occur. Impacts would remain **minor adverse** with **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Installation of six fewer WTGs would reduce impacts from noise, vessel traffic, and anchoring when compared to the Proposed Action. However, since the number of WTGs to be removed would be small relative to the total number of WTGs, the same **minor adverse** with **minor beneficial** impacts are expected. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Alternative E-1 would result in similar impacts as the Proposed Action from all piled foundations. Alternatives E-2 and E-3 would avoid piled foundations, reducing underwater noise impacts and resulting in greater artificial reef effects from larger foundations. The overall impact level would be the same as the Proposed Action: **minor adverse** with **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* The reduced number of Falmouth offshore export cables would reduce seafloor disturbance compared to the Proposed Action. Because cable installation would still occur in the same corridor, the same **minor adverse** with **minor beneficial** impacts are expected. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.
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. *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 wetlands, primarily because of land disturbance and in consideration of regulatory requirements for avoiding, minimizing, and mitigating impacts on wetlands.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on wetlands through short-term or permanent disturbance from activities within or adjacent to these resources and in consideration of avoidance, minimization, and mitigation measures for wetlands required under federal and state statutes. *Cumulative Impacts of the Proposed Action:* The Proposed Action when combined with the impacts from ongoing and planned activities	*Alternative C:* Alternative C would result in slightly greater impacts on wetlands than the Proposed Action from longer onshore cable routes, with Alternative C-2 having the greatest impacts followed by Alternative C-1. 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 other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* The impacts associated with the Proposed Action would not change under Alternative D because the alternative only differs in offshore components, and offshore components would not contribute to impacts on wetlands; the same **moderate adverse** impacts on wetlands are anticipated. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* The impacts associated with the Proposed Action would not change under Alternative E because the alternative only differs in offshore components, and offshore components would not contribute to impacts on wetlands; the same **moderate adverse** impacts on wetlands are anticipated. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* The impacts associated with the Proposed Action would not change under Alternative F because the alternative only differs in offshore components, and offshore components would not contribute to impacts on wetlands; the same **moderate adverse** impacts on wetlands are anticipated. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
		including other offshore wind activities would be **moderate adverse**.				
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 **moderate** to **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 **moderate** to **major adverse** impacts because some commercial fisheries would experience substantial long-term disruptions. Presence of structures would cause **minor** to **moderate adverse** impacts on for-hire recreational fishing and could include **moderate beneficial** impacts.	*Proposed Action:* The Proposed Action would have **moderate** to **major adverse** impacts depending on the fishery and fishing operation. Some fishing operations could experience long-term, major disruptions. However, it is estimated that most vessels would only have to adjust somewhat to account for disruptions due to impacts. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.	*Alternative C:* Routing the Brayton Point offshore export cable onshore to avoid the Sakonnet River could result in slight reductions in impacts on fishers that use the Sakonnet River but the difference in impact would be slight and the same overall **moderate** to **major adverse** impacts would result. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* By removing six WTGs, Alternative D would provide more area in the northern portion of the Lease Area for commercial fishing vessels to operate without potential impacts from structures, slightly reducing the potential for gear entanglement and allisions. The same **moderate** to **major adverse** impacts would result. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Alternative E-1 would have similar impacts as the Proposed Action. The larger foundations under Alternatives E-2 and E-3 would increase the potential for gear entanglement and loss. Conversely, the larger foundations would increase beneficial artificial reef effects. The same **moderate** to **major adverse** impacts would result. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Installation of fewer cables would require less hard cable protection, reducing the potential for gear entanglement and loss but any difference in impacts would be small. The same **moderate** to **major adverse** impacts would result. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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. *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 due to disturbance, damage, disruption, and destruction of individual cultural resources.	*Proposed Action:* The Proposed Action would have **major adverse** impacts on cultural resources. BOEM anticipates that NHPA requirements to identify historic properties and resolve adverse effects would reduce the significance of potential impacts on some historic properties but mitigation of both physical and visual adverse effects on historic properties would still be needed under the Proposed Action. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **minor** to **major**.	*Alternative C:* Alternative C-1 or C-2 cable routes could introduce adverse impacts on a larger number of individual cultural resources as compared to the Proposed Action. However, Alternatives C-1 and C-2 routes are predominantly along public road ROWs and may not contribute additional impacts in these previously disturbed areas. The same **major adverse** impacts would result. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.	*Alternative D:* Eliminating six WTGs is not anticipated to result in a reduction of impacts on marine cultural resources and would only slightly reduce the visibility of the Project on historic aboveground resources. The same **major adverse** impacts would result. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.	*Alternative E:* Alternative E-3 would result in the greatest potential for impacts on marine cultural resources because of the larger foundation size, followed by Alternatives E-2 and E-1. Overall, the anticipated range of impact severity on individual marine cultural resources under Alternatives E-1, E-2, and E-3 would be the same as the Proposed Action and the overall impact would remain **major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.	*Alternative F:* Reducing the number of installed cables would reduce the overall area subject to seabed disturbance, thereby reducing adverse impacts on marine cultural resources including the Nantucket Sound TCP. However, most cultural resources are located in other areas unaffected by this alternative; therefore, the same **major adverse** impacts would result. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.
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.	*Proposed Action:* The Proposed Action would have **minor adverse** and **minor beneficial** impacts on demographics, employment, and economics. Adverse impacts include temporary and permanent disruptions to commercial fishing and recreational business operations. Beneficial impacts include	*Alternative C:* Installation of longer onshore cable routes under Alternative C would result in increased traffic delays, disruptions to business and residential access, and related construction impacts. Alternative C-2 would result in the greatest impact followed by Alternative C-1; however,	*Alternative D:* Alternative D would install six fewer WTGs, which would result in a shorter duration of noise impacts and less vessel traffic. However, the Project would generate less energy and would result in slightly lower beneficial impacts associated with delivering a reliable supply of	*Alternative E:* Alternative E, which would involve installing a range of foundation types, would not have measurable impacts on demographics, employment, and economics that are materially different from the impacts of the Proposed Action. The overall impact levels would be the same as for	*Alternative F:* Alternative F, which would involve reducing the number of Falmouth offshore export cables from five to three, would not have measurable impacts on demographics, employment, and economics that are materially different from the impacts of the Proposed Action. The overall

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
	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** impacts, primarily associated with impacts on commercial fishing and other marine businesses from offshore wind development. **Moderate beneficial** impacts would result from increased jobs, tax revenues, improved ports, and marine industry diversification.	job creation, workforce development, and income and tax revenue. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **minor adverse** and **moderate beneficial** impacts.	the overall impact magnitude would be the same: **minor adverse** and **minor beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	energy. The overall impact levels would be the same as for the proposed action**: minor adverse** and **minor beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	the Proposed Action**: minor adverse** and **minor beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	impact levels would be the same as for the Proposed Action**: minor adverse** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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. *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 due to gentrification and potential loss of income for low-income and minority workers; and **minor beneficial** impacts related to employment in the offshore wind industry and displaced fossil fuel emissions after offshore wind projects are operational.	*Proposed Action:* The Proposed Action would have **minor adverse** impacts attributable to air emissions, noise at ports, onshore construction, and impacts on marine businesses. The Proposed Action may have disproportionally high **major adverse** impacts on Tribal Nations due to potential impacts on ancient, submerged landforms. The Proposed Action would also have **minor beneficial** impacts from displacement of fossil fuel energy generation and employment opportunities. *Cumulative Impacts of the Proposed Action:* Overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **moderate adverse**.	*Alternative C:* Increased length of the Brayton Point onshore export cable route would result in construction-related increases in air emissions, traffic, and noise. However, the location of the Alternative C onshore cables would not occur in areas with environmental justice populations. Impacts from Alternative C would be the same as the Proposed Action: **major adverse** and **minor beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Alternative D would install six fewer WTGs than the Proposed Action, which would slightly reduce the impacts of vessel activity in ports and offshore structures on fishing. The impact magnitude of Alternative D would remain **major adverse** and **minor beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Under Alternative E-1, use of all piled foundations would result in similar impacts as the Proposed Action. Under Alternatives E-2 and E-3, use of foundations that avoid pile driving would slightly reduce impacts on businesses in environmental justice communities that rely on fishing or tourism by reducing noise associated with foundation installation. Impact magnitude would remain **major adverse** and **minor beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Reducing the number of Falmouth offshore export cables from five to three would not meaningfully change the impacts on environmental justice from the Proposed Action. Impact magnitude would remain **major adverse** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.
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 from land disturbance and accidental releases during onshore construction, as well	*Proposed Action:* The Proposed Action would have **minor adverse** impacts resulting from port utilization, accidental spills, and land disturbance and construction impacts, and **moderate adverse** impacts associated with the need for zoning relief for the Falmouth landfalls and substation sites. The Proposed Action would also have **minor beneficial** impacts by supporting designated uses and infrastructure improvements at ports. *Cumulative Impacts of the Proposed Action:* Overall, impacts from ongoing	*Alternative C:* Alternative C would increase the length of the Brayton Point onshore cable route, resulting in increased impacts from land disturbance, traffic, and noise compared to the Proposed Action, with Alternative C-2 resulting in the most impacts. The overall impact magnitudes would be the same as the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing	*Alternative D:* The impacts associated with the Proposed Action would not change under Alternative D because the alternative only differs in offshore components, and the offshore components would not substantively contribute to impacts on land use and coastal infrastructure; the same **moderate adverse** and **minor beneficial** impacts are anticipated. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other	*Alternative E:* The impacts associated with the Proposed Action would not change under Alternative E because the alternative only differs in offshore components, and the offshore components would not substantively contribute to impacts on land use and coastal infrastructure; the same **moderate adverse** and **minor beneficial** impacts are anticipated. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other	*Alternative F:* The impacts associated with the Proposed Action would not change under Alternative F because the alternative only differs in offshore components, and the offshore components would not substantively contribute to impacts on land use and coastal infrastructure; the same **moderate adverse** and **minor beneficial** impacts are anticipated. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
	as from the views of offshore structures that could affect the use and value of onshore properties; **minor beneficial** impacts would result from productive use of ports and related infrastructure for offshore wind activity.	and planned activities including other offshore wind activities would result in **moderate adverse** impacts and **minor beneficial** impacts.	and planned activities including other offshore wind activities would be the same as the Proposed Action.	offshore wind activities would be the same as the Proposed Action.	offshore wind activities would be the same as the Proposed Action.	offshore wind activities would be the same as 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 (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.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts associated with changes in navigation routes, delays in ports, and degraded communication and radar signals. Some commercial fishing, recreational, and other vessels would avoid the Wind Farm Area altogether. *Cumulative Impacts of the Proposed Action:* Overall, impacts from ongoing and planned activities including other offshore wind activities would result in **moderate adverse** impacts.	*Alternative C:* Routing the Brayton Point offshore export cable onshore would slightly reduce the impacts on navigation and vessel traffic from fewer miles of offshore cable installation in the Sakonnet River, which would reduce the potential for collisions with slow-moving cable-laying vessels. Alternative C-2 would cross the Fall River Harbor Federal Navigation Channel three times, contributing to an increased potential for short- and long-term impacts. However, overall impact levels under Alternative C-1 and C-2 would be the same as the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Installation of six fewer WTGs under Alternative D would incrementally decrease impacts on vessel traffic compared to the Proposed Action by providing additional space closer to Nantucket Shoals and coastal areas, which are more frequently used by fishing and recreational vessels but would not change the overall impact magnitude of **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Alternative E, which would involve installing a range of foundation types, may slightly change the duration of foundation construction and the number of vessels, but any differences would be small and last only for the duration of construction. The overall impact levels 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 other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Reducing the number of Falmouth offshore export cables from five to three would result in a slight reduction in cable-laying vessel construction activity but overall impacts would be similar to those of the Proposed Action and the same **moderate adverse** impact level would result. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.
3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, Surveys, and Search and Rescue)	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and radar systems, **moderate** for SAR operations; and **major** 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 **negligible** impacts for marine mineral extraction; **minor** impacts for aviation and air	*Proposed Action:* The Proposed Action would result in **negligible** impacts for marine mineral extraction and cables and pipelines; **minor** impacts for aviation and air traffic, radar systems, and most military and national security uses; **moderate** for SAR operations; and **major** impacts for scientific research and surveys. *Cumulative Impacts of the Proposed Action:* The Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind activities would be **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic, radar systems, and most	*Alternative C:* Alternative C rerouting of export cables onshore would reduce localized impacts on cables and pipelines; however, overall impacts would remain the same as described under the Proposed Action: **negligible** impacts for marine mineral extraction and cables and pipelines; **minor** impacts for aviation and air traffic, radar systems, and most military and national security uses; **moderate** for SAR operations; and **major** impacts for scientific research and surveys. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other	*Alternative D:* Alternative D could decrease impacts on radar systems on Nantucket Island by removing six WTGs closest to shore. While this would reduce line-of-sight impacts of the three radar systems on Nantucket Island, localized, long-term impacts on the other radar systems in the geographic analysis area are still anticipated, and overall impacts would remain the same as described under the Proposed Action: **negligible** impacts for marine mineral extraction and cables and pipelines; **minor** impacts for aviation and air traffic, radar systems, and most military and national security uses; **moderate** for	*Alternative E:* The suction bucket and GBS foundations proposed under Alternatives E-2 and E-3 would have a larger seabed footprint and would exclude more area from future submarine and cable pipeline placement as compared to the piled foundations proposed under Alternative E-1. However, because future cables and pipelines would have the option to route around the foundations, impacts on cables and pipelines would remain the same as described under the Proposed Action: **negligible** impacts for marine mineral extraction and cables and pipelines; **minor** impacts for aviation and air traffic, radar systems, most military	*Alternative F:* Reducing the number of Falmouth offshore export cables to three would not meaningfully change the impacts on cables and pipelines because crossings would still be required at this, and other locations within the geographic analysis area. Impacts would remain the same as described under the Proposed Action: **negligible** impacts for marine mineral extraction and cables and pipelines; **minor** impacts for aviation and air traffic, radar systems, and most military and national security uses; **moderate** for SAR operations; and **major** impacts for scientific research and surveys.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Fisheries Habitat Impact Minimization	Alternative D Nantucket Shoals (Preferred Alternative)	Alternative E Foundation Structures	Alternative F Muskeget Channel Cable Modification
	traffic, and cables and pipelines; **moderate** for radar systems due to WTG interference; **minor** for military and national security uses, except for USCG SAR operations, which would have **moderate** adverse impacts; and **major** for scientific research and surveys.	military and national security uses; **moderate** for SAR operations;, and **major** for NOAA's scientific research and surveys.	offshore wind activities would be the same as the Proposed Action.	SAR operations; and **major** impacts for scientific research and surveys. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	and national security uses; **moderate** for SAR operations; and **major** impacts for scientific research and surveys. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.
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** 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 **moderate adverse** impacts from increased noise, vessel traffic, and offshore structures. **Minor beneficial** impacts would result from offshore structures that provide opportunities for sightseeing and fishing.	*Proposed Action:* The Proposed Action would result in **minor** impacts associated with noise, anchored vessels, hindrances on recreational vessel navigation, and visual impacts from the presence of offshore wind structures. **Minor beneficial** impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures. *Cumulative Impacts of the Proposed Action:* Overall, impacts from ongoing and planned activities including other offshore wind activities would result in **moderate adverse** impacts and **minor beneficial** impacts.	*Alternative C:* Alternative C would increase the length of the Brayton Point onshore cable route, resulting in increased impacts from traffic, noise, and temporary emissions that degrade the recreational experience, with Alternative C-2 resulting in the most impacts. The overall impact magnitudes would be the same as the Proposed Action: **minor** and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative D:* Installation of six fewer WTGs under Alternative D would result in a negligible reduction of impacts on visual resources. Gear entanglements and loss, as well as allisions, and recreational fishing may slightly decrease due to fewer structures but the overall impact magnitude is the same as the Proposed Action: **minor** and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative E:* Alternative E, which would involve installing a range of foundation types, would not have measurable impacts on recreation and tourism that are materially different from the impacts of the Proposed Action. Impacts would be **minor** and **minor beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as the Proposed Action.	*Alternative F:* Alternative F, which would reduce the maximum number of Falmouth offshore export cables from five to three, would not have measurable impacts on recreation and tourism that are materially different from the impacts of the Proposed Action. Impacts would be **minor** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be the same as 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 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 **major adverse** impacts on seascape and landscape resources and **major** impacts on open ocean due to 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 **minor 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 result in **major adverse** impacts.	*Alternative C:* Installation of longer onshore export cables and infrastructure would result in slightly greater localized, temporary visual impacts near construction sites than the Proposed Action. However, the overall impact on visual and scenic resources would be approximately the same as the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse.**	*Alternative D:* Eliminating six WTGs may result in a slight reduction in visual impacts, but the number of structures removed would be small and it is unlikely these changes would be noticeable to the casual viewer. Therefore, impacts from Alternative D are anticipated to be approximately the same 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 other offshore wind activities would be **major adverse**.	*Alternative E:* Installation of different foundation types under Alternatives E-1, E-2, and E-3 would not change the most prominent visible aspects of WTGs and OSPs and, therefore, would have no meaningful difference in impacts on seascape, open ocean, and landscape character units and viewer experience compared to the Proposed Action and would result in **major adverse** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.	*Alternative F:* The reduction in the number of cables installed along the Falmouth offshore export cable route under Alternative F may reduce the number of vessel trips required to install the cables, but this slight reduction in vessel activity would have no meaningful difference in impacts compared to the Proposed Action and would result in **major adverse** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities including other offshore wind activities would be **major adverse**.

Chapter 3

Affected Environment and Environmental Consequences

This chapter thus addresses the affected environment, also known as the existing baseline, for each resource area and the potential environmental consequences to those resources from implementation of the alternatives described in Chapter 2, *Alternatives*. The direct and indirect impacts of the alternatives are analyzed excluding consideration of the existing baseline and ongoing activities, and also including consideration of the existing baseline and ongoing activities. In addition, this section addresses the impact of the alternatives when combined with other past, present, or reasonably foreseeable planned activities, i.e. cumulative impacts, using the methodology and assumptions outlined in Chapter 1, *Introduction*, and Appendix D, *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 and Unavailable Information*.

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

3.1 Impact-Producing Factors

BOEM completed a study on the North Atlantic OCS of 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 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 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 Project, including construction, 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.

IPF	Sources and Activities	Description
Discharges/intakes	• Vessels • Structures • Onshore point and non-point sources • Dredged material • Installation, operation, and maintenance of submarine transmission lines, cables, and infrastructure • High-voltage direct current (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 National Pollutant Discharge Elimination System (NPDES) 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 material seaward of the baseline is regulated under the Marine Protection, Research, and Sanctuaries Act, unless meeting an exclusion. The material may then be regulated by another federal or state law, such as 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 (EMFs) 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.

IPF	Sources and Activities	Description
Gear utilization	• Monitoring surveys	Refers to entanglement and bycatch during monitoring surveys.
Land disturbance	• Vegetation clearance • Excavation • Grading • Placement of fill material	Refers to land disturbances 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 use offshore vessels, and that may produce light above the water onshore and offshore, as well as underwater. Refers to lighting associated with onshore Project infrastructure during construction and O&M, such as permanent lighting at O&M facilities.
Noise	• Aircraft • Vessels • Turbines • Geophysical (HRG surveys) and geotechnical surveys (drilling) • Construction equipment • Operations and maintenance • Onshore and offshore construction and installation • Vibratory and impact pile driving • Dredging and trenching • 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 and onshore substations). May also be noise generated from turbines themselves or interactions of the turbines with wind and waves.
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 WTGs, OSPs, and scour/cable protection	Refers to the post-construction, long-term presence of onshore 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 development of the Final EIS and in coordination with cooperating agencies, BOEM considered potential additional mitigation measures that could further avoid, minimize, or mitigate impacts on the physical, biological, socioeconomic, scenic and visual, and cultural resources assessed in this document. These potential additional mitigation measures are described in Appendix G, *Mitigation and Monitoring*, Table G-2, and analyzed in the relevant resource sections in this chapter. BOEM may choose to incorporate one or more of these additional mitigation measures in the preferred alternative. Where the impacts of an action alternative are determined through the inclusion of any mitigation and monitoring measures, all of those measures will be incorporated in the ROD if that alternative is selected. In addition, other mitigation measures may be required through completion of 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, Table G-2, may not all be within BOEM's statutory and regulatory authority to require; however, other jurisdictional governmental agencies may potentially require them. BOEM may choose to incorporate one or more additional measures in the ROD and adopt those measures as conditions of COP approval. All SouthCoast Wind-committed measures are part of the Proposed Action.

3.3 Definition of Impact Levels

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 2007 *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* were used as the initial basis for establishing adverse impacts specific to each resource. These resource-specific impact-level definitions were then further refined based on prior NEPA analyses, scientific literature, and best professional judgment and are presented in each resource section. The impact classification used in the analyses is considered an adverse impact unless specified with a bolded "beneficial."

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 35-year life of the Project. Following O&M, SouthCoast Wind would complete 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 that occur during construction or decommissioning and that may extend beyond construction or decommissioning, potentially lasting for several months to 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 for a long period of time (e.g., decades or longer) and that may extend for the life of the Project (35 years). An example would be the loss of habitat where a foundation has been installed.
- Permanent effects: Effects that extend beyond the life of the Project. An example would be the conversion of land to support new onshore facilities.

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 (GHG) emissions. Where relevant, the potential impacts are discussed under each resource, while a more comprehensive analysis of impacts resulting from ongoing and planned non-offshore and other offshore wind activities can be found in Appendix D.

The definitions of potential impact levels used to describe the contributed impact of the Proposed Action and each alternative can be found in the individual resource sections.

3.4 Physical Resources

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.

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.

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.

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.

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.

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.

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.

3.5 Biological Resources

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 geographic analysis area. This geographic analysis area, as shown on Figure 3.5.6-1, includes the Canadian Scotian Shelf, Northeast U.S. Continental Shelf, Southeast Continental Shelf, and Gulf of Mexico LMEs. This broad geographic analysis area includes the proposed Project area (defined as the area encompassing the Lease Area and ECCs) and is likely to capture the movement range for marine mammal species that could be affected by the proposed Project. The geographic analysis area does not include all areas that would be transited by Project vessels from all manufacturing points of origin outside of the United States (e.g., Europe if local supply chains cannot be established), but includes the Gulf of Mexico LME because vessel transits may occur between the Lease Area and ports in the Gulf of Mexico (Corpus Christi, Texas and Altamira, Mexico).

Due to the size of the geographic analysis area, the analysis of IPFs of the proposed Project focuses on marine mammals that would likely occur in and near the proposed Offshore Project area and have the potential to be affected by the Proposed Action. The Offshore Project area includes the SouthCoast Wind Lease Area (OCS-A-0521) and the offshore export cable corridors shown on Figure 1-1 (Chapter 1, Section 1.2, *Purpose and Need of the Proposed Action*).

Description of the Affected Environment

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, and reproduction (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 (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* includes odontocetes and mysticetes.

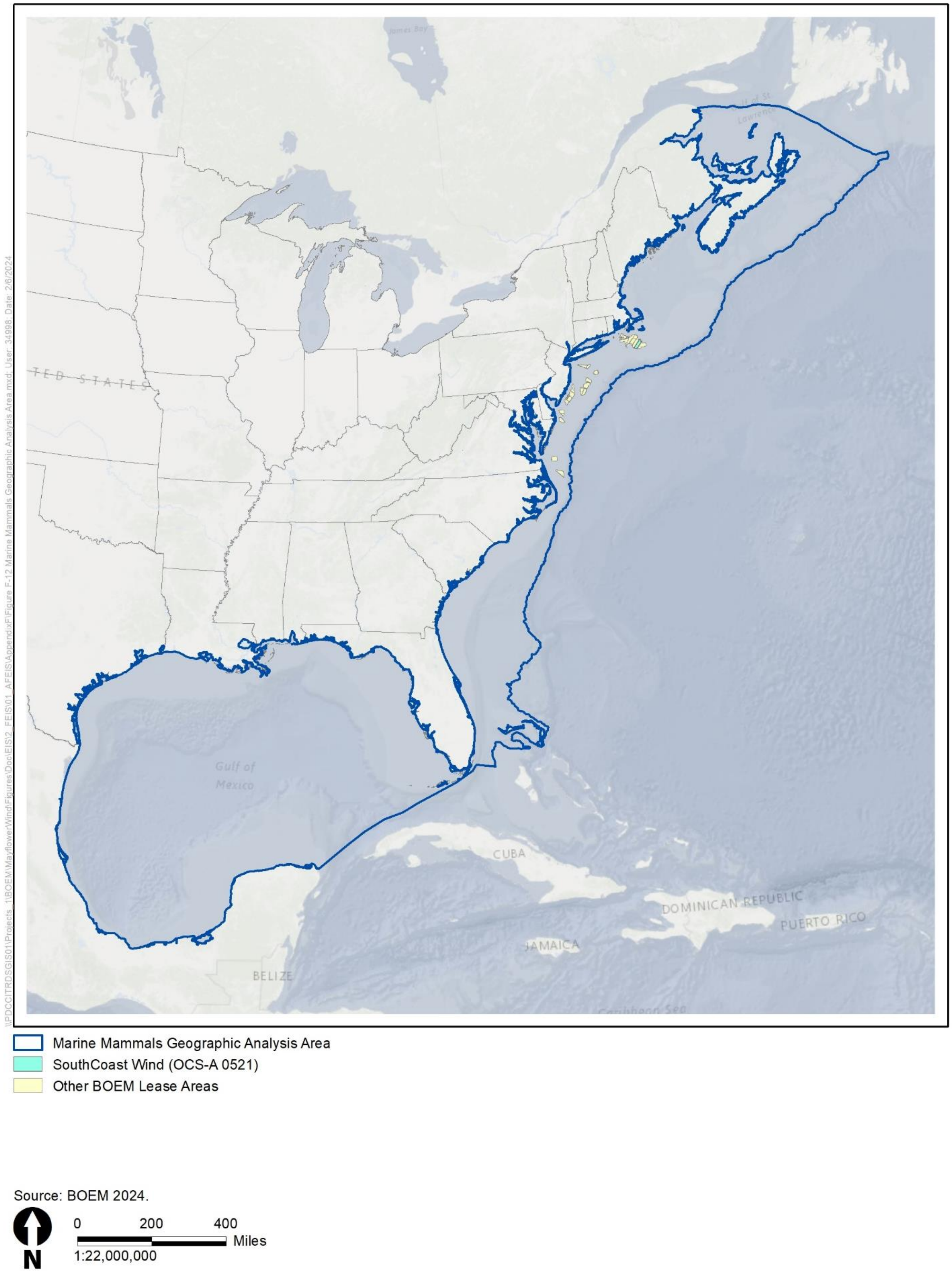


Figure 3.5.6-1. Marine mammals geographic analysis area

Marine mammal composition in the Northwest Atlantic OCS region includes 40 species, comprising 6 mysticetes, 29 odontocetes, 4 pinnipeds, and 1 sirenian species (i.e., manatees and dugongs) (BOEM 2014; CSA Ocean Sciences, Inc. 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*), 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, through which Project vessels would transit on their way to and from ports in the Gulf of Mexico. Three additional species, Rice's whale (*B. ricei*), melon-headed whale (*Peponocephala electra*), and Fraser's dolphin (*Lagenodelphis hosei*), 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 40 marine mammal species in the Atlantic Ocean 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. Therefore, impacts on prey items must also be considered when assessing impacts on marine mammals. Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat,* summarizes the effects on fish, invertebrates, and EFH. Seasonal

[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*). 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.

migrations may also be influenced by other factors, including predation pressures (Corkeron and Connor 1999).

Of the 40 species known to occur or could occur in the northwest Atlantic OCS, only 30 (Table 3.5.6-1) have documented ranges that include the Offshore Project area as six species within the toothed whales and dolphins group were considered to have “hypothetical” occurrences, two species (melon-headed whale and Fraser’s dolphin) occur in the Gulf of Mexico, and the beluga (*Delphinapterus leucas*) occurs north of the Canadian Scotian Shelf and were, therefore, excluded from the assessment of the Proposed Action (BOEM 2014). The West Indian manatee (*Trichechus manatus*) was also excluded from the assessment because this species is considered extralimital and rare and is not expected to occur in the Project area. The analysis of the Proposed Action focuses on 30 species of marine mammals that have been documented or are considered likely to occur in the Offshore Project area and that would likely overlap with the Proposed Action including construction, O&M, and decommissioning activities (COP Volume 2, Table 6-62; SouthCoast Wind 2024). Descriptions of marine mammals that could occur in the Project area are summarized in the COP for the proposed Project (COP Volume 2, Table 6-62; SouthCoast Wind 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 2022; Roberts et al. 2016, 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.

Species occurrence, seasonality, habitat use, and density were determined based on the best available literature, government databases, and site-specific analyses conducted for the proposed Project (see COP Volume 2, Table 6-61; SouthCoast Wind 2024 for a complete list of all marine mammal literature, guidelines, reports, and data sources used). Several studies of marine mammal occurrence and distribution have been conducted in or near the Offshore Project area. Aerial high-definition (aerial HD) surveys were conducted as project-specific surveys for the Lease Area monthly from November 2019 through October 2020 (Mayflower-APEM 2020a–i). The Northeast Large Pelagic Survey (NLPS), beginning in 2011, collects visual and acoustic data on the abundance, distribution, and temporal occurrence patterns of marine mammals in the Massachusetts and Rhode Island lease areas (Kraus et al. 2016). Survey efforts are directed toward large whales but also include information on small marine mammals (Kraus et al. 2016). The New England Aquarium has been contracted by the Massachusetts Clean Energy Center with funding provided by BOEM to conduct NARW surveys in support of offshore wind development (MCEC n.d.). The Massachusetts Clean Energy Center, in collaboration with SouthCoast Wind and other developers in the Massachusetts and Rhode Island lease areas, jointly funded a continuation of these digital aerial surveys from October 2018 to August 2019 (O’Brien et al. 2020) and continuing in March and October 2020 (O’Brien et al. 2021). The New England Aquarium aerial surveys are currently ongoing. Further, acoustic and visual Protected Species Observer (PSO) data were collected for the proposed Project during 2019 (AIS Inc. 2020; RPS 2019).

Table 3.5.6-1. Marine mammal species likely to occur in the Project area

Species	Scientific Name	Stock	Best Population Estimate [a]	Status under MMPA [b]	Status under ESA	Relative Occurrence in Project Region [c]	Population trend [d]	Reference for Population Data
Baleen Whales (Mysticetes)								
Blue whale	*Balaenoptera musculus*	W. North Atlantic	402 [e]	Strategic	Endangered	Rare	Unavailable	Hayes et al. (2020)
Fin whale	*Balaenoptera physalus*	W. North Atlantic	6,802	Strategic	Endangered	Common	Unavailable	Hayes et al. (2021)
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	1,396	Non-Strategic	Not Listed	Common	+2.8%/year	Hayes et al. (2021)
Minke whale	*Balaenoptera acutorostrata*	Canadian East Coast	21,968	Non-Strategic	–	Common	Unavailable	Hayes et al. (2021)
NARW	*Eubalaena glacialis*	W. North Atlantic	338 [f]	Strategic	Endangered	Common	Decreasing	Hayes et al. (2023)
Sei whale	*Balaenoptera borealis*	Nova Scotia	6,292	Strategic	Endangered	Common	Unavailable	Hayes et al. (2021)
Toothed Whales (Odontocetes)								
Atlantic spotted dolphin	*Stenella frontalis*	W. North Atlantic	39,921	Non-Strategic	–	Rare	Decreasing	Hayes et al. (2020)
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	W. North Atlantic	93,233	Non-Strategic	–	Common	Unavailable	Hayes et al. (2020)
Common bottlenose dolphin	*Tursiops truncatus*	W. North Atlantic, Northern Migratory Coastal	62,851	Strategic	–	Common	Decreasing	Hayes et al. (2021)
Pantropical spotted dolphin	*Stenella attenuata*	W. North Atlantic	6,593	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Risso's dolphin	*Grampus griseus*	W. North Atlantic	35,215	Non-Strategic	–	Uncommon	Unavailable	Hayes et al. (2020)

Species	Scientific Name	Stock	Best Population Estimate [a]	Status under MMPA [b]	Status under ESA	Relative Occurrence in Project Region [c]	Population trend [d]	Reference for Population Data
Short beaked common dolphin	*Delphinus delphis*	W. North Atlantic	172,974	Non-Strategic	–	Common	Unavailable	Hayes et al. (2021)
Striped dolphin	*Stenella coeruleoalba*	W. North Atlantic	67,036	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
White-beaked dolphin	*Lagenorhynchus albirostris*	W. North Atlantic	536,016	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	95,543	Non-Strategic	–	Common	Unavailable	Hayes et al. (2021)
Blainville's beaked whale	*Mesoplodon densirostris*	W. North Atlantic	10,107 [g]	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Cuvier's beaked whale	*Ziphius cavirostris*	W. North Atlantic	5,744 [g]	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Dwarf sperm whale	*Kogia sima*	W. North Atlantic	7,750[h]	Non-Strategic	–	Rare	Increasing [i]	Hayes et al. (2020)
Gervais' beaked whale	*Mesoplodon europaeus*	W. North Atlantic	10,107 [g]	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Killer whale	*Orcinus orca*	W. North Atlantic	Unknown	Non-Strategic	–	Rare	Unavailable	Waring et al. (2015)
Long-finned pilot whale	*Globicephala melas*	W. North Atlantic	39,215	Non-Strategic	–	Uncommon	Unavailable	Hayes et al. (2020)
Pygmy sperm whale	*Kogia breviceps*	W. North Atlantic	7,750 [h]	Non-Strategic	–	Rare	Increasing [i]	Hayes et al. (2020)
Short-finned pilot whale	*Globicephala macrorhynchus*	W. North Atlantic	28,924	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Sowerby's beaked whale	*Mesoplodon bidens*	W. North Atlantic	10,107 [g]	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)

Species	Scientific Name	Stock	Best Population Estimate [a]	Status under MMPA [b]	Status under ESA	Relative Occurrence in Project Region [c]	Population trend [d]	Reference for Population Data
Sperm whale	*Physeter macrocephalus*	North Atlantic	4,349	Strategic	Endangered	Uncommon	Unavailable	Hayes et al. (2020)
True's beaked whale	*Mesoplodon mirus*	W. North Atlantic	10,107 [g]	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Earless Seals (Pinnipeds)								
Harbor seals	*Phoca vitulina*	W. North Atlantic	61,336	Non-Strategic	–	Common	Unavailable	Hayes et al. (2021)
Gray seals	*Halichoerus grypus*	W. North Atlantic	27,300	Non-Strategic	–	Common	Increasing	Hayes et al. (2021)
Hooded seals	*Cystophora cristata*	W. North Atlantic	Unknown	Non-Strategic	–	Rare	Unavailable	Hayes et al. (2020)
Harp seal	*Phoca groenlandica*	W. North Atlantic	7.6 million	Non-Strategic	–	Uncommon	Unavailable	Hayes et al. (2020)

[a] Unless otherwise noted, best available abundance estimates are from NMFS stock assessment reports (Hayes et al. 2020, 2021, 2023).
[b] The MMPA defines a "strategic" stock as a marine mammal stock (a) for which the level of direct human-caused mortality exceeds the potential biological removal level; (b) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; (c) which is listed as a threatened or endangered species under the ESA; or (d) is designated as depleted.
[c] Data from SouthCoast Wind COP Volume 2.
[d] Increasing = beneficial trend, not quantified; Decreasing = adverse trend, not quantified; Unavailable = population trend analysis not conducted on this species.
[e] The minimum population estimate is reported as the best population estimate in the most recently updated 2021 draft stock assessment report (SouthCoast Wind 2024).
[f] This estimate is based on the Draft 2022 U.S Atlantic and Gulf of Mexico Marine Mammal Stock Assessments (Hayes et al. 2023).
[g] This estimate includes Gervais' beaked whales and Blainville's beaked whales for the Gulf of Mexico stocks, and all species of *Mesoplodon* undifferentiated beaked whales in the Atlantic.
[h] This estimate includes both dwarf and pygmy sperm whales.
i Increasing trend should be interpreted with caution (Hayes et al. 2020).
ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act

The Atlantic Marine Assessment Program for Protected Species (AMAPPS) coordinates data collection and analysis to assess the abundance, distribution, ecology, and behavior of marine mammals in the U.S. Atlantic. These include both ship and aerial surveys conducted between 2010 and 2019. Although most of the shipboard AMAPPS surveys have been focused on offshore areas outside the Offshore Project area, aerial surveys regularly cover the Project area, and certain shipboard surveys are focused directly on wind energy areas (Palka et al. 2017, 2021). Abundance and density estimates for several marine mammal species were derived using the AMAPPS survey data collected from 2010 to 2014 (Palka et al. 2017). AMAPPS data have been used to create a spatial density mapping tool to visualize seasonal trends in density in several species (Palka et al. 2021). In addition, a habitat-based cetacean density model for the U.S. Exclusive Economic Zone of the East Coast (eastern U.S.) and Gulf of Mexico was developed by the Duke University Marine Geospatial Ecology Laboratory in 2016 (Roberts et al. 2016, 2022a–m). These models were subsequently updated to include more recently available data in 2017, 2018, 2019, 2020, and 2022 (Curtice et al. 2019, Roberts et al. 2017, 2018, 2020, 2022a–m, 2023). Habitat-density models for 17 cetacean species have also recently been created by Chavez-Rosales et al. (2019). Collectively, these estimates are considered the best information currently available for marine mammal densities in the U.S. Atlantic. The general findings of these surveys are presented in the following paragraphs.

Threatened and Endangered Marine Mammals

The ESA (16 USC 1531 et seq.) classifies certain species as threatened or endangered based on the species' overall population status and health. Of the 30 marine mammals species known to occur in the geographic analysis area, five are classified as endangered: the blue whale (*Balaenoptera musculus*), fin whale, NARW, sei whale (*Balaenoptera borealis*), and sperm whale (COP Volume 2, Section 6.8, Table 6-62; SouthCoast Wind 2023). The BA for SouthCoast Wind (BOEM 2024a) 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. While the threatened West Indian manatee could occur in the Project area, it is considered rare in this region. Due to the low likelihood of encountering this species, impacts on this species are not analyzed further. 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 2024a).

Blue whales: Blue whales are considered rare migrants in the U.S. Atlantic (Hayes et al. 2020) and while acoustically detected during the winter, were not visually observed in the Massachusetts and Rhode Island WEA (Kraus et al. 2016). Three blue whale observations were recorded in the northeast U.S. Atlantic during recent AMAPPS surveys, all of which occurred during the summer months (Palka et al. 2021). No blue whale observations were recorded during visual or acoustic surveys conducted in the Project area (AIS Inc. 2020; Mayflower-APEM 2020a–2020m). There are less than 10 records of occurrence of the blue whale in the Offshore Project area before 2010 (BOEM 2014). The mean abundance of blue whales in the Offshore Project area from 1998 to 2020 is estimated at less than one individual (0.000-0.016/29.15 nm^2 [100 km^2]) (Roberts et al. 2022a).

Fin whales: Fin whales are common/regular year-round residents in the Project area and were recorded during the NLPS (i.e., detected visually or acoustically) in the Massachusetts and Rhode Island lease areas and the Project area with peak occurrences during the late spring and summer (Kraus et al. 2016) and were observed during recent AMAPPS surveys (Palka et al. 2021). Additionally, fin whales were observed moving through the Project area during visual surveys (AIS Inc. 2020; RPS 2019). Modeled fin whale abundance from 1998 to 2020 shows peak abundances in the Offshore Project area occurring from April to August, at approximately 0.40-0.63 fin whales/29.15 nm^2 (100 km^2) (Roberts et al. 2022b). Fin whales also use the nearby Nantucket shoals, with modeled density peaks in June and July at approximately 1 to 1.6 fin whales/29.15 nm^2 (100 km^2) (Roberts et al. 2022b). A Biologically Important Area (BIA) for feeding has been delineated for the area east of Montauk Point, New York to the west boundary of the Massachusetts WEAs between the 49-foot (15-meter) and 164-foot (50-meter)-depth contour from March to October (LaBrecque et al. 2015).

Sei whales: Sei whales may potentially occur in the Project area and were observed in the Massachusetts and Rhode Island lease areas during the NLPS from March to June (Kraus et al. 2016) and recorded during recent AMAPPS surveys (Palka et al. 2017, 2021). Sei whale modeled density from 1999 to 2020 showed a peak in abundance from April to June, with highest densities in May at approximately 0.16 to 0.25 sei whales/ 29.15 nm^2 (100 km^2) (Roberts et al. 2022c). Sei whale modeled density in the Nantucket shoals was highest from April to May at 0.040 to 0.63 sei whales/29.15 nm^2 (100 km^2), but also peaked, to a lesser degree, in November and December (Roberts et al. 2022c). Persistent year-round detections of sei whales in Southern New England and the New York Bight highlight these regions as ecologically important to this species (Davis et al. 2020). In general, sei whales are observed offshore with periodic incursions into more shallow waters for foraging (Hayes et al. 2020).

Sperm whales: Sperm whales are primarily expected to occur in the Lease Area during the summer and fall and were sighted there during the NLPS and observed during recent AMAPPS surveys (Palka et al. 2017, 2021). Modeled density of sperm whales in the Lease Area from 1998 to 2019 peaked in August at approximately 0.16 to 0.25 sperm whale/29.15 nm^2 (100 km^2) and again in October at the same density (Roberts et al. 2022d). Modeled density of sperm whales on Nantucket Shoals peaks in June at 0.10 to 0.16 sperm whale/29.15 nm^2 (100 km^2) (Roberts et al. 2022d).

NARW: NARWs are considered common visitors to the Project area with hotspots consistently observed along the northeastern boundary of the Lease Area, adjacent to the Nantucket Shoals, during spring 2011–2015, spring 2017–2019, and winter 2017–2019 (Quintana-Rizzo et al. 2021). From 2015 to 2019, Palka et al. (2021) reported acoustic detections of NARWs in all seasons in the northeastern portion of the Lease Area, with the highest number of days of acoustic detections in the winter and spring; 22 to 67 days of acoustic detections from November to February and again from March to April. Generally, the highest densities of whales occur east of the Lease Area over Nantucket Shoals but may occur in any season in the Project area. There is also the potential for NARW occurrence year-round in the proposed ECCs, with a greater likelihood of occurrence during spring and winter months.

During 2018–2021 New England Aquarium (NEAq) aerial survey activities (Campaign 5 and Campaign 6b), NARWs were the third most observed whale species (O'Brien et al. 2022). In total, 175 sightings of

321 NARWs were recorded during Campaign 5. During Campaign 5 the majority of sightings occurred in the Nantucket Shoals, within 20 nm of offshore wind lease areas, with just one NARW sighted on the boundary of the SouthCoast Wind and Beacon Wind Lease Areas (O'Brien et al. 2020). During Campaign 6b, 90 sightings of 169 NARWs were recorded, all sightings were outside of the Lease Area, but within 15 nm of the Massachusetts lease areas (O'Brien et al. 2022). In 2021, two to five NARWs were observed in the northeastern portion of the Lease Area in the winter, while in the spring, two to five NARWs were observed in the southwest portion of the Lease Area (O'Brien et al. 2021, 2022). While the number of NARWs spotted in the Lease Area are low, other datasets of NARWs indicate that the Nantucket Shoals and surrounding areas are high value habitat. Recent visual detection records of NARWs have been reported on Whale Map (Johnson et al. 2024; Johnson et al. 2021b) through the combination of data from aerial surveys, vessel surveys, and opportunistic vessels. Recent acoustic detections have also been reported from data collected from buoys and Slocum glider surveys. Whale Map reported that within the 5-year period of 2018 to 2023, in and around the entire Massachusetts and Rhode Island WEA, including the adjacent Nantucket Shoals, there have been 2,442 definite visual sightings of NARWs. Of these sightings, 12 occurred in the Project area. Within this same area and time frame, Whale Map reported 886 definite acoustic detections and 897 possible acoustic detections. It is unknown how many individual animals these visual and acoustic detections represent from the data in Whale Map. The NEFSC Passive Acoustic Cetacean Map also records acoustic detections from moorings, buoys, and gliders. During the 5-year period of 2017 to 2022, the Passive Acoustic Cetacean map recorded 1,645 definitive NARW detections in the Massachusetts and Rhode Island WEA and the surrounding area. In addition, 359 possible detections were recorded (NEFSC 2024). The importance of this area as NARW habitat is also indicated by the regular implementation of Seasonal Management Areas (SMAs) and Dynamic Management Areas (DMAs) implemented by NMFS to reduce vessel strikes (NMFS 2024e). The area around Block Island, west of the WEA is designated as an SMA, where vessel speed is reduced from November 1 to April 30 while NARWs utilize the habitat (NMFS 2024e). DMAs are created when NARW are spotted moving through an area that experiences vessel traffic and implements a speed reduction. DMAs were created or extended around Nantucket and Martha's Vineyard 21 times in 2022 (NMFS 2024e). Modeled density of NARW from 2011 to 2020 peaked in the winter and spring months. During these months (November to May), abundance ranged from 0.16 to 1 NARW/29.15 nm^2 (100 km^2) (Roberts et al. 2022e).

The best abundance estimate for NARWs is based on the most recent NMFS stock assessment report (2023 draft) with an estimate of 372 individuals (Linden 2024). The species is considered critically endangered and experienced a decline in abundance between 2011 and 2020 with an overall decline of 29.7 percent (Hayes et al. 2023). The sharpest decrease observed from 2015–2020 appears to have slowed, though the NARW population continues to experience annual mortalities above recovery thresholds. Since 2017, NARW has been experiencing an Unusual Mortality Event (UME) with entanglement in fishing gear and vessel strikes as the primary causes of mortality, serious injury, and morbidity (sublethal injury and illness) (NMFS 2024b). By 2024, the ongoing UME documented a cumulative total of 142 NARWs with 41 dead, 36 seriously injured, and 65 morbidity cases, which represent a substantial loss in NARW population.

Of the marine mammal species listed under the ESA, critical habitat has only been designated for the NARW. The NARW critical habitat within the geographic analysis area includes the feeding areas in Cape Cod Bay, Stellwagen Bank, and the Great South Channel, as well as the calving grounds that stretch from off Cape Canaveral, Florida to Cape Fear, North Carolina. The NARW is also a Massachusetts state-listed endangered species, and the Massachusetts Ocean Management Plan established a core habitat Special, Sensitive, or Unique resource area for NARW 0.5 mile (0.8 kilometer) west of the central portion of the Falmouth ECC based on data that identified statistically significant use for feeding by NARW (COP Appendix L1, Figure 3-3; SouthCoast Wind 2024). These critical and core habitat areas do not directly overlap with the Offshore Project area. The northeast critical habitat area is located to the north and east of the Massachusetts and Rhode Island lease areas, but vessel operations associated with offshore wind development may occur through these areas. Additionally, the Brayton Point ECC runs through approximately 18 miles (29 kilometers) of the corner of the NARW Seasonal Management Area, off the west coast of Martha's Vineyard. This area encompasses NARW migratory routes and feeding grounds and indicates where all vessels 65 feet (19.8 meters) or longer must reduce speed to no more than 10 nautical miles per hour from November 1 through April 30 (COP Appendix L1, Figure 3-1; SouthCoast Wind 2024). Finally, a Biological Important Area for NARW migration runs along the eastern U.S. coastline and includes the Massachusetts and Rhode Island lease areas.

While the Offshore Project area does not occur in any designated critical habitat areas for NARW, the Lease Area is adjacent to Nantucket Shoals, which is a recently identified foraging area for NARWs and the only known winter foraging ground for NARWs (Quintana-Rizzo et al. 2021). The physical oceanographic and bathymetric features provide for year-round high phytoplankton biomass, likely contributing to increased availability of NARW zooplankton prey (Quintana-Rizzo et al. 2021). Waters from the Gulf of Maine, the Great South Channel, and Nantucket Sound mix in the shallow dune-like Nantucket Shoals. The convergence of these waters creates a well-mixed water column throughout the year associated with NARW foraging aggregations (Limeburner and Beardsley 1982; Quintana-Rizzo et al. 2021). Modeled NARW abundance in the Nantucket Shoals from 2011 to 2020 peaked in the winter and early spring months, with densities from January to May peaking at 4 to 6.3 NARW/29.15 nm^2 (100 km^2) and again in November and December (Roberts et al. 2022e).

NARW observations made outside the Lease Area consistently occurred in the nearby Nantucket Shoals and portions of the Massachusetts and Rhode Island lease areas year-round, with abundances peaking from winter through early spring (Quintana-Rizzo et al. 2021; O'Brien et al. 2022). Recently, the presence of NARWs has also increased in the summer and fall, which overlaps with the current schedule for pile driving for projects in the Rhode Island and Massachusetts wind energy areas (Quintana-Rizzo et al. 2021). In earlier years (2012–2015), NARW sighting rates were zero from May through November, but in more recent years (2017–2019) NARWs were sighted in all months except October (Quintana-Rizzo et al. 2021). Model outputs also indicated that mean residence time has tripled to an average of 13 days from December through May in these wind energy areas (Quintana-Rizzo et al. 2021). Southern New England is not a new habitat for NARWs; small numbers have been historically documented here since the beginning of modern survey effort in the late 1970s (O'Brien et al. 2022). However, NARW presence within southern New England has become more common, particularly during winter and spring, but with the potential to occur year-round within this habitat (O'Brien et al. 2022). Their increased presence could be in response to a decline in prey in abandoned feeding habitats or as a result of prey items shifting to more favorable conditions within Nantucket Shoals; NARW feeding has been observed in all seasons in southern New England (O'Brien et al. 2022). This increasing occurrence trend could mean an extension of critical habitat into southern New England waters (Quintana-Rizzo et al. 2021).

Non-ESA-Listed Marine Mammals

Pursuant to the MMPA (16 USC 1361 et seq.), all marine mammals are protected, and their populations are monitored by NOAA and USFWS. Mysticetes that are not federally listed and regularly occur near or in the Offshore Project area and Massachusetts and Rhode Island lease areas include the humpback whale and the minke whale. Humpback whales in the western North Atlantic belong to the West Indies distinct population segment, which is not listed under the ESA; however, this species is listed as endangered under the MESA and listed as a SGCN in Rhode Island. Humpback whales are considered regular year-round residents with sightings expected in the spring and summer months in the Lease Area and in the ECCs during winter migrations. Humpback whales were observed in the Massachusetts and Rhode Island lease areas during the NLPS (Kraus et al. 2016) with sightings mainly during spring and summer and the species noted as nearly absent during the fall and winter (Stone et al. 2017). During Campaign 5, O'Brien et al. (2020) recorded two sightings, each of one humpback whale, in the Lease Area. During Campaign 6a, O'Brien et al. (2021) recorded 22 sightings of 44 humpback whales, with one whale sighted in the northeastern portion of the Lease Area. Humpback whales were also observed during the AMAPPS I and II shipboard and aerial surveys (Palka et al. 2017, 2021) and recorded visually and acoustically during surveys of the Project area (AIS Inc. 2020; RPS 2019). Modeled density for humpback whales, from 2010 to 2020, in the Offshore Project area are highest from April to November, peaking in June at 0.40 to 0.63 humpback whales/29.15 nm^2 (100 km^2) (Roberts et al. 2022f). Humpback whale modeled density in the Nantucket Shoals was highest from April to November, peaking in October at 0.40 to 0.63 humpback whales/29.15 nm^2 (100 km^2). A UME was declared for this species in January 2016, and since then, a total of 227 humpback whale UMEs have been reported along the Atlantic Coast with 45 humpback whale UMEs reported in Massachusetts and 11 in Rhode Island (NMFS 2024a). About half of the whales examined in the UME showed evidence of vessel strikes or entanglement in fishing gear.

Minke whales can occur in the Offshore Project area and have been observed in and near the Lease Area, with most sightings occurring in the spring and summer (O'Brien et al. 2020, 2021, 2022). Modeled density for the minke whale in the Offshore Project area from 1999 to 2019 peaked from April to September with peak densities in June at 1.6 to 2.5 minke whales/ 29.15 nm^2 (100 km^2) (Roberts et al. 2022i). Minke whale density is relatively high throughout the year in the Nantucket Shoals, peaking in the spring and summer months with the highest density in June at 2.5 to 4.0 whales/ 29.15 nm^2 (100 km^2). Both the humpback whale and minke whale have been sighted along the Brayton Point ECC, through the Sakonnet River (Schwartz 2021). A UME was also declared for the minke whale in January 2017 (NMFS 2024c). A total of 174 individuals stranded from Maine to South Carolina, with 60 occurring in Massachusetts and 12 in Rhode Island. Preliminary results of necropsy examinations indicate evidence of human interactions or infectious disease; however, these results are not conclusive (NMFS 2024c).

There are 19 odontocetes known to occur near or in the Offshore Project area and Massachusetts and Rhode Island lease areas, 4 may commonly occur and include Atlantic white-sided dolphin (*Lagenohynchus acutus*), common bottlenose dolphin, short-beaked common dolphin (*Delphinus delphis*), and harbor porpoise, and 15 that are considered rare or uncommon include Atlantic spotted dolphin (*Stenella frontalis*), pantropical spotted dolphin (*Stenella attenuata*), white-beaked dolphin (*Lagenorhynchus albirostris*), Risso’s dolphin (*Grampus griseus*), striped dolphin (*Stenella coeruleoalba*), pilot whale (long finned and short finned) (*Globicephala melas*, *Globicephala macrorhynchus*), dwarf and pygmy sperm whale (*Kogia sima, Kogia breviceps)*, killer whale (*Orcinus orca*), Cuvier's beaked whale (*Ziphius cavirostris*), Mesoplodon beaked whales (Blainsville’s (*Mesoplodon densirostris*), Gervais’ (*M. europaeus*), Sowerby’s (*M. bidens*), and True’s (*M. mirus*). During the NLPS, the short-beaked common dolphin, common bottlenose dolphin, and harbor porpoise were all commonly identified while the Atlantic white-sided dolphin, Risso’s dolphin, and pilot whale were occasionally recorded in the Massachusetts and Rhode Island lease areas (Kraus et al. 2016).

Modeled density for short-beaked common dolphin in the Offshore Project area from 1998 to 2019 was highest from May to December with peak densities in June and July at approximately 16 to 25 individuals/29.15 nm^2 (100 km^2) (Roberts et al. 2022h). Short-beaked common dolphin modeled density in the Nantucket Shoals peaked in November and December at 25 to 40 individuals/29.15 nm^2 (100 km^2) (Roberts et al. 2022h). Modeled density for common bottlenose dolphin in the Offshore Project area from 1998 to 2019 was highest in July at 1.6 to 2.5 individuals/29.15 nm^2 (100 km^2); in all months density was higher farther offshore (Roberts et al. 2022j). Common bottlenose dolphins occurred in greater density in the eastern portions of Nantucket Shoals relative to the Offshore Project area; modeled density peaked in July and August at 6.3 to 10 individuals/29.15 nm^2 (100 km^2). Modeled density of harbor porpoise from 1999 to 2020 was highest in the winter months with density peaking in March at 16 to 25 porpoises/29.15 nm^2 (100 km^2) (Roberts et al. 2022k). Harbor porpoise occur year-around in the Nantucket Shoals with densities peaking in May at 16 to 25 individuals/29.15 nm^2 (100 km^2). Modeled density for Risso’s dolphin in the Offshore Project area and the Nantucket Shoals from 1998 to 2019 was relatively low throughout each year with densities concentrated further offshore; densities peaked in the Offshore Project area in December at 0.25 to 0.40 dolphins/29.15 nm^2 (100 km^2) (Roberts et al. 2022l). Modeled density for pilot whales from 1998 to 2019, with less than 20 sightings in the Offshore Project Area, was predicted at 0.63 to 1 individuals/29.15 nm^2 (100 km^2) (Roberts et al. 2022m).

Atlantic white-sided dolphin, Risso’s dolphin, and short-beaked common dolphin were observed during acoustic and visual surveys during the summer and fall of 2019 and geotechnical surveys conducted in the Project area in 2020 (AIS Inc. 2020; RPS 2019). Additionally, dwarf sperm whale, long-finned pilot whale, Risso’s dolphin, Atlantic white-sided dolphin, bottlenose dolphin, striped dolphin, and harbor porpoise have all been sighted along the Brayton Point ECC, through the Sakonnet River (Schwartz 2021).

Pinniped species which may commonly occur in the Offshore Project area include the harbor and gray seal. The size of the region harbor seal populations and haul out sites have been increasing in recent years and these seals are routinely sited from fall through spring with known haul outs at Brenten Point, Rome Point, Citing Rock, Cold Spring Rock, Seal Rock, and Cormorant Cove (Schwartz 2021). During aerial surveys of the Project area conducted in November and December of 2019, one gray seal and several unidentified pinniped species were recorded (Mayflower-APEM 2020a, 2020b) and during acoustic surveys conducted in the Project area in summer and fall of 2019 and geotechnical surveys conducted in the Project area in 2020, gray seal and harbor seal were both observed (AIS Inc. 2020; RPS 2019). See COP Volume 2, Figure 6-40 (SouthCoast Wind 2024) for the locations of seal observations recorded during the 2019 PSO surveys (AIS Inc. 2020; RPS 2019) and aerial surveys (Mayflower-APEM 2020a–m). The gray, harp, and hooded seal have also been sighted along the Brayton Point ECC through the Sakonnet River (Schwartz 2021). Harp seals, however, are uncommon in the Massachusetts and Rhode Island Lease Areas and are generally found stranded as starving juveniles, primarily in the winter and spring (Harris et al. 2002; Kenney and Vigness-Raposa 2010). There is no estimate for the numbers of harp seals off the northeastern United States. While harp seal occurrences in in the United States have been increasing since the 1980s, particularly in the Gulf of Maine, these individuals are considered dispersed from the population center of an estimated 7.6 million individuals farther north in eastern Canada and the Arctic (Kenney and Vigness-Raposa 2010; Hayes et al. 2022).

Modeled density of all seal species from 1999 to 2020 peaked in May in the Offshore Project area at approximately 10 to 16 seals/ 29.15 nm^2 (100 km^2); however, at the proposed cable landfall in Falmouth, density peaked in June at approximately 63 to 100 seals/29.15 nm^2 (100 km^2) (Roberts et al. 2022g). Further, seal density in the nearby Nantucket Shoals was relatively high throughout the year, with density peaking in June at 250 to 400 individuals/29.15 nm^2 (100 km^2). Since July 2018, increased numbers of gray seal and harbor seal mortalities have been recorded across Maine, New Hampshire, and Massachusetts (NMFS 2023a). This event was declared a UME by NMFS and encompassed 3,152 seal strandings from Maine to Virginia. Between July 2018 and March 2020, 1,113 seals stranded off of the Massachusetts, Rhode Island, and Connecticut coastlines. The pathogen phocine distemper virus was found in the majority of deceased seals and was identified as the cause of the UME. As of the writing of this document, the UME is considered nonactive with closure pending (NMFS 2023a).

Overview of Sound and Marine Mammal Hearing

Underwater noise is a particular concern for marine mammals. 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. 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 is called transmission loss (Richardson et al. 1995). The amount of transmission loss that occurs depends on the source receiver separation, frequency of the sound, properties of the water column, and properties of the seafloor layers. Underwater sound levels are expressed in dB, using a logarithmic ratio relative to a fixed reference pressure of 1 µPa (equal to 10^{-6} Pa or 10^{-11} bar).

The efficiency of underwater sound propagation allows marine mammals to use underwater sound as a primary method of communication, navigation, prey detection (i.e., foraging), and predator avoidance (Richardson et al. 1995; Southall et al. 2007; OSPAR Commission 2009). Anthropogenic (i.e., human-introduced) noise has gained recognition as an important stressor for marine mammals because of their reliance on underwater hearing (Richardson et al. 1995; Ketten 1998). Underwater sound can be produced by biological and physical oceanographic sources, as well as anthropogenic sources. Biological sounds include vocalizations made by marine mammals and physical oceanographic sounds, including wind and wave activity, rain, sea ice, and undersea earthquakes. Anthropogenic sounds include vessel traffic, military activities, marine construction, and oil and gas exploration. Some of these 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). Underwater noise generated by human activities can often be detected by marine mammals many kilometers from the source.

Anthropogenic noise sources can be categorized generally as impulsive or non-impulsive and as intermittent or continuous. Noise generated from ongoing non-offshore wind activities includes impulsive (e.g., pile-driving military training exercises (e.g., munitions), and small-scale seismic surveys)) and non-impulsive (e.g., vessels, aircraft, dredging) sources. Sound sources that are audible by a given species have the potential to cause masking or behavioral effects, and some may also cause permanent threshold shift (PTS) and temporary threshold shift (TTS) when closer to the sound source. Impact pile driving, seismic exploration, and sonar surveys can lead to PTS/injury-level effects in marine mammals. In addition, high-intensity tactical sonar activities have been linked to stranding events (Fernandez et al. 2005; Cox et al. 2006; Balcomb and Claridge 2001; Jepson et al. 2003; Wang and Yang 2006; Parsons et al. 2008; D'Amico et al. 2009; Dolman et al. 2010). The frequency and number of noise-generating anthropogenic activities in the geographic analysis area is likely to change over space and time and, thus, is difficult to predict. 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 could 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.

Marine mammals are acoustically diverse, with wide variations in ear anatomy and hearing ability (Ketten 1991). An animal's physical 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, 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 (plots of hearing threshold at different sound frequencies) have been developed based on captive behavioral response studies (reactions to sound) and electrophysiological experiments (measuring auditory evoked potentials) (Erbe et al. 2012). Auditory evoked potentials have been measured in some toothed whale (odontocetes) and pinniped species (Southall et al. 2007; Finneran 2015; Tougaard et al. 2022), while direct measurements of baleen whale (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 (Houser et al. 2001; Ketten and Mountain 2011, 2014 in Southall et al. 2019; Cranford and Krysl 2015; Richardson et al. 1995; Wartzok and Ketten 1999; Au and Hastings 2008; Reichmuth 2007).

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 from underwater noise are expressed using two common metrics: SPL, measured in dB relative to 1 µPa (dB re 1 µPa), and sound exposure level (SEL), a measure of energy in decibels relative to 1 µPa squared second (dB re 1 µPa2s). SPL is an instantaneous value represented as either root mean squared (RMS) SPL (also, SPLRMS) or peak SPL (also, SPLpeak), whereas SEL is the total noise energy to which an organism is exposed over a given time period, typically 1 second for pulse sources. As such, the cumulative SEL (SELcum, also SEL 24h) metric is appropriate when assessing effects to marine mammals from cumulative exposure to multiple pulses.

For marine mammals, NMFS has developed the *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS 2018). The technical guidance established acoustic criteria identifying the potential for onset of PTS and TTS (NMFS 2018). In 2024, NMFS published updated technical guidance (NMFS 2018, 2024f) that includes revisions to both the marine mammal weighting functions and thresholds used to inform potential auditory injury and TTS. Technical updates also included the addition of in-air criteria for otariids and pinnipeds, updated marine mammal audiogram and TTS data, lower noise exposure thresholds (SELcum) for high (below 10kHz) frequency cetaceans and in-water otariid pinnipeds, inclusion of new impulsive TTS onset data for in-water phocid pinniped, and the adoption of marine mammal hearing group terminology based on Southall et al. (2019). The updated technical guidance also adopted the term “auditory injury” (AUD INJ), which includes but is not limited to PTS, to acknowledge that AUD INJ may occur but may not necessarily result in PTS. Auditory injury onset thresholds for all sound sources are divided into two broad categories: impulsive and non-impulsive. NMFS developed dual metric thresholds using peak SPL and weighted cumulative SEL from impulsive sounds and considers onset of AUD INJ to have occurred when either one of the two metrics is exceeded. For non-impulsive sounds, thresholds for weighted cumulative SEL are used. The thresholds are further subdivided by hearing group to acknowledge that not all marine mammal species have identical hearing or susceptibility to noise-induced hearing loss (Table 3.5.6-2).

NMFS has also established behavioral disturbance thresholds for marine mammals that utilize an RMS SPL of 160 dB re 1 µPa for impulsive/intermittent sounds and 120 dB re 1 µPa for non-impulsive sounds for all marine mammal species (NMFS 2013). Unlike PTS and TTS thresholds, behavioral disturbance thresholds are not frequency weighted to account for different hearing abilities by the seven marine mammal hearing groups. Additional details on marine mammal acoustic threshold criteria, functional hearing groups, and auditory weighting functions applied to thresholds are provided in COP Volume 2, Section 6.8.2.1, Table 6-66, and Appendices O, and U2 (SouthCoast Wind 2024).

Table 3.5.6-2. Marine mammal functional hearing groups

Hearing Group	Taxonomic Group	Generalized Hearing Range
UNDERWATER		
Low-frequency cetaceans (LFCs)	Baleen whales (e.g., humpback whale, blue whale)	7 Hz to 36 kHz
High-frequency cetaceans (HFCs)	dolphins, toothed whales, beaked whales, bottlenose whales	150 Hz to 160 kHz
Very high-frequency cetaceans (VHFCs)	True porpoise, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*	200 Hz to 165 kHz
Phocid pinnipeds (PPW)	True seals (e.g., harbor seal)	40 Hz to 90 kHz
Otariid pinnipeds (OW)	Sea lions and fur seals	60 Hz to 68 Hz
IN-AIR		
Phocid pinnipeds (PA)	True seals (e.g., harbor seal)	42 Hz to 52 Hz
Otariid pinnipeds (OA)	Sea lions and fur seals	90 Hz to 40 Hz

Source: NMFS 2024f.
Hz = hertz; kHz = kilohertz

Table 3.5.6-3 outlines the acoustic thresholds for onset of acoustic impacts (AUD INJ/PTS and TTS) for marine mammals for both impulsive and non-impulsive noise sources. Impulsive noise sources considered in this assessment include impact pile driving, some HRG equipment, and explosion of UXO. Non-impulsive noise sources include vibratory pile driving, vessel traffic, some HRG surveys, turbine operations, and dredging.

Table 3.5.6-3. Acoustic marine mammal injury (AUD INJ/PTS and TTS) thresholds based on NMFS (2024f)

Marine Mammal Functional Hearing Group	Effect	Impulsive Source		Non-Impulsive Source
		PK (dB re 1 μPa)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 s$)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 s$)
UNDERWATER				
Low-frequency cetaceans (LFC)	AUD INJ/PTS	222	183	197
	TTS	216	168	177
High-frequency cetaceans (HFC)	AUD INJ/PTS	230	193	201
	TTS	224	178	181
Very High-frequency cetaceans (VHFC)	AUD INJ/PTS	202	159	181
	TTS	196	144	161
Phocid pinnipeds (PPW)	AUD INJ/PTS	223	183	195
	TTS	217	168	175

Marine Mammal Functional Hearing Group	Effect	Impulsive Source		Non-Impulsive Source
		PK (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 µPa²s)	Weighted SEL_{24h} (dB re 1 µPa²s)
Otariid pinnipeds (OW)	AUD INJ/PTS	230	185	199
	TTS	224	170	179
IN-AIR				
Phocid pinnipeds (PA)	AUD INJ/PTS	162	140	154
	TTS	156	125	134
Otariid pinnipeds (OA)	AUD INJ/PTS	177	163	177
	TTS	171	148	157

Note: Peak sound pressure (PK) values are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kilohertz): Values presented for SEL_{cum} use a 24-hour cumulative analysis unless stated otherwise. dB re 1 µPa = decibels relative to 1 micropascal; dB re 1 µPa²s = decibels relative to 1 micropascal squared second

Non-auditory Injury Criteria for Explosives (Unexploded Ordnance)

Shock waves associated with underwater detonations can induce both auditory effects (AUD INJ/PTS and TTS) (Table 3.5.6-3) and non-auditory physiological effects, including direct tissue damage (mortality, slight lung injury, and gastrointestinal injury) known as primary blast injury. The magnitude of the acoustic impulse (which is the integral of the instantaneous sound pressure) of the underwater blast causes the most common injuries and, therefore, its value is used to determine if mortality, slight lung injuries, and gastrointestinal injuries occur (Finneran et al. 2017). Mortality and slight lung injury are the primary non-auditory effects considered; the threshold for each depends upon an animal's mass and depth. Table 3.5.6-4 provides an estimate of mass of the different marine mammal species considered in this assessment. Finneran et al. (2017) summarize criteria and thresholds used by the U.S. Navy to assess the potential for mortality and slight lung and gastrointestinal injury from explosive sources. Table 3.5.6-5 lists equations used to calculate thresholds based on effects observed in 1 percent of exposed animals.

Table 3.5.6-4. Representative calf/pup and adult mass estimates used for assessing impulse-based onset of lung injury and mortality threshold exceedance distances [a]

Impulse Animal Group	Representative Species	Calf/Pup Mass (kilograms)	Adult Mass (kilograms)
Baleen whales and sperm whale	Sei whale (*Balaenoptera borealis*) Sperm whale (*Physeter macrocephalus*)	650	16,000
Pilot and minke whales	Minke whale (*Balaenoptera acutorostrata*)	200	4,000
Beaked whales	Gervais' beaked whale (*Mesoplodon europaeus*)	49	366
Dolphins, kogia, pinnipeds, and sea turtles	Harbor seal (*Phoca vitulina*)	8	60
Porpoises	Harbor porpoise (*Phocoena phocoena*)	5	40

[a] Values are based on the smallest expected animals for the species.

Table 3.5.6-5. Thresholds for onset of non-auditory injury based on observed effects on 50 percent of exposed animals

Hearing Group	Mortality (Severe lung injury) [a]	Slight Lung Injury [b]	Gastrointestinal Tract Injury
All marine mammals	$103M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa·s	$47.5M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa·s	$L_{pk,flat}$: 237 dB

[a] *M* animal (adult and/or calf/pup) mass (kilograms) (see Table C.9 in U.S. Navy 2017); *D* animal depth (meters).
[b] Lung injury (severe and slight) thresholds are dependent on animal mass.

Auditory Explosive Thresholds

The supersonic shock wave from an explosion transitions to a normal pressure wave at a range determined by the weight and type of the explosive used. The ranges to the impulsive TTS and AUD INJ (Table 3.5.6-3) are applicable for determining auditory injury impacts.

Behavioral Explosive Thresholds

Single blast events within a 24-hour period are not presently considered by NMFS to produce behavioral effects if they are below the onset of TTS thresholds for frequency-weighted SEL and peak pressure level (Table 3.5.6-3). Therefore, the effective disturbance threshold for single events in each 24-hour period is the TTS onset.

3.5.6.2 Impact Level Definitions for Marine Mammals

Impact level definitions for marine mammals are provided in Table 3.5.6-6. Impact levels are intended to serve NEPA purposes only and they are not intended to incorporate similar terms used in other statutory or regulatory reviews. For example, the term “negligible” is used for NEPA purposes as defined here and is not necessarily intended to indicate a negligible impact or effect under the MMPA. Similarly, the use of “detectable” or “measurable” in the NEPA significance criteria is not necessarily intended to indicate whether an effect is “insignificant” or “adverse” for purposes of ESA Section 7 consultation.

Table 3.5.6-6. 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.

Impact Level	Impact Type	Definition
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 would 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, other than the Proposed Action, as described in Appendix D, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP and the Project would not take place, thus, baseline conditions for marine mammals would continue to follow current regional trends. Hence, not approving the Project's COP would have no additional direct and indirect effects of the Project on marine mammals, where the direct and indirect effects are defined as the alternative impacts (without baseline). 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 direct and indirect effects on marine mammals and their habitat. All marine mammal species in the geographic analysis area are also subject to ongoing anthropogenic impacts.

The main known contributors to mortality events include collisions with vessels (ship strikes), 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, which can have physiological effects on marine mammals; EMFs, which can result in behavioral changes in marine mammals; cable emplacement and maintenance and port utilization, which can disturb benthic prey species for marine mammals and affect water quality; gear utilization, which can lead to an increased risk of interactions with fishing gear; lighting, which can result in behavioral changes in marine mammals and effects on prey species; noise, which can have physiological and behavioral effects on marine mammals; the presence of structures, which can result in behavioral changes in marine mammals, effects on prey species, which can affect prey availability for, and distribution of, marine mammals, and increased risk of interactions with fishing gear; and vessel traffic, which increases risk of vessel collision. Impacts of ongoing activities on marine mammal prey items are assessed in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, which summarizes the effects on fish, invertebrates, and EFH.

The following ongoing offshore wind activities in the geographic analysis area would contribute to impacts on marine mammals (based on the scenario shown in Appendix D).

- Continued O&M of three offshore wind projects:
    - Block Island Project (five WTGs) installed in state waters.
    - CVOW-Pilot Project (two WTGs and one OSP) installed in OCS-A 0497.
    - South Fork Wind Farm Project (12 WTGs and 1 OSP) installed in OCS-A 0517.
- Ongoing construction of eight offshore wind projects:
    - Vineyard Wind 1 Project (62 WTGs and 1 OSP) in OCS-A 0501.
    - Revolution Wind Project (65 WTGs and 2 OSPs) in OCS-A 0486.
    - Sunrise Wind Project (94 WTGs and 1 OSP) in OCS-A 0487.
    - New England Wind Project (128 WTGs and 2 OSPs) in OCS-A 0534 and a portion of OCS-A 0501.
    - Empire Wind Project (138 WTGs and 2 OSPs) in OCS-A 0512.
    - Ocean Wind 1 Project (98 WTGs and 3 OSPs) in OCS-A 0498.
    - Atlantic Shores South Project (195 WTGs and 2 OSPs) in OCS-A 0499.
    - CVOW-C Project (176 WTGs and 3 OSPs) in OCS-A 0483.

Many marine mammal migrations cover long distances, and these factors individually and in combination can have impacts on individuals over broad geographical and temporal scales. Ongoing activities (excluding the Proposed Action) are expected to continue to contribute to impacts on marine mammals.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing O&M of the Block Island and CVOW-Pilot projects and construction and O&M of multiple offshore wind projects would affect marine mammals through the primary IPFs of noise and presence of structures. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, cable emplacement and maintenance, port utilization, and lighting that are described in detail in the following sections for planned offshore wind activities.

IPFs with the greatest potential impact on marine mammals from ongoing non-offshore wind activities in the geographic analysis area are discussed here and in Appendix D, *Planned Activities Scenario,* Section D.2.

Accidental releases and discharges: Marine mammals are particularly susceptible to the effects of contaminants from pollution and discharges as they accumulate through the food chain or are ingested with garbage. Polychlorinated biphenyls (PCBs) and chlorinated pesticides (e.g., DDT, DDE, dieldrin) are of most concern and can cause long-term chronic impacts. These contaminants can lead to issues in reproduction and survivorship and other health concerns (e.g., Pierce et al. 2008; Jepson et al. 2016; Hall et al. 2018; Murphy et al. 2018); however, the population-level effects of these and other contaminants are unknown. Research on contaminant levels for many marine mammal species is lacking. Some information has been gathered from necropsies conducted from bycatch and, therefore, focus on smaller whale species and seals. Moderate levels of these contaminants have been found in pilot whale blubber (Taruski et al. 1975; Muir et al. 1988; Weisbrod et al. 2000). Weisbrod et al. (2000) examined PCBs and chlorinated pesticide concentrations in bycaught and stranded pilot whales in the western North Atlantic. Contaminant levels were similar to or lower than levels found in other 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. Additionally, 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).

Trash and debris may be released by vessels or ports operations throughout the geographic analysis area. Worldwide, 62 of 123 (about 50 percent) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). The global stranding data indicate potential debris induced mortality rates of 0 to 22 percent. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological impacts on individuals to population-level impacts (Browne et al. 2015). While federal regulations are in place to prevent accidental releases, it is possible that some debris could be lost overboard during ongoing offshore wind and non-offshore wind activities.

Unexpected or unanticipated events, including vessel collisions or allisions, events that would result in equipment failure, or oil spills and chemical releases could occur during the construction, operations, or decommissioning phases of offshore wind projects. Such incident occurred on July 2024 wherein structural damage to a turbine blade at Vineyard Wind 1 offshore wind farm caused the blade to detach while undergoing testing, resulting in debris to accumulate in the water and some washing ashore around Nantucket, Vineyard, and Rhode Island sounds (Vineyard Wind 2024). Based on preliminary investigations conducted by Arcadis US Inc. (2024), the blade materials and debris are comprised of fiberglass, semi-rigid foam, and polyester resins similar to materials that can be found in textiles, boat construction, and the aviation industry. These stable physical and chemical properties are also the basis for the acceptance of the blades for landfill disposal once retired, as non-toxic, non-hazardous, solid waste materials. Further evaluations will consider the potential for degradation of the residual blade materials that remain in the environment and potential exposure routes and other fate and transport mechanisms. Offshore wind developers are required to develop a comprehensive federally-approved emergency response plan to address unanticipated accidents as part of the permitting process. Vineyard Wind and GE Vernova have since conducted root cause analyses, debris recovery efforts and debris containment, onshore and offshore cleanup operations, and are engaged with federal (including BSEE and USCG), state, tribal, and local stakeholders to ensure the health and safety of its workforce, mariners, and the environment (Vineyard Wind 2024a).

While exposure to accidental releases and discharges from ongoing non-offshore wind activities could lead to 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. Thus, impacts from accidental releases and discharges from ongoing non-offshore wind activities would likely be minor for mysticetes (including NARWs), 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 and discharges associated with the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to result in negligible impacts (BOEM 2021a, 2021b, 2023a, 2023d). Offshore wind projects will comply with their Oil Spill Response Plan 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. 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 to minor (BOEM 2021a, 2021b, 2023a, 2023b). Impacts from emplacement and maintenance of submarine cables and pipelines are anticipated to be negligible. Sediment resuspension during cable and pipeline emplacement and maintenance would 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.

Climate change: Global climate change is an ongoing risk for marine mammal species in the geographic analysis area. Warming and sea level rise could affect marine mammals through increased storm frequency and severity, altered habitat/ecology, altered migration patterns, increased disease incidence, and increased erosion and sediment deposition (Evans and Bjørge 2013; Evans and Waggitt 2020; Learmonth et al. 2006). Increased temperatures can alter habitat, modify species' use of existing habitats, change precipitation patterns, and increase storm intensity (USEPA 2016; NASA 2019; Love et al. 2013). 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 (USEPA 2016; NASA 2019; Love et al. 2013). 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 2016). 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, population-level 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 on 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.

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 minimize the likelihood of nonnative 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.

EMFs: The marine environment continuously generates a variable ambient EMFs. The motion of electrically conductive seawater through Earth's magnetic field induces voltage potential, thereby creating electrical currents. Surface and internal waves, tides, and coastal ocean currents all create weak induced EMFs. Their magnitude at a given time and location is dependent on the strength of the prevailing magnetic field, site, and time-specific ocean conditions. Other external factors like electrical storms and solar events can also cause variability in the baseline level of EMF naturally present in the environment (CSA Ocean Sciences, Inc. 2019).

Existing in-service submarine telecommunication cables present in the offshore export cable corridors would presumably continue to operate and generate EMF effects under the No Action Alternative. As the type and capacity of these cables are 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. Additional EMFs would also emanate from new offshore export cables and interarray cables constructed for offshore wind projects. Up to 32,537 miles (52,363 kilometers) of cable would be added in the geographic analysis area from other planned offshore wind activities, producing an EMF in the immediate vicinity of each cable during operations. Exponent Engineering, P.C. (2018) modeled EMF levels for South Fork Wind Farm export cables and interarray cables. The model estimated magnetic field levels ranging from 13.7 to 76.6 milligauss on the bed surface above the buried and exposed export cables. Modeled estimates for interarray cables ranged from 9.1 to 65.3 milligauss above the cables. Induced field strength would decrease effectively to 0 milligauss within 25 feet (7.6 meters) of each cable.

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 future submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation.

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

Gear utilization: Fisheries interactions can have adverse effects on multiple 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) 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). Depending on the severity of entanglement, this could lead to reduced foraging and swimming capacity and eventual mortality due to drowning.

Of the species considered in this assessment, entanglement in fishing gear is listed as a threat to humpback whales, NARWs, blue whales, fin whales, sei whales, minke whales, common bottlenose dolphins, Atlantic white-sided dolphin, Risso's dolphin, short-finned pilot whales, harbor seals, and gray seals (Hayes et al. 2020, 2022, 2023; NMFS 2024d) with evidence of fishery interactions causing injury or mortality for each of these species in the Greater Atlantic Regional Fisheries Office/NMFS entanglement/stranding database (Hayes et al. 2022, 2023; NMFS 2024d). Entanglement in fishing gear has 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). NMFS estimates that 83 percent of NARW individuals have been entangled in fishing gear at least once and 59 percent of these individuals show evidence of multiple fishing gear entanglements, with rates increasing over the past 30 years (NMFS 2024d; King et al. 2021; Knowlton et al. 2012). Juveniles and calves are entangled at higher rates than adults. From 2017–2024, fishery entanglements caused an estimated six mortalities or serious injuries in NARWs per year (Hayes et al. 2023). In 2024, four active entanglement cases were reported bringing to cumulative total to 90 entanglement cases since 2017 (NMFS 2024b). Entanglement wounds have also become more severe since 1990, potentially caused by an increased use of stronger lines in fixed fishing gear (Knowlton et al. 2016). Recent literature indicates that the proportion of NARW mortality attributed to fishing gear entanglement is likely higher than previously estimated from recovered carcasses (Pace 2021). In 2021, there were five active entanglements/entrapment cases, three of which were new. Of the three newly entangled whales (with attached gear), two were in U.S. waters and one in Canadian waters. When factoring in entanglement scars, seven additional entanglement events occurred in Canadian waters and four in U.S. waters in 2021 (Pettis et al. 2022). Entanglement may also be responsible for high mortality rates in other large whale species (Read et al. 2006). Of the available information, there are considerable data on the potential for entanglement of humpback whales. 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). Limited information is available for sperm whale entanglement mortalities; however, from 1993–1998 there were documented three sperm whale entanglements, two of which were in the North Atlantic Ocean. Three additional sperm whale mortalities from entanglement were also 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 this stock from 2017–2021, although one stranding mortality in Florida in 2021 was attributed to ingestion of plastics, including fishing net (NMFS 2024d).

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 at 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 in various commercial, recreational, and subsistence fisheries 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, short-finned pilot whales, harbor porpoises, white-sided dolphins, harbor seals, and gray seals have been documented in several fisheries' bycatch data. Several commercial fisheries have documented bycatch. The ones that most commonly report bycatch are pelagic longlining, bottom trawling, and sink gillnetting (Hayes et al. 2020, 2021). 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, 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, with the exception of NARW. Impacts on individual mysticetes, 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 long-term major impacts for NARW because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species. Impacts on individual mysticetes other than NARWs, 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 NARWs 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, and pinniped entanglement with gear used for biological monitoring in ongoing offshore wind projects would occur. Fisheries monitoring plans for ongoing offshore wind activities requires coordination and/or permitting with the appropriate federal agencies and 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 2023c), 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). There are no documented entanglement cases associated with biological monitoring for Block Island wind farm, the CVOW-Pilot Project, or the Vineyard Wind 1 Project. There are 13 documented seal deaths from South Fork Wind Farm biological monitoring; however, these occurred during gillnet surveys, and South Fork Wind Farm has since ceased gillnet surveys. While impacts from gear utilization associated with biological monitoring on individual marine mammals could occur, monitoring plans will have sufficient mitigation procedures in place to reduce potential impacts to not result in population-level effects. Accordingly, impacts are expected to be negligible to minor (BOEM 2021a, 2021b, 2023a, 2023d).

Lighting: The addition of 975 WTGs and 17 OSPs 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, 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 (BOEM 2021a, 2021b, 2023a).

Noise – overview: Underwater sound is a pervasive issue throughout the world's oceans and can adversely affect marine mammals. Vessel traffic, seismic surveys, and active naval sonars are the main anthropogenic contributors to low- and mid-frequency noises in oceanic waters (NMFS 2018), with vessel traffic the dominant contributor to ambient sound levels in frequencies below 200 Hz (Arveson and Vendittis 2000; Veirs et al. 2016). In the marine mammal geographic analysis area, underwater noise is generated from ongoing non-offshore wind and ongoing offshore wind activities including impulsive (e.g., impact pile driving, G&G surveys, UXO detonation) and non-impulsive (e.g., vibratory pile driving and drilling, military training and testing activities, vessels, G&G surveys, aircraft, dredging) sources. 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. 2021).

The potential for underwater noise to result in injury, mortality, or disturbance of marine mammals depends on the received sound level, frequency of the sound relative to the hearing ability of the animal, and level of natural background (or ambient) noise. Potential effects include non-auditory injury, permanent or temporary hearing loss, behavioral changes, acoustic masking, or increases in physiological stress (Götz et al. 2009) and can range from subtle changes in behavior at low received levels to strong disturbance effects or potential injury or mortality at high received levels (Southall et al. 2007, 2019). 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 (UXO) without mitigation or if explosives are used in decommissioning. Although many marine mammals can adapt to changes in pressure during their deep foraging dives, the shock waves produced by explosives expose the animal to rapid changes in pressure, which in turn, causes a rapid expansion of air-filled cavities (e.g., the lungs). This forces the surrounding tissue or bone to move beyond its limits that may lead to tears, breaks, or hemorrhaging. The extent and severity of such injury that would occur depends on several factors including the size of these air-filled cavities, ambient pressure, how close an animal is to the blast, and how large the blast is (U.S. Navy 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: Sound reaching the receiver with ample duration and sound pressure level can result in a loss of hearing sensitivity in marine mammals, termed a noise-induced threshold shift. Auditory thresholds for underwater noise are expressed using three common metrics: root-mean-square sound pressure level (SPL or L_{rms}), and peak sound pressure (L_{pk}), both measured in dB re 1 µPa; and sound pressure level (SEL or L_E), a measure of energy in dB re 1 µPa^{2}s. L_{pk} is an instantaneous value, whereas SEL is the total noise energy of an event or number of events (e.g., over a period of 24 hours, SEL_{24h}), and L_{rms} is that total energy to which an animal is exposed normalized to 1 second.

A noise-induced threshold shift may consist of a TTS or PTS. TTS is a relatively short-term, reversible loss of hearing following noise exposure (Southall et al. 2007), often resulting from cellular fatigue and metabolic changes (Saunders et al. 1985). While experiencing either TTS or PTS, the hearing threshold rises, and a sound must be louder to be detected. PTS is an irreversible loss of hearing (permanent damage) following noise exposure that commonly results from inner ear hair cell loss or severe damage or other structural damage to auditory tissues (Saunders et al. 1985; Henderson et al. 2008). There have not been any field studies that have examined TTS or permanent hearing damage (i.e., PTS) in free-ranging marine mammals exposed to anthropogenic sounds. TTS has been demonstrated in high-frequency cetaceans (HFCs) (dolphins), very high-frequency cetaceans (VHFCs) (harbor porpoise), and pinnipeds (harbor seal, California sea lion, northern elephant seal) in response to exposure to impulsive and non-impulsive noise sources (a review is provided in Southall et al. 2007; NMFS 2013; Finneran 2015). Prolonged or repeated exposure to sound levels sufficient to induce TTS without recovery time can lead to PTS (Southall et al. 2007). A PTS of 7-10 dB was demonstrated in an individual harbor seal after 2 exposures to an underwater 4.1 kHz pure tone fatiguing stimulus gradually increased to a maximum received sound pressure of 184 dB re 1 µPa with a duration of 60 seconds (Kastak et al. 2008).

TTS effects are temporary at the individual level, with recovery occurring over a short period of time (e.g., within several days) after the completion of the activities causing the effect. Effects on populations are dependent on the potential for individuals of the population to be affected (e.g., spatial overlap) or the health of the population being able to withstand temporary or permanent physiological effects associated with individuals experiencing TTS, PTS, or other physiological effects.

Physiological stress: The presence of anthropogenic noise, even at low levels, can increase physiological stress in a range of taxa, including humans (Kight and Swaddle 2011; Wright et al. 2007). This is extremely difficult to measure in wild animals, but several methods have recently emerged that may allow for reliable measurements in marine mammals. Baleen plates store both adrenal steroids (stress biomarkers, 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).

Disturbance (behavioral effects): Marine mammals show varying levels of disturbance to underwater noise sources and behavioral responses can range from minor to severe, depending on a suite of variables including season, location, species, life-history stage, and the type of noise. Observed behavioral responses include displacement, avoidance, increases or decreases in vocal activity and habituation, as well as changes to or cessation of biologically important behaviors which include breeding, calving, foraging, resting or socializing; changes in diving behavior (e.g., reduced or prolonged dive times, changes in swimming speed and direction); aggressive behavior (e.g., jaw clapping or tail/fluke slapping); and changes in historical migration routes. Behavioral responses can ultimately cause disruption in foraging patterns, increases in physiological stress and alertness, reduced breeding opportunities, increased swim speed and dive times, and changes to group association patterns (e.g., tighter groups). In response to underwater noise, if a marine mammal changes its behavior or moves to avoid the noise, impacts may not be important to the individual, stock, or population as a whole. However, if marine mammals were to be displaced from a breeding area or foraging ground, impacts among the individuals and population could be significant (Booth et al. 2020). Studies have found that in species such as the blue whale, call production was increased amidst received sound exposure levels of 131 dB re 1 μPa2-s, potentially indicating the species attempt to “compensate” for increases in background noise levels (Di Iorio and Clark 2010). However, other studies have shown that in species such as the bowhead whale, calling rates increased at low received levels of airgun sounds, but then decreased when received levels exceeded a certain threshold (Blackwell et al. 2015). Available studies show variation in response to underwater sound and further support how the degree of impact depends on many factors (e.g., behavioral state, reproductive state, distance to the sound source).

To better understand and categorize the potential effects of behavioral responses, Southall et al. (2007) developed a behavioral response severity scale of low, moderate, or high (Southall et al. 2007; Finneran et al. 2017). This scale was recently updated (Southall et al. 2021). The revised report updated the single severity response criteria defined in Southall et al. 2007 into three parallel severity tracks that score behavioral responses from 0 to 9. The three severity tracks are survival, reproduction, and foraging. This approach is acknowledged as being relevant to vital rates, defining behaviors that may affect individual fitness, which may ultimately affect population parameters. It is noted that not all the responses within a given category need to be observed but that a score is assigned for a severity category if any of the responses in that category are displayed. To be conservative, the highest (or most severe) score is to be assigned for instances where several responses are observed from different categories. In addition, the authors acknowledge that it is no longer appropriate to relate "simple all-or-nothing thresholds" to specific received sound levels and behavioral responses across broad taxonomic groupings and sound types due to the high degree of variability within and between species and noise types. The new criteria also move away from distinguishing noise impacts from impulsive versus non-impulsive sound types into considering the specific type of noise (e.g., pile driving, seismic, vessels).

The study also noted that mysticetes and odontocetes should be considered separately given their different life history strategies. Mysticetes are known to be capital breeders, accumulating energy on feeding grounds and transferring energy to calves in breeding grounds, whereas odontocetes are generally considered income breeders with less discrete feeding and breeding periods occurring throughout the year. Given that anthropogenic activities generally focus on specific habitats within an animal's home range (e.g., feeding or breeding grounds), this may affect their ability to compensate for disturbances.

Acoustic masking: Acoustic masking occurs when sound signals used by marine mammals overlap in time, space, and frequency with another sound source (Richardson et al. 1995). Masking can reduce communication space, limit the detection of relevant biological cues, and reduce echolocation effectiveness. If little or no overlap occurs between the introduced sound and the frequencies used by the species, listening and communication are not expected to be disrupted. Similarly, if the introduced sound is present only infrequently, very little to no masking would occur. In addition to the frequency and duration of the masking sound, strength, temporal pattern, and location of the introduced sound also play a role in the extent of the masking (Madsen et al. 2002; Branstetter et al. 2013a, 2013b, 2016; Erbe et al. 2016; Sills et al. 2017).

A growing body of literature is focused on improving the framework for assessing the potential for masking of animal communication by anthropogenic noise and understanding the resulting effects. More research is needed to understand the process of masking, the risk of masking by anthropogenic activities, the ecological significance of masking, and what anti-masking strategies are used by marine animals and their degree of effectiveness before masking can be incorporated into regulation strategies or mitigation approaches (Erbe et al. 2016). As a result, this assessment considered the potential for masking qualitatively by comparing the frequencies of anthropogenic sources with the frequencies at which marine mammal vocalizations are made and the functional hearing ranges of marine mammal species.

Noise Impacts under Alternative A – No Action: Noise generated from ongoing non-offshore wind activities includes impulsive sources (e.g., seismic surveys) and non-impulsive sources (e.g., vessels, aircraft, dredging, military training [sonar and munitions training]). 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 (Balcomb 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 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.

Noise generated from ongoing offshore wind activities include impact and vibratory pile driving, foundation/relief drilling, cable-laying, dredging, HRG surveys, UXO detonations, vessel noise, and operational turbine noise. Impacts from these activities on marine mammals have been previously analyzed from ongoing offshore wind projects in the New England and Mid-Atlantic regions (e.g., Vineyard Wind 1, South Fork Wind, Ocean Wind 1, and Revolution Wind) and BOEM determined impacts to range from negligible to minor or minor to moderate, depending on the nature of activity and the marine mammal species or hearing group. For Vineyard Wind 1, noise impacts due to pile driving were determined to be moderate for LFC mysticetes, while impacts were found to be minor for NARWs due to avoidance of peak seasons of occurrence and the incorporation of NARW-specific mitigations. For South Fork Wind, noise associated with impact pile driving were found to have moderate impacts on fin whales, minke whales, humpback whales, and harbor porpoises; minor effects on NARWs, Atlantic spotted dolphins, Atlantic white-sided dolphins, bottlenose dolphins, and common dolphins; and negligible effects on Risso's dolphin, sei whales, sperm whales, and pilot whales. Noise impacts due to dredging from South Fork Wind 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 were determined to likely result in minor impacts on seals and porpoises (BOEM 2021b). Analyses for both Ocean Wind 1 and Revolution Wind determined that noise generated from construction-related activities would have minor to moderate impacts on marine mammals, depending on species.

Vessel noise during construction was determined to have minor or moderate impacts, depending on hearing groups. For Vineyard Wind 1, vessel noise would be expected to have moderate impacts 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. Similarly, analysis for South Fork Wind determined vessel noise impacts to be minor on all marine mammals.

Operational noise was determined to have negligible to minor or minor to moderate impacts on marine mammals, varying by species or hearing groups. Specifically, for Revolution Wind, operational noise was determined to have moderate impacts on LFC marine mammals and negligible to minor impacts on all other marine mammal hearing groups. For Vineyard Wind 1, operational noise was determined to have negligible impacts on marine mammals while for Ocean Wind 1, operational noise was determined to have minor impacts (BOEM 2021a, 2021b, 2023a, 2023b).

BOEM also 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, some HRG surveys) and non-impulsive sources (e.g., vibratory pile diving, some HRG surveys, vessels, aircraft, cable laying or trenching, foundation/relief drilling, dredging, other site preparation activities, turbine operations, military training [sonar and munitions training]). Of those activities, only impact pile driving, vibratory pile driving, seismic surveys, and sonar surveys are anticipated to cause PTS/injury-level effects in marine mammals. While all sound sources that are audible by a given species have the potential to cause masking and behavioral responses, sound sources that exceed specific auditory thresholds may lead to PTS/TTS. All ongoing offshore wind projects are expected to include applicant-proposed measures (e.g., shutdown zones, noise mitigation, protected species observers), similar to the measures included in the Vineyard Wind 1, South Fork Wind, Ocean Wind 1, and Revolution Wind projects (BOEM 2021a, 2021b, 2023a, 2023b), 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, *Impacts of Alternative B – Proposed Action on Marine Mammals*.

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., HFCs and VHFCs), 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 O&M, and BOEM found that no changes to port utilization would occur (BOEM 2021a). 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 2023b). 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). Port expansion activities are localized to nearshore habitats and are expected to result in temporary, short-term impacts, if any, on marine mammals. Port utilization may also increase vessel noise, and as assessed under noise IPF section above, may affect marine mammals. However, the response would be expected to be temporary and short term. The impacts on water quality from sediment suspension during port expansion activities is temporary and short term and would be similar to those described under the cable emplacement and maintenance IPF in the previous section. Impacts from port utilization from ongoing construction and operation of offshore wind projects have been previously analyzed and are anticipated to be negligible.

Presence of structures: There are more than 130 artificial reefs in the Mid-Atlantic region. Artificial reefs are made of a variety of materials including cars, trucks, subway cars, bridge rubble, barges, boats, and large cables (MAFMC 2024. Artificial reefs may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals, if present where artificial reefs are located. In addition to offshore structures currently in the geographic analysis area, ongoing offshore wind projects will add WTGs, OSPs, and met towers to the offshore environment. Hard bottom from scour and cable protection and vertical structures such as WTG foundations in a soft-bottom habitat can create artificial reefs, thus inducing the “reef” effect. 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 bottoms. Increased prey abundance would be localized at foundation and cable protection locations, and a substantial increase in use of offshore wind project areas by foraging whales is not anticipated (NMFS 2021a). Disruption of normal behaviors could also occur due to the presence of offshore structures. Although spacing between the WTGs, OSPs, 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 presence and operation of individual WTGs could alter local hydrodynamic patterns at a fine scale. These changes, mainly resulting from the extraction of kinetic wind energy by turbine operations and reduction in wind stress at the air-sea interface, can lead to changes in horizontal and vertical water column mixing patterns (Miles et al. 2021). Laboratory measurements demonstrate that water flows are reduced immediately downstream of foundations but would return to ambient levels within relatively short distances (i.e., a few feet) or up to 3,281 feet (1,000 meters) depending on local conditions (Miles et al. 2017; Schultze et al. 2020; Johnson et al. 2021a). The downstream area affected by reduced flows is dependent on pile diameter. For monopiles (i.e., the structures with the largest diameter), effects are expected to dissipate within 300–400 feet (91–122 meters). Hub height and oceanographic conditions (e.g., currents, stratification, depth) also influence hydrodynamic impacts of foundations. Individual foundations may increase vertical mixing and deepen the thermocline, potentially increasing pelagic productivity locally (English et al. 2017; Kellison and Sedberry 1998). Eddies may also form as a result of water flowing around WTG and ESP foundations (Chen et al. 2016), which could also increase local retention of plankton, though this is hypothesized based on modeling conducted based on conditions present during storm activities and not in situ observations. A recent modeling study found that offshore wind structures could deepen the thermocline in the wind farm area by 3.3 to 6.6 feet (1 to 2 meters) and also lead to a greater retention of cooler water in the wind farm area during the summer (Johnson et al. 2021a). However, other studies indicate direct observations of the influence of a monopile extended to at least 984 feet (300 meters) but was indistinguishable from natural variability in a subsequent year (Schultze et al. 2020). The range of observed changes in current speed and direction 984–3,281 feet (300–1,000 meters) from a monopile is likely related to local conditions, wind farm scale, and sensitivity of the analysis.

Recently, NASEM reviewed and summarized the oceanographic and atmospheric effects from the presence of offshore wind energy structures (NASEM 2024). 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 8–10 monopile diameters from the foundation. This scale of direct influence is confirmed with high-resolution numerical modeling, with modeled turbulence impacts extending up to 328 feet (100 meters) downstream of an individual turbine (Schultze et al. 2020). The types of environmental variables affected up to a 328-foot (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 5–15 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 United States. This is expected to result in a lower concentration of hydrodynamic impacts, other factors being equal (e.g., foundation structure geometry).

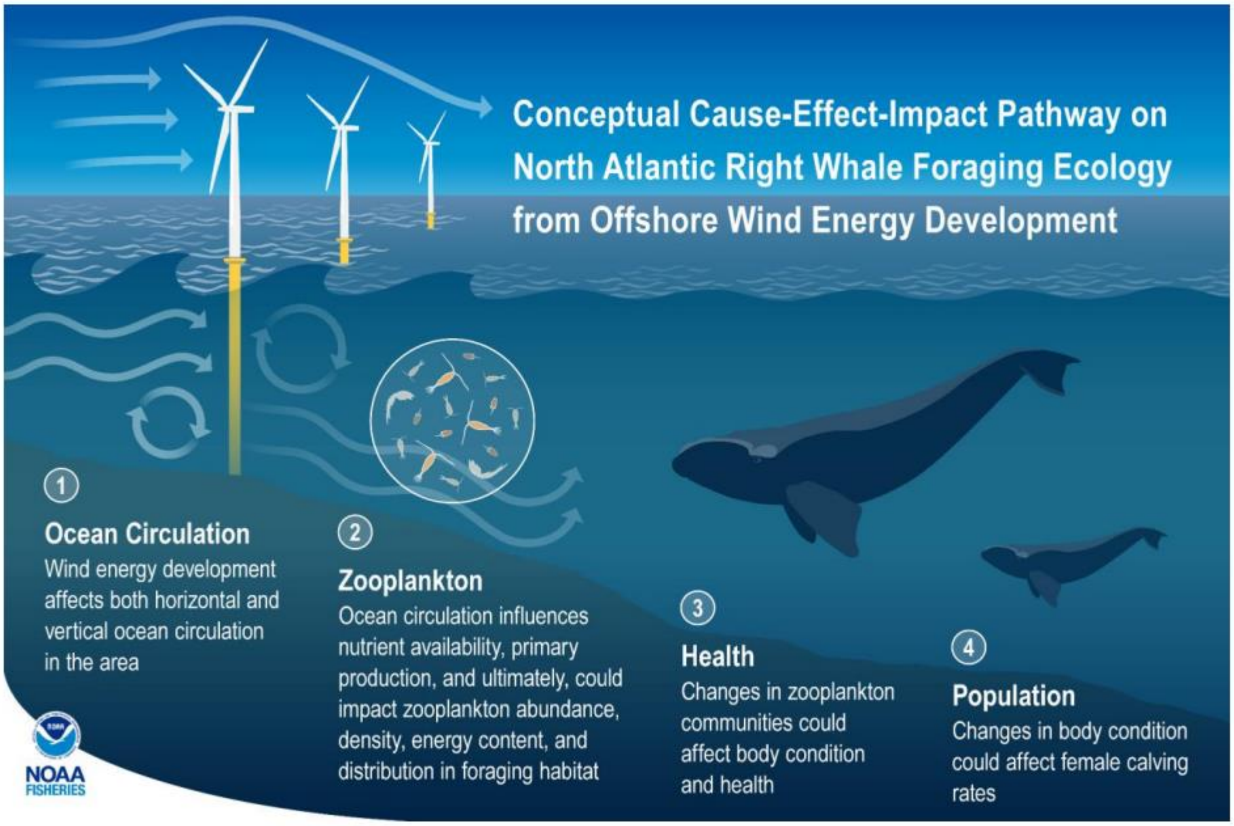
Atmospheric Effects

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.

The physical processes described above could affect prey presence or distribution. This possible impact is primarily relevant to baleen whales, as their prey includes planktonic prey such as copepods whose aggregation and density are primarily driven by hydrodynamic processes. As aggregations of plankton, which provide a dense food source for NARWs to efficiently feed upon, are concentrated by physical and oceanographic features, increased mixing may disperse aggregations and decrease efficient foraging opportunities. Potential impacts of hydrodynamic changes in prey aggregations are specific to marine mammals that feed on plankton, whose movement is largely controlled by water flow, as opposed to other marine mammals that eat fish, cephalopods, crustaceans, and marine vegetation, which are either more stationary on the seafloor or are more able to move independent of typical ocean currents. Figure 3.5.6-2 displays this conceptual cause-effect-impact pathway from physical oceanography to foraging success. However, there is considerable uncertainty as to the spatial and temporal scale of this potential effect from non-offshore wind activities and as to whether there would be broader ecological changes that would affect marine mammals in the future and how those changes would interact with other human-caused impacts, including fishing entanglement, vessel strikes, and ongoing climate change.

Therefore, based on available data, the impact of the increased presence of structures on marine mammals and their habitats is uncertain, its significance unknown, and likely varies by species and location.



Source: BOEM 2024b.

Figure 3.5.6-2. Conceptual cause-effect-impact pathway on NARW foraging ecology from offshore wind development

Given the uncertainty as described above, the hydrodynamic effects of offshore wind are unknown and may result in increases, decreases, or no change in prey availability. Furthermore, the effects on prey availability may be difficult to discern 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 has supported independent review of potential hydrodynamic impacts on NARW prey through NASEM which is summarized previously, funded two hydrodynamic modelling studies looking at Southern New England, and is also jointly funding with NMFS the following: 1) coupled hydrodynamic-ecosystem modeling of southern New England impacts from offshore wind energy development, 2) investigations of aggregations of NARW around Nantucket Shoals,[2] and has also supported for over a decade the Atlantic Marine Assessment Program for Protected Species[3] (AMAPPS).

In consideration of all the information presented above the potential impacts of ongoing and planned offshore wind projects would be similar to those described for ongoing activities under Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals*. Impacts from the presence of structures from ongoing and planned activities would likely be minor adverse for mysticetes (including NARW), odontocetes, and pinnipeds; although impacts on individuals would be detectable and measurable if they were to occur, the effects are highly uncertain and unlikely to rise to population-level effects for most species. Impacts on odontocetes and pinnipeds may result in slight beneficial effects due to increased foraging success around turbine foundations due to the artificial reef effect resulting in some aggregation of prey species.

Traffic (vessel strikes): Vessel collisions are a major source of mortality and injury for many marine mammal species (Hayes et al. 2021; Laist et al. 2001). Almost all sizes and classes of vessels have been involved in collisions with marine mammals around the world, including large container ships, ferries, cruise ships, military vessels, recreational vessels, commercial fishing boats, whale-watch vessels, research vessels, and even jet-skis (Dolman et al. 2006). Research into vessel strikes and marine mammals has focused largely on 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 speed and size are important factors for determining the probability and severity of vessel strikes. The size and bulk of the large vessels inhibit the ability for crew to detect and react to marine mammals along the vessel's transit route. Vessel strikes have been preliminarily determined as a leading cause of death for humpback whales during the current UME (NMFS 2024a) and a primary contributor to the NARW UME (NMFS 2024b). 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 80 meters or longer traveling at speeds greater than 13 knots. A more recent analysis conducted by Conn and Silber (2013) built upon collision data collected by Vanderlaan and Taggart (2007) and Pace and Silber (2005) included new

[2] https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/AT-22-13.pdf
[3] https://www.fisheries.noaa.gov/new-england-mid-atlantic/population-assessments/atlantic-marine-assessment-program-protected#:~:text=We%20conduct%20surveys%20and%20develop,sea%20turtles%20use%20our%20waters.

observations of serious injury to marine mammals as a result of vessel strikes at lower speeds (e.g., 2 and 5.5 knots). 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. 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, and that the probability of death declined by 50 percent at speeds less than 11.8 knots.

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 March 2019 to February 2020 was composed of cargo/carriers (22.4 percent), fishing vessels (19.6 percent), pleasure craft (19.1 percent), tugs (11.4 percent), other/undefined (11.1 percent), cruise ships/large ships (10.5 percent), and tanker/oil tanker (5.8 percent) (DNV GL 2021). Vessels more than 80 meters in length or longer and, therefore, those more likely to cause lethal or severe injury to large whales (Laist et al. 2001), in this area account for up to 38.7 percent of vessel traffic.

North Atlantic cetaceans and pinnipeds including, but not limited to, the 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 were recorded by Hayes et al. 2021 for the following species.

- Since 2017, there have been 16 confirmed vessel strikes on NARWs, 14 of which resulted in mortality or serious injury. From 2016–2020, 29 percent of the observed mortality and serious cases were attributed to vessel strike (Hayes et al. 2022). Applying this to the estimated mortality/serious injury cases (n= 156), it is estimated that 46 cases of mortality have occurred between the same time period (Hayes et al. 2022). In 2020, 1.3 collisions occurred with U.S. vessels. Two 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 (van der Hoop et al. 2012; Corkeron et al. 2018).
- For data collected in 2020, the fin whale had an annual average rate of 0.8 U.S. vessel collision. Between 2014 and 2018, there were confirmed fin whale mortalities linked with vessel collisions: two in 2016 and one each in 2017 and 2018.
- Similar to the fin whale, the annual average rate of vessel collisions was 0.8 per year for the sei whale.

- The minke whale had between one and two confirmed cases of whale mortalities linked with vessel traffic in North Atlantic waters between 2014 and 2018, with the exception of the year 2016, which had no confirmed deaths. The average rate of vessel collisions is 1.2 in U.S. waters.
- Humpback whales: Of the 184 whales involved in the 2016–2023 humpback whale UME, 40 percent showed evidence of human interaction (either entanglement or vessel strike). 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 common 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. Nineteen percent (n = 134) showed no evidence of human interaction and 69 percent (n = 478) could not be determined.
- Hayes et al. 2021 did not report any harbor porpoise strandings exhibiting evidence of vessel strikes for the Gulf of Maine/Bay of Fundy stock.

As a result of the impacts of vessel strikes on NARWs, NMFS implemented a seasonal, mandatory vessel speed rule in certain areas along the U.S. East Coast to reduce the risk of vessel collisions with NARWs. These Seasonal Management Areas require all vessels to maintain speeds of 10 knots or less and to avoid Seasonal Management Areas when possible. In 2020, NMFS reviewed the effectiveness of the Seasonal Management Area program. 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 Seasonal Management Areas to 3, while serious injuries (defined as a 50 percent probability of leading to mortality) increased from 2 to 4 and injuries increased from 8 to 14 (potentially due to increased monitoring levels). Laist et al. 2014 and NMFS (2020a) assessed the effectiveness of Seasonal Management Areas 5 years after their initiation by comparing the number of NARWs and humpback whale carcasses attributed to ship strikes since 1990 to proximity to the Seasonal Management Areas. Prior to implementation of Seasonal Management Areas, they found that 87 percent of NARW and 46 percent of humpback whale ship-strike deaths were found either inside Seasonal Management Areas or within 52 miles (83 kilometers, 43 nm), and that no ship-struck carcasses were found within the same proximity during the first 5 years of Seasonal Management Areas. Additional voluntary 10-knot speed restrictions are implemented for areas with aggregating NARWs outside of established Seasonal Management Areas in the form of Dynamic Management Areas and Slow Zones. In August 2022, NMFS proposed amendments to the vessel speed rule that could modify the spatial and temporal boundaries of the Seasonal Management Areas, restrict speeds to 10 knots for most vessels 35 feet (19.8 meters) or larger, create a Dynamic Speed Zone framework that would implement mandatory speed restrictions when whales are known to be present in areas outside of Seasonal Management Areas, and update the safety deviation provision (50 CFR 224).

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 (vessel strikes) on mysticetes 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, with the exception of NARWs. Additionally, impacts of traffic (vessel strikes) on individual mysticetes could have population-level effects, but the population should sufficiently recover. The impacts of traffic (vessel strikes) on NARWs from ongoing non-offshore wind activities would be major because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species. The impacts of traffic (vessel strikes) on odontocetes and pinnipeds from ongoing non-offshore wind 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, 2023a, 2023b). Therefore, ongoing offshore wind activities are anticipated to be negligible on marine mammals via the vessel traffic IPF, as vessel strikes from this industry are not likely to occur.

Impacts of Alternative A on ESA-Listed Species

Impacts of Alternative A on ESA-listed marine mammal species would be the same as the IPFs discussed above. The ESA-listed species that are common in the Lease Area is NARW (peak abundance in late fall through spring), fin whale (peak abundance late spring through summer) and sei whale (peak abundance spring through summer). The blue whale and sperm whale are rare and uncommon, respectively, in the Lease Area.

The three common ESA-listed whales, however, are also some of the most susceptible to vessel collisions in the region, and it is known that high traffic areas alter marine mammal distribution and behavior (COP Volume 2, Section 6.8.2.2, Table 6-67; SouthCoast Wind 2024). From 2015 to 2019, the minimum rates of human-caused mortality for sei whales and fin whales were calculated at 0.8 and 1.85 individuals per year, respectively (Hayes et al. 2022). From 2016 to 2020, the annual detected human-caused mortality for NARWs averaged 8.1 individuals per year (Hayes et al. 2022). Further, NARWs are susceptible to vessel strikes across the entire region. Given the breadth of their range, the scope of work for the construction phase of each lease area and other ongoing and planned activities, the timing of construction activities and implementation and adherence to mitigation plans for each lease area would be critical in reducing harmful interactions with NARW and other ESA-listed species. Current and ongoing activities and offshore wind development other than the proposed Project would affect all ESA-listed species occurring along the Atlantic OCS and transiting and foraging through various wind energy lease areas.

Adverse impacts on the commonly occurring ESA-Listed whales would have a disproportionate impact on their respective populations compared to non-listed marine mammal populations, as a function of their smaller populations. Genetic bottlenecks are more likely in breeding populations with few reproductive individuals—about 100 breeding female NARWs of a population of fewer than 338 whales

(Hayes et al. 2022), giving birth every 6 to 10 years (NMFS 2023b)—and bottlenecks may be further exacerbated from the proposed Project. From an evolutionary perspective, this makes individuals less genetically fit, increasing the probability of inbreeding and decreasing the ability for individuals to successfully adapt to changing environmental conditions due to decreased genetic diversity and fitness.

Any future federal or private activities that could affect federally listed marine mammals in the geographic analysis area would need to comply with ESA Section 7 or Section 10, respectively, to ensure that the proposed activities would not jeopardize the continued existence of the 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., mike 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.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative 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 may contribute to impacts on marine mammals include undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; dredging and port improvement; marine minerals use and ocean-dredged material disposal; military use (i.e., sonar and munitions training); marine transportation; research initiatives; fisheries use and management; oil and gas activities, which includes the development of projects from oil and gas leases recently sold in the Gulf of Mexico in 2023 and up to three new lease sales between 2024 and 2029; installation of new structures (artificial reefs); and onshore development activities (refer to Appendix D, *Planned Activities Scenario,* Section D.2 for a description of planned activities). These activities could result in temporary or permanent 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, EMFs and cable heat, cable emplacement and maintenance, port utilization, noise, and the presence of structures as described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals,* for ongoing non-offshore wind activities.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on marine mammals during construction, O&M, and decommissioning of the projects. Other offshore wind activities in the geographic analysis area for marine mammals include the construction, O&M, and decommissioning of approximately 35 offshore wind projects, which would result in an additional 2,945 WTGs and offshore substation platforms in the geographic analysis area (Appendix D, Table D-2).

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

Accidental releases: Gradually increasing non-offshore wind vessel traffic over time would increase the risk of accidental releases. Accidental releases of fuel, fluids, hazardous materials, trash, and debris may also increase as a result of planned offshore wind activities. The risk of any type of accidental release would be increased primarily during construction when additional vessels are present, but also during operations and decommissioning of offshore wind facilities. Similarly, there would be a low risk of a leak of fuel, fluids, or hazardous materials from any one of approximately 2,945 WTGs and offshore substation platforms. Total fuel, fluids, or hazardous materials in the geographic analysis area is estimated at about 25 million gallons (95 million liters) (Appendix D, Table D2-3). 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). Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on individual fitness, including adrenal effects, hematological effects, liver effects, lung disease, poor body condition, skin lesions, and several other health effects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). 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. 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 future 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, operation, 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). 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 future offshore wind activities would likely be negligible compared to other ongoing trash releases.

Though exposure to accidental releases from 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 planned offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable.

Cable emplacement and maintenance: Cable emplacement and maintenance activities for ongoing and planned non-offshore wind activities (i.e., for undersea transmission lines or submarine telecommunications cables) could periodically occur in the geographic analysis area. Cable emplacement and maintenance activities disturb bottom sediments and cause temporary local increases in suspended sediment that are generally limited to the emplacement corridor. Other offshore wind projects could disturb approximately 181,822 acres (73,581 hectares) of seabed while installing interarray and export cables, causing an increase in suspended sediment. Those effects would be similar to those observed during construction of the Block Island Wind Farm (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 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.

There are no data on physiological effects of suspended sediment on marine mammals or marine mammal avoidance of sediment plumes. Some marine mammal species live in high-turbidity waters or employ foraging techniques that generate sediment plumes, suggesting that some 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). Refer to Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, 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 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 in Section 3.5.6.3, *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 minimize the likelihood of nonnative 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 OSPs 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 intake systems (CWIS) for HVDC converters and cable-laying equipment. As discussed in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat,* 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.

EMFs and cable heat: Planned offshore wind activities would install Up to 9,970 miles (16,045 kilometers) of export and interarray cables, increasing the production of EMF in the geographic analysis area (Appendix D, Table D2-1). Marine mammals appear to detect EMF intensity as low as 50 milligauss (Normandeau et al. 2011); however, scientific evidence is limited. As such, marine mammals may be sensitive to minor changes in EMFs, and it is theoretically possible that they could detect EMF from export and interarray cables (Walker et al. 2003). However, to be exposed to EMF above this 50 milligauss 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. There is a potential for animals to react to local variations of the geomagnetic field caused by power cable EMFs, including a temporary change in swim direction following exposure to EMFs (Gill et al. 2005). These effects are more likely with exposure to HVDC cables versus HVAC cables (Normandeau et al. 2011). However, no EMF impacts on marine mammals associated with underwater cables have been documented. EMF effects would be reduced by cable burial to an appropriate depth and the use of shielding, if necessary. Additionally, submarine cables typically maintain a minimum separation of at least 330 feet (101 meters), which ensures that there would be no additive EMF effects from adjacent cables. Therefore, BOEM anticipates EMF effects on marine mammals would be negligible.

Buried submarine cables can warm the surrounding sediment in contact with the cables up to tens of centimeters (Taormina et al. 2018). There are no data on cable heat effects on marine mammals (Taormina et al. 2018), but it is expected that the localized heating along a cable would not have any detectable impacts on marine mammals as above-sediment cables are cooled by the water, while the extent of heat from buried cables is limited to sediments (Taormina et al. 2018). Therefore, effects on marine mammals from cable heat are expected to be negligible.

Although increased heat in the sediment could affect benthic organisms that serve as prey for fish species that forage in the benthos that piscivorous marine mammals forage upon, there is expected to be ample available resources nearby that would not affect the availability of forage fish for marine mammals. Based on the narrowness of cable corridors and expected weakness of thermal radiation, impacts on benthic organisms are not expected to be significant (Taormina et al. 2018) and would be limited to a small area around the cable. Given the expected cable burial depths, thermal effects would not occur at the surface of the seabed where marine mammals would forage. Any effects on marine mammal prey availability would be too small to be detected or meaningfully measured and therefore, would be negligible. As such, EMFs and cable heat would not be expected to appreciably contribute to cumulative impacts on marine mammals.

Gear utilization. Ongoing and planned offshore wind projects are likely to include surveys that monitor biological resources in and nearby associated project areas throughout various stages of development, similar to the Proposed Action. These could include acoustic, trawl, and trap and pot surveys, as well as other methods of sampling the biota in the area. Benthic monitoring and video surveys could include ROVs to capture still or live video images of the subsurface. Moored passive acoustic monitoring (PAM) systems or mobile PAM platforms such as towed PAM, autonomous surface vehicles, or autonomous underwater vehicles may be used prior to, during, and following construction. Non-offshore wind activities, particularly commercial and recreational fishing, currently contribute and are expected to continue contributing to entanglement risk for marine mammals. Baseline conditions for commercial fisheries, which contribute entanglement risk and, thus, is a leading cause of mortality to marine mammals are discussed in detail in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*.

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). However, while the presence of monitoring gear could affect marine mammals by entrapment or entanglement, developers and future developers would be required to include marine mammal mitigation and monitoring procedures in COPs, submitted to agencies, that are designed to avoid entanglement or entrapment in any biological survey plans. Developers are also expected to comply with BOEM's guidance for fisheries surveys provided in BOEM (2023c), 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. Thus, it is expected that monitoring plans would have sufficient mitigation procedures in place to reduce potential impacts such that they are extremely unlikely to occur and would not result in population-level effects for any species. 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 previously described entanglement or entrapment risk for marine mammals and potential impacts. 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. are expected to occur at short-term, regular intervals over the lifetime of the projects and would have no perceptible consequences to individuals or the population. However, the potential extent and number of animals potentially exposed cannot be determined without project-specific information.

If entanglement or entrapment occurs, the impacts of gear utilization from planned non-offshore wind activities on mysticetes (except NARWs), odontocetes, and pinnipeds would be moderate because they are likely to result in long-term consequences to individuals or populations that are detectable and measurable. Impacts on individual mysticetes, odontocetes, and pinnipeds could have population-level effects, but the population should sufficiently recover. Gear utilization from planned non-offshore wind activities would likely result in major impacts for NARWs if a NARW is entangled because impacts on individual NARWs could have severe population-level effects and could compromise the viability of the species.

Lighting: The addition of up to 3,025 WTGs and 55 OSPs new offshore structures in the geographic analysis area with long-term hazard and aviation lighting, as well as lighting associated with construction vessels, would increase artificial lighting. If nighttime pile driving was permitted, increased lighting could increase prey concentrations and attract marine mammals. BOEM would require offshore wind developers to comply with the current design guidance for avoiding and minimizing artificial lighting effects; however, artificial light could aggregate prey species at night. According to Orr et al. (2013), the impact of operational lighting effects from wind farm facilities on marine mammal distribution, behavior, and habitat is expected to be minimal under recommended design and operating practices. Impacts from lighting from ongoing and planned offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or the population. As such, lighting would not be expected to appreciably contribute to cumulative impacts on marine mammals.

Noise: Noise sources from ongoing and planned offshore wind and non-offshore wind activities are similar to those described previously under Section 3.5.6.3, *Impacts of Alternative A – No Action Alternative on Marine Mammals*. The following analysis describes the extent of impacts associated with planned offshore wind and non-offshore wind activities expanding on the impact analysis provided in Section 3.5.6.3. The sources as previously analyzed for ongoing non-offshore wind activities would continue to persist in the geographic analysis area, and potential effects on marine mammals would remain unchanged as previously described. The following noise impacts would analyze the additional risks from planned offshore wind projects in the geographic analysis area in relation to impacts discussed in Section 3.5.6.3.

Planned offshore wind activities in the geographic analysis area that could cause underwater noise are pile driving (installation of WTGs and OSP, and installation and removal of piles to support cable landfall construction activities), G&G surveys (HRG surveys and geotechnical drilling activities), detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and dredging and drilling during construction, vessel traffic during O&M, and turbine operation. Each of these sub-IPFs are discussed under their own heading in the following sections. Decommissioning activities related to noise are likely similar to those outlined for construction activities.

Noise - aircraft: Other offshore wind activities may employ helicopters and fixed-wing aircraft for transporting construction and/or maintenance crew, or monitoring during construction activities, which emit sound that could affect marine mammals. In general, marine mammal behavioral responses to aircraft most commonly occur at distances of less than 1,000 feet (less than 305 meters) (Patenaude et al. 2002). Most aircraft operations would occur above this altitude except under specific circumstances (e.g., helicopter landings on the service operations vessel or visual inspections of WTGs).

Aircraft operations have resulted in temporary, minor, behavioral responses including short surface durations for bowhead and belugas (Patenaude et al. 2002), transient sperm whales (Richter et al. 2006), abrupt dives for sperm whales (Smultea et al. 2008), and percussive behaviors, i.e., breaching and tail slapping (Patenaude et al. 2002). Responses appear to be heavily dependent on the behavioral state of the animal, with the strongest reactions seen in resting individuals (Würsig et al. 1998). BOEM requires all aircraft operations to comply with current approach regulations for NARWs or unidentified large whales (50 CFR 222.32). These include the prohibition of aircraft from approaching within 1,500 feet (457 meters), which would minimize the potential responses of marine mammals to aircraft noise. In addition, based on the physics of sound propagation across different media (e.g., air and water), only a small portion of the acoustic energy from aircraft operations couples into the water. With the implementation of mitigation measures, noise impacts from aircraft are expected to be negligible to marine mammals.

Noise - dredging: Site-preparation activities may include dredging to remove materials from the seafloor in preparation for construction of the foundation and ECCs. Underwater noise generated by dredging depends on the type of dredge equipment used. The two most common types of dredge equipment used for offshore wind projects are mechanical and hydraulic. Mechanical dredging uses crane-operated buckets, grabs (clamshell), or backhoes, and hydraulic (suction) and controlled-flow excavation dredging uses suction. SPL source levels for suction dredges range from 172 to 190 dB re 1 µPa-m with frequencies between 1 and 2 kilohertz (Robinson et al. 2011; Todd et al. 2015; McQueen et al. 2019; Zykov et al. 2007). Source levels for mechanical clamshell dredging have been estimated as 176 dB re 1 µPa-m (BC MoTI 2016). As a result, PTS effects are considered unlikely (Todd et al. 2015), but temporary hearing loss could occur if receivers are close to dredging activities over a sustained period. 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. Behavioral responses of marine mammals to dredging activities have included avoidance in bowhead whales, gray whales, minke whales, and gray seals (Bryant et al. 1984; Richardson et al. 1990; Anderwald et al. 2013). Diederichs et al. (2010) found short-term avoidance of dredging activities by harbor porpoises near breeding and calving areas in the North Sea. Pirotta et al. (2013) found that, despite a documented tolerance of high vessel presence, as well as high availability of food, bottlenose dolphins spent less time in the area during periods of dredging. The study also showed that with increasing intensity in the activity, bottlenose dolphins avoided the area for longer durations (with one instance being as long as 5 weeks; Pirotta et al. 2013).

While behavioral responses may occur from noise exposure to dredging, the transitory nature of this activity in ongoing and planned offshore wind projects are likely to result in impacts that are short term and of low intensity. Masking and behavioral reactions from dredging may be more likely for mysticetes and pinnipeds due to the low-frequency spectrum over which the sounds occur and the overlap with their best hearing sensitivity, but the extent over which this would occur would be temporary and localized. Therefore, impacts from dredging noise would be minor for all marine mammals.

Noise - drilling: Drilling which may occur during geotechnical surveys, foundation installation, and HDD at the export cable landfalls, produces low-frequency (20–1,000 Hz), non-impulsive, continuous noise. Most measurements of offshore drilling noise have been taken during oil exploration and production drilling (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 SPLs (in the 30 to 2,000 Hz band) have been measured up to 145 dB re 1 µPa m from a jack-up platform (Erbe and McPherson 2017), and up to 162 dB re 1 µPa m from an anchored drilling vessel (Huang et al. 2023). This could exceed the continuous noise threshold for behavioral disturbances of 120 dB re 1 µPa out to approximately 126 meters (143 feet), but these events are expected to be short term, which limits the number of marine mammals potentially present during construction. Noise produced from drilling would also be considered similar to vessel noise, which does not tend to elicit more than minor reactions. HDD equipment is generally located on shore, and the sound that propagates into the water is considered to be negligible (Willis et al. 2010).

Research suggests that the sensitivity of marine mammals to drilling noise varies between and within species and is likely context-dependent (Richardson et al. 1990). For example, ringed seals (*Pusa hispida*) and harbor porpoises may be relatively tolerant to drilling activities (Moulton et al. 2003; Todd et al. 2009). Todd et al. (2020) measured drilling noise from jack-up platforms and concluded that harbor porpoises can only detect drilling noise out to a distance of approximately 70 meters (230 feet) from the source at the study site and concluded that the noise is unlikely to interfere with or mask echolocation clicks. In terms of behavioral disturbance, drilling activities may exceed the continuous noise threshold of 120 dB re 1 µPa out to approximately 143 feet (126 meters) from the source and given the low-frequency nature of drilling sounds, baleen whales may be more vulnerable to disturbance. The majority of studies on baleen whale behavioral responses to drilling noise have been conducted on arctic species in the context of oil and gas extraction, and these studies currently serve as the best available proxies. Bowhead whales have been reported to avoid a radius of approximately 6 miles around an operating drillship, with some individuals avoiding the site up to 12 miles (19 kilometers) away (Richardson et al. 1995). Richardson et al. (1990) performed playback experiments of drilling and dredging noises and observed bowhead whale responses. Behavioral reactions were observed for most of the animals, such as orienting away from the sound, cessation of feeding, and altered surfacing, respiration, and diving cycles (Richardson et al. 1990). Roughly half of the bowhead whales responded to the drilling noise playback at a received level of 115 dB re 1 µPa (20- to 1,000-Hz band) (Richardson et al. 1990). Blackwell et al. (2017) reported that bowhead whale calling rates correlated with increasing levels of drilling noise, where calling rates initially increased, peaked, and then decreased. Therefore, while drilling may cause behavioral responses, these responses are not expected to be long lasting or biologically significant to marine mammal populations. While behavioral responses may occur from drilling noise, responses are expected to be short term and of low intensity. Impacts from potential drilling activities on all marine mammals would, therefore, be minor.

Noise - G&G (HRG surveys and geotechnical drilling activities): For the purposes of offshore wind projects, geophysical surveys use active acoustic sources to evaluate the feasibility of turbine installation and to identify potential hazards. 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). Individual marine mammals would have to remain close to the sound source for extended periods of time to be exposed to noise of sufficient intensity to cause TTS or PTS, which is considered unlikely. Geotechnical surveys may introduce low-level, intermittent, broadband noise into the marine environment. These sounds could result in acoustic masking in LFCs or HFCs but are unlikely to result in behavioral disturbance given their low source levels and intermittent use.

Of the few empirical studies assessing the effect of HRG sources on marine mammals, 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 scientific echosounder, 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, and Cholewiak et al. (2017) found a decrease in beaked whale echolocation click detections during use of an EK-60. 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). 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. BOEM also requires applicants to develop mitigation plans such as those outlined in COP Appendix O (e.g., protected species observers, clearance zones), which would further minimize exposure risk. There are project design criteria and BMPs that are laid out in a recent Programmatic Letter of Concurrence (BOEM 2021c) that, if followed, would result in insignificant behavioral effects and very unlikely physiological effects on marine mammals. Therefore, impacts from G&G surveys would be limited to short-term behavioral disturbances within a localized area around the G&G survey equipment with no population-level impacts expected for any species. Impacts would, therefore, be minor for all marine mammals.

Noise - impact and vibratory pile driving: The installation of WTG foundations into the seabed involves pile driving, which can produce high SPLs in the underwater environment and may affect marine mammals. The construction of up to 2,945 new WTG and offshore substation platform foundations in the geographic analysis area would create underwater noise and may affect marine mammal species in the area. Construction of offshore wind facilities is expected to occur intermittently over an 8-year period in lease areas that are anticipated to be developed in the geographic analysis area. The generation of underwater noise during pile driving and the probability of impact are dependent on the type of pile being driven, type of hammer, substrate type, water depth, and species' auditory capabilities (ICF Jones and Stokes and Illingworth and Rodkin, Inc. 2009). These impacts would vary in extent and intensity based on the scale and design of each project, as well as the schedule of project activities.

There are three potential exposure scenarios that marine mammals could experience.

- Concurrent exposure to noise from two or more impact or vibratory hammers operating simultaneously.
- Non-concurrent exposure to noise from multiple pile-driving events within the same year.
- Exposure to two or more concurrent or non-concurrent pile-driving events over multiple years.

Concurrent pile-driving scenarios would increase the geographical extent and sound intensity to which a marine mammal is exposed at a given time when the piles are being driven but would decrease the total number of days of exposure (assuming the project is completed faster if they drive piles consecutively and, thus, they can install more piles per day than if pile driving is non-concurrent). Concurrent pile driving may be considered appropriate or desirable if scheduled to avoid critical periods when sensitive or particularly vulnerable populations (e.g., NARW) are present in highest densities and to complete project construction faster. However, this could result in greater potential for TTS and PTS to occur in marine mammals that are more likely to be present during concurrent pile driving. Because driving non-concurrently would likely extend the time over which construction would occur, this scenario could increase the total number of exposure days. Given that multiple planned activities are proposed for construction, it is likely that some individual marine mammals would experience two or more impact and vibratory pile-driving noise exposure days within the same year.

Pile-driving activities from other offshore wind development projects are likely to exceed PTS and TTS thresholds for all marine mammal functional hearing groups. Depending on mitigations applied (single versus double bubble curtain and the use of exclusion zones), these effects could be reduced. However, due to the observed avoidance behavior of several marine mammal species during impact pile-driving activities, certain marine mammal species (HFCs and pinnipeds) are less likely to be exposed to underwater noise for sufficient duration to cause PTS and TTS. For example, toothed whales and baleen whales show varying levels of sensitivity to mid-frequency impulsive noise sources, with observed responses ranging from displacement (Maybaum 1993) to avoidance behavior (animals moving rapidly away from the source) (Hatakeyama et al. 1995; Watkins et al. 1993); thus, behavioral responses may reduce incidences of exceeding PTS and TTS thresholds.

Brandt et al. (2011) measured harbor porpoise acoustic activity during impact pile driving of 91 monopile foundations in the offshore North Sea at a wind farm construction site. At 0.447 mile (720 meters) during one pile-driving event, maximum values were measured at 196 dB re 1 μPa (L_{pk}), 176 dB re 1 μPa^{2}s (SEL), and 170 dB re 1 μPa^{2}s. At a distance of 1.43 miles (2,300 meters) from pile driving, maximum levels reached 184 dB re 1 μPa (L_{pk}), 164 dB re 1 μPa^{2}s (SEL), and 157 dB re 1 μPa^{2}s. Porpoise vocal activity was demonstrated to completely cease up to one hour after pile driving and remained below average levels for 24 to 72 hours at distances up to 1.6 miles (2.6 kilometers) from the pile-driving site. Reduced vocal activity was evident up to 11.1 miles (17.8 kilometers) from the site, although increased vocal activity was shown to temporarily increase at 14 miles (22 kilometers) distance during pile driving, which could be explained by animals moving to this area to avoid the area of potential noise disturbance. Results from Brandt et al. 2011 indicate an overall reduced abundance of harbor porpoise during the 5-month installation period of the piles, with the authors postulating that this was either a direct (e.g., sensory disturbance, communication masking) or indirect (reduced prey availability) effect of pile-driving noise.

A more recent analysis by Brandt et al. (2016) from eight offshore wind facility projects in the North Sea suggests harbor porpoises actively avoid pile-driving activities during the construction and installation phase. Across the eight projects, a gradient decline in porpoise detections at different distances from pile-driving activities was observed. During pile-driving activities, porpoise detections declined by 68 percent within 3.1 miles (5 kilometers) of the noise source, declined by 26 percent between 6.2 and 9.3 miles (10 and 15 kilometers), but showed no further declines beyond 10.6 to 12.4 miles (17 to 20 kilometers). Within 20 to 31 hours post-pile driving, porpoise detections increased in the 0- to 3.1-mile (0- to 5-kilometer) range. Further, little to no habituation was found (i.e., over the course of installation, porpoises stayed away from pile-driving activities and these responses did not wane) and there was no indication of the presence of temporal overall effects from construction of the eight wind facilities. 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.

A study conducted during wind farm construction in Cromarty Firth, Scotland compared the effect of impact and vibratory pile-driving on the vocal presence of both bottlenose dolphins and harbor porpoises in and outside the Cromarty Firth area (Graham et al. 2017). The researchers found a similar level of response, of both species to both impact and vibratory piling, likely due to the similarly low, received sound exposure levels from the two approaches (129 dB re 1 μPa2s [vibratory] and 133 dB re 1 μPa2s [impact], both at 812 meters from the pile). There were no statistically significant responses attributable to either type of pile-driving activity in the three metrics considered: daily presence/absence of a species, number of hours in which a species was detected, or duration of daytime (between 6:00 a.m. and 6:00 p.m.) 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 in the Cromarty Firth (closest to pile-driving activity) compared to areas outside the Cromarty Firth. The authors hypothesized that the lack of a strong response was because the received levels were very low in this particularly shallow environment, despite similar size piles and hammer energy to other studies. This study underscores the important influence of environmental conditions on the propagation of sound and its subsequent impacts on marine mammals.

In addition to avoidance behavior, several studies have observed other behavioral responses in marine mammals. A playback study on two harbor porpoises revealed that high-amplitude sounds, like pile driving, may adversely affect foraging behavior in this species by decreasing catch success rate (Kastelein et al. 2019). In another playback study, trained dolphins were asked to perform a target detection exercise during increasing levels of vibratory pile driver playback sounds (up to 140 dB re 1 μPa) (Branstetter et al. 2018). Three of the five dolphins exhibited either a decrease in their ability to detect targets in the water or a near-complete cessation of echolocation activity, suggesting the animals became distracted from the task by the vibratory pile-driving sound.

In addition to bottlenose dolphins and harbor porpoises, the effects of pile driving have been studied on a limited set of additional species. Würsig et al. (2000) studied the response of Indo-Pacific hump-backed dolphins (*Sousa chinensis*) to impact pile driving in the seabed in water depths of 20–26 feet (6–8 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 had ceased, dolphin abundance and behavioral activities returned to pre-pile-driving numbers and behaviors. Southall et al. (2021) evaluated four observational studies of harbor porpoise responses to pile driving (Brandt et al. 2009, 2011; Thompson et al. 2010; Tougaard et al. 2009a). In each study, group vocal responses (changes in clicking behavior) were reported, but it was difficult to distinguish whether the reported reductions in clicks could represent a reduction in foraging or avoidance in disturbed areas or both. The evaluation determined that harbor porpoises responded to pile driving with minor reductions in vocal output, possible sustained avoidance, reduced vocal mechanisms, and habitat avoidance (Southall et al. 2021).

A telemetry study conducted off the east coast of England showed that harbor seals may temporarily leave an area affected by pile-driving noise. Seal abundance was reduced by 19–83 percent up to 15.5 miles (25 kilometers) away during the installation of impact pile driving of WTG monopiles but found no significant displacement within 2 hours of cessation of pile-driving activities (Russell et al. 2016). Monitoring studies in the Dutch North Sea showed that harbor seals may avoid large areas (24.8 miles [39.9 kilometers]) during pile driving and other construction activities. However, seals returned to the area following construction activities, indicating that avoidance was temporary (Lindeboom et al. 2011). These findings are consistent with the best available information on noise and marine mammals, which predicts a spectrum of effects depending on duration and intensity of exposure, as well as species and behavior of the animal (e.g., migrating, foraging). Southall et al. (2021) evaluated an observational study (Blackwell et al. 2004) of responses in ringed seals (*Phoca hispida*) to underwater pile-driving noise. They concluded that observed responses ranked zero (no response detected with methods sufficient to identify responses relevant to survival, feeding, or reproduction) to one (mild orientation responses) (Southall et al. 2021: Table 3). Based on the available literature, it is expected that seals are likely to exhibit moderate, but temporary behavioral responses to impact pile-driving activities.

Because there are no studies that have directly examined the behavioral responses of baleen whales to pile driving, studies using other impulsive sound sources such as seismic airguns serve as the best available proxies. With seismic airguns, the distance at which responses occur depends on many factors, including the volume of the airgun (and consequently source level), as well as the hearing sensitivity, behavioral state, and even life stage of the animal (Southall et al. 2021). Malme et al. (1986) observed the responses of migrating gray whales to seismic exploration.[4] At average peak pressure (L_{pk}) of about 173 dB re 1 μPa, feeding gray whales had a 50 percent probability of stopping feeding and leaving the area. Some whales stopped feeding at peak levels (L_{pk}) of 163 dB re 1 μPa. Individual responses were highly variable. Most whales resumed foraging activities once the airgun activities stopped. Dunlop et al. (2017) observed that migrating humpback whales would avoid airgun arrays[5] less than 3 kilometers away when received SELs were over 140 dB re 1 $\mu Pa^2 s$ (Dunlop et al. 2017). Controlled exposure experiments with simulated military sonar and other mid-frequency sounds showed decreased vocal activity and disruption in foraging patterns for deep feeding blue whales (Goldbogen et al. 2013).

Acoustic masking can occur if the frequencies of the activity overlap with the communication frequencies used by marine mammals. The dominant frequencies emitted from impact pile-driving activities are dependent on the type of pile being driven, type of hammer, substrate type, and water depth (ICF Jones and Stokes and Illingworth and Rodkin, Inc. 2009). JASCO Applied Sciences modeled impact pile-driving activities for the Proposed Action in COP Appendix U2 (SouthCoast Wind 2024), which can be used to estimate the potential for masking to occur during other offshore wind activities. Modeling results indicate that dominant frequencies of impact pile-driving activities for the proposed Project were concentrated below 1 kilohertz. Based on these results, low-frequency cetaceans (LFCs) and pinnipeds are more likely to experience acoustic masking than HFCs and VHFCs.

The short-term consequences of masking from pile-driving activities range from temporary changes in vocal patterns to avoidance of important areas. Longer-term consequences include permanent changes to vocal patterns; reductions in fitness, survivorship, and recruitment; and abandonment of important habitat areas. Most marine mammal species use a range of frequencies to communicate. Pile-driving activities would not overlap with the vocalization of all marine mammal communications. As a result, a complete masking of marine mammal communications from the No Action Alternative would not be expected. In addition, the duty cycle of sound sources is also important when considering masking effects. Low-duty-cycle sound sources such as impact pile driving are less likely to mask marine mammal communications, as the sound transmits less frequently with pauses or breaks between impacts, providing opportunities for communications to be heard.

Overall, it is reasonable to assume that there would be greater impacts on LFCs (i.e., baleen whales) than other species groups, even though direct research on pile-driving noise on baleen whales is limited. As discussed above, there is evidence suggesting that baleen whales may avoid or change their behavior when exposed to impulsive sounds. Secondly, their primary frequency range for listening to their environment and communicating with others overlaps with the dominant frequency of impact and vibratory pile-driving noise. Finally, because baleen whales have specific feeding and breeding grounds (unlike toothed whales who can perform these life functions over broader spatial scales), disturbance by anthropogenic noise occurring in one of these key geographic areas may come at an increased cost to these species. Considering the number and extent of projects planned in the geographic analysis area, some individual fitness-level impacts are expected to result from impact pile-driving activities. These

[4] 20-cubic-inch airgun.
[5] 20- and 140-cubic-inch airgun.

impacts would be further reduced with the implementation of project-specific applicant mitigation measures required by BOEM as conditions of compliance with the ESA and MMPA and other federal regulations. For example, noise abatement devices, such as double-bubble curtains, can be used to reduce the overall acoustic energy that is introduced and decrease the geographic extent of noise-related impacts. The implementation of shutdown zones and seasonal restrictions based on species presence in an area can reduce the intensity and likelihood of effects to minor, by only allowing activity when animals are not present. These measures would reduce the potential for PTS and TTS effects from pile driving on marine mammals. Some behavioral avoidance and masking effects are still considered likely; however, those effects are not expected to result in significant behavioral responses leading to longer-term consequences to individuals or populations.

Noise - turbine operation: 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. Both airfoil sound and mechanical vibration may result in long-term, continuous noise in the offshore environment. Based on the currently available sound field data for turbines smaller than 6.2 MW (Tougaard et al. 2020) and comparisons to acoustic impact thresholds (NMFS 2018), underwater sound from offshore wind turbine operations (without the Proposed Action) is not likely to cause PTS or TTS in marine mammals but could cause behavioral and masking effects at close distances. Tougaard et al. (2020) aggregated the existing sound field measurements from 17 operating wind farms and modeled the received sound levels as a function of recording distance, wind speed, and turbine size. Based on their model, the mean of all the data normalized to a measurement made at 328 feet (100 meters), for a turbine 1 MW in size operating at a wind speed of 10 m/s was a received SPL of 109 dB re 1 µPa (SE=1.7 dB). Based on the model, the noise from a single, 1 MW turbine dropped below ambient conditions within 1,312 feet (400 meters) of the foundation or a few kilometers for an array of 81 turbines. For high ambient noise conditions, the distance at which the turbine can be heard above ambient noise was even less. It is important to note that just because a sound is audible, that does not mean that it would be disturbing or be at a sufficient level to mask important acoustic cues. There are many natural sources of underwater sound, which vary over space and time and would affect an animal's ability to hear turbine operational noise over ambient conditions. Lucke et al. (2007) explored the potential for acoustic masking from operational noise by conducting hearing tests on trained harbor porpoises while they were exposed to sounds resembling operational wind turbines (i.e., < 1 kHz). Of the two masking conditions (i.e., high: SPL of 128 dB re 1 µPa and moderate: 115 dB re 1 µPa), designed based on noise measurements from operational turbines of sizes less than 5 MW, they saw masking effects at a received level of 128 dB re 1 µPa at frequencies of 700 Hz, 1 kHz, and 2 kHz, but found no masking at SPLs of 115 dB re 1 µPa. At this broadband-received level, the noise at 700 Hz, 1 kHz, and 2 kHz was 6.8 dB, 7.3 dB, 4.8 dB over unmasked conditions, respectively. Based on these results, the researchers concluded that masking may occur within 66 feet (20 meters) of an operating turbine. This research considered the contemporaneous size turbines, i.e., < 5 MW, and the noise they make during operation. Larger turbines are being considered now (up to 18 GW); however, empirical measurements have only been conducted for turbines with nominal power between 2.3 and 8.4 MW (Bellmann et al. 2023). In this study (Bellmann et al. 2023), 27 available operating noise measurements from 24 German offshore wind farms in the North and Baltic Sea were analyzed and found no strong correlation between noise levels and the nominal power of turbines. However, the study found a noticeable trend where turbines with higher nominal power (>5 MW at 119 dB) tend to be somewhat quieter than those with lower nominal power (≤5 MW at 122.5 dB). This difference may be attributed by the transition from gearboxes to direct drive systems, as well as the increasing size and weight of the rotor drive system and foundation structures such that fewer vibration amplitudes are transmitted due to the large masses. Consequently, the more recent turbine models appear to be somewhat quieter compared to older versions due to the development of larger, more efficient and low-maintenance systems. Bellmann et al. (2023) also concludes that at a distance of 328 feet (100 meters) from the turbine, broadband noise levels remain below 130 dB. While the tonal, low-frequency components of the turbines in operation can still be measured a few kilometers outside of the wind farms, at increasing distance, the emitted noise becomes harder to distinguish from general background noise levels.

Very few empirical studies have looked at the effect of operational wind turbine noise on wild marine mammals. Some have shown an increase in acoustic occurrences of marine mammals during the operational phase of wind farms (harbor seals - Russell et al. [2016], harbor porpoise – Scheidat et al. [2011]), while another study showed a decrease in the abundance of porpoises one year after operation began in comparison with the pre-construction period (Tougaard et al. 2005). However, no change in acoustic behavior was detected in the animals that were present (Tougaard et al. 2005). In these field monitoring studies, it is unclear if the behavioral responses result from operational noise, or merely the presences of turbine structures. Regardless, these findings suggests that turbine operational noise did not have any gross adverse effect on the acoustic behavior of the animals.

Due to their low sound levels, behavioral and masking effects associated with turbine operational noise are not expected to have significant impacts on individual survival, population viability, distribution, or behavior, and are not expected to occur outside a very small radius around a given turbine. In addition, the audibility of turbine operational noise may be further limited by the ambient noise conditions of the environment (e.g., Jansen and de Jong 2016). Therefore, turbine operational noise is expected to have a negligible to minor impact on marine mammals. Minor impacts, such as masking in low ambient noise conditions, may be more likely for low frequency cetaceans, due to the low frequency nature of operational noise and this group’s hearing sensitivity (note: pinnipeds also have low frequency hearing, but their threshold of hearing is higher). As larger turbines with differing technologies (e.g., direct-drive) come online, more acoustic measurements are necessary to characterize the relationship between foundation size, type, and the sound levels associated with operation of a single or an array of WTGs, as this may affect the physical distance in which potential behavioral or masking impacts may be possible (Stöber and Thomsen 2021).

Noise - UXO detonation: Other offshore wind activities may encounter UXO on the seabed in the lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. As previously discussed, 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, size of the animal, and the location of the animal relative to the explosive. Injuries may include physical (non-auditory) injury such as hemorrhages or damage to the lungs, liver, brain, or ears, as well as auditory impairment such as PTS and TTS (Ketten 2004). Smaller animals are generally at a higher risk of blast injuries.

To predict the potential impacts of UXOs on marine species, several models have been developed. Goertner (1982) developed a model for physical injuries to cetaceans at a range of depths, and a modified version of this model is recommended by NMFS for predicting injury impacts to marine mammals. PTS effect distances was modeled by von Benda-Beckmann et al. (2015) for charge masses ranging from 2–2,205 feet (1–1,000 kilograms) at depths up to 98 feet (30 meters) based on recordings from several UXO detonations in the North Sea and predicted PTS effect ranges for harbor porpoises from hundreds of meters to 9.3 miles (15 kilometers), and the effect range generally increased with increasing charge mass and depth. In 2021, Hannay and Zykov focused on auditory injury rather than physical injury. They modeled the distance to NMFS auditory exceedance thresholds for five species groups (LFCs and HFCs; phocid pinnipeds; otariid pinnipeds/sea turtles) exposed to UXO detonations of various charge masses at four sites in the Revolution Wind Project area. While exposure ranges would vary among lease areas based on environmental conditions and other factors, their results provide an example of predicted exposure ranges in U.S. waters. The largest effect ranges were predicted for HFCs exposed to a 1,000 pounds (454 kilograms) detonation (the largest charge mass modeled) at 16 kilometers (L_{pk}) and 11.3 kilometers (SEL) for PTS, and 20.2 kilometers for TTS (SEL; used by NMFS for the behavioral threshold for a single detonation) (Hannay and Zykov 2021). The distances to auditory injury were always greater than the predicted ranges for non-auditory injury associated with the blast impulse. It is worth noting that when UXOs are detonated they do not always fully detonate, meaning the explosion may not be as large as predicted by the charge mass. The modeling studies presented previously are based on the assumption that the charge fully detonates.

The number, charge mass, and location of UXOs that may need controlled detonation for other projects are relatively unknown until a site assessment is performed. Therefore, it is difficult to predict the potential likelihood and frequency of effects of UXO detonation from other projects in the geographic analysis area. However, while the likelihood of encountering this stressor is unknown, the effects are well documented. At close ranges, UXO detonations can be injurious or lethal. Several mitigative measures for handling UXOs would be required to decrease the chance that a marine mammal would be severely injured or killed from an explosion. For example, seasonal and time of day restrictions can be put in place to avoid times when marine mammals may be present, noise mitigation devices (e.g., double bubble curtain) can be applied to reduce noise beyond a certain radius of the detonation, and visual and PAM of clearance zones can be used to reduce the number of marine mammals present within the predicted distance from a UXO that could cause injury or death. In addition, lower-order detonation methods, such as deflagration, are in development and could substantially decrease the energy released into the environment, therefore decreasing the effect ranges (Robinson et al. 2020). With mitigative measures in place, the intensity of this IPF is expected to be reduced. The likelihood of

UXO detonation associated with planned offshore wind projects is unknown; however, it is expected to be low given the preferred, non-detonation options available.

For all potential UXO clearance activities, the risk of PTS is considered to be low due to the required permitting, monitoring, and mitigation measures. It is also unlikely that PTS would occur in NARW. Although other marine mammals could experience PTS from high-order detonations, mortalities or non-auditory injuries are not expected to occur. Therefore, impacts on mysticetes (including the NARW), odontocetes, and pinnipeds from UXO detonations are expected to be moderate, with no significant impacts on the population level.

Noise - vessels: Vessel activity associated with both offshore wind and non-offshore wind would continue to affect marine mammals in the geographic analysis area as described for the ongoing activities under Section 3.5.6.3, *Impacts of Alternative A – No Action Alternative on Marine Mammals*. New vessel traffic expected under the planned activities scenario would predominantly be associated with the planned offshore wind projects; although increases in commercial traffic cannot be ruled out. In general, vessel noise increases with ship size, power/speed, propeller blade size, number of blades, and rotations per minute, with the majority of underwater noise generated by propeller cavitation and singing (Gray and Greeley 1980; JASCO 2011; Mitson 1995). Large ships generate broadband, continuous noise with sound energy concentrated in the lower frequency range (less than 1 kilohertz) (McKenna et al. 2012). SPL Source levels for large vessels range from 177 to 188 dB re 1 µPa-m (McKenna et al. 2012). SPL Source levels for dynamically positioned vessels range from 150 to 180 dB re 1 µPa-m (BOEM 2014). Smaller vessels typically produce higher-frequency sound concentrated in the 1,000–5,000-hertz range, with SPL source levels ranging from 150 and 180 dB re 1 µPa-m (Kipple 2002; Kipple and Gabriele 2003).

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, although the specific behavioral changes vary widely across species. Physical behavioral responses include changes to dive patterns (e.g., longer dives in beluga whales [Finley et al. 1990]), disruption to resting behavior (harbor seals [Mikkelsen et al. 2019]), increases in swim velocities (belugas [Finley et al. 1990], humpback whales [Sprogis et al. 2020], narwhals [Williams et al. 2022]), and changes in respiration patterns (longer inter-breath intervals in bottlenose dolphins [Nowacek et al. 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 (low-frequency-weighted received SPL at 100 meters was 133 dB re 1 µPa) compared to control and low-noise conditions (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. 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 a completely novel interaction (Finley et al. 1990). Reactions may also be correlated with other contextual features, such as the number of vessels present, their proximity, speed, direction or pattern of transit, or vessel type. For a more detailed and comprehensive review of the effects of vessel noise on specific marine mammal groups, the reader is referred to Erbe et al. (2019).

Some marine mammals may change their acoustic behaviors in response to vessel noise, either due to a sense of alarm or in an attempt to avoid masking. For example, fin whales (Castellote et al. 2012) and belugas (Lesage et al. 1999) have altered the 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 vocal 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.

Understanding the scope of acoustic masking is difficult to observe directly, but several studies have modeled the potential decrease in "communication space" when vessels are present (Clark et al. 2009; Erbe et al. 2016; Putland et al. 2017). For example, Putland et al. (2017) showed that during the closest point of approach (less than 6.2 feet [10 kilometers]) of a large commercial vessel, the potential communication space of Bryde's whale was reduced by 99 percent compared to ambient conditions.

During construction, vessel noise associated with other offshore wind projects is expected to be nearly continuous and have extensive geographical extent, whereas during the operational phase, vessel noise is expected to be infrequent (occurring mostly for maintenance work) and should be localized in extent due to the use of smaller vessels for maintenance work. The required vessel slow-downs to reduce strike risk are expected to reduce the amount of noise 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. Increased vessel noise from planned offshore wind projects is expected to have minor impacts for NARWs and all other marine mammals.

Noise - summary of Impacts: Noise generated from ongoing non-offshore wind activities include impulsive (e.g., non-airgun seismic surveys) and non-impulsive (e.g., vessels, aircraft, dredging, military training [munitions training and sonar surveys]) sources. Impact pile driving, seismic exploration, and sonar surveys can lead to PTS/injury-level effects in marine mammals. As previously mentioned, high-intensity sonar activities not associated with offshore wind development have been linked to stranding events (Fernandez et al. 2005; Cox et al. 2006; Balcomb and Claridge 2001; Jepson et al. 2003; Wang and Yang 2006; Parsons et al. 2008; D'Amico et al. 2009; Dolman et al. 2010). 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 OSP 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. For all other activities, TTS and behavioral thresholds could be exceeded. The predicted effect would be permanent in the case of some PTS effects and non-auditory injury/mortality resulting from UXO detonations, and short term with respect to TTS, behavioral effects, and masking. The geographic extent is considered localized for PTS effects and extensive for behavioral disturbance effects, as noise could exceed behavioral thresholds several tens of kilometers away depending on the activity. The frequency of the activity causing the effect is considered infrequent for impact pile driving, vibratory pile driving, UXO detonations, aircraft, cable laying and trenching, and dredging noise; frequent for HRG survey noise; and continuous for WTG operation noise. With the application of mitigation measures similar to those outlined in COP Appendix O (SouthCoast Wind 2024) for UXO detonations, the likelihood of mortality and non-auditory injury of a marine mammal from UXO detonations is considered low. Based on the source levels available in the literature, some PTS, TTS, behavioral disturbance, and masking effects on LFCs, HFCs, VHFCs, and phocid pinnipeds in water are considered likely, with respect to this IPF, but would vary by species and population. Based on the available information regarding offshore wind activities in the geographic analysis area (Figure 3.5.6-1), the impact of noise is considered moderate and short term for LFCs, HFCs, VHFCs, and phocid pinnipeds in water. Considering the extent of offshore wind projects planned in the geographic analysis area (Appendix D, *Planned Activities Scenario*), it is likely that underwater noise impacts sufficient to cause adverse effects on marine mammals are anticipated to occur. However, all projects are expected to include applicant-proposed measures (e.g., exclusion zones, protected species observers), similar to the measures included in Vineyard Wind 1 and South Fork, that would minimize underwater noise impacts on marine mammals.

The intensity of the noise IPF is considered moderate for UXO detonations for marine mammals, as PTS is possible for all species except NARW. Impacts on NARW would also be moderate, but would be limited to short-term, medium-intensity impacts, such as behavioral responses or TTS because PTS is not likely to occur for this species with mitigation. Impacts from impact pile driving would also be considered moderate for marine mammals, except NARWs, as PTS thresholds could be exceeded. PTS is not expected for NARWs from impact pile driving; however, the spatial extent of pile-driving noise below PTS thresholds would be extensive, thus, moderate impacts are expected for this species. All other noise impacts (excluding UXO detonations and impact pile driving) considered under Alternative A would be negligible to minor for marine mammals because PTS is not expected to result from other activities in Alternative A; however, behavioral disturbances would be expected to occur.

Based on the above analysis and in consideration of all the discussed noise sources, noise impacts from planned offshore wind activities would likely result in moderate, short-term or permanent (i.e., PTS) impacts for LFCs, HFCs, VHFCs, and pinnipeds. Impacts on individual marine mammals would be detectable and measurable; however, populations are expected to recover from the impacts. Noise impacts from planned non-offshore wind activities could be moderate for listed species such as 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.

Presence of structures: The addition of up to 2,945 new WTGs and OSP foundations in the geographic analysis area would result in artificial reef and hydrodynamic effects that influence primary and secondary productivity and the distribution and abundance of fish and invertebrate community structure within and in proximity to project footprints. Depending on proximity and extent, hydrodynamic and reef effects from planned activities could influence the availability of prey and forage resources for marine mammals. The presence of these additional structures could also result in entanglement in or ingestion of lost fishing gear that becomes tangled on structures, avoidance or displacement, and behavioral disruption, as described for ongoing activities in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals*. 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. Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant hydrodynamic effects at broader scales. An increase in offshore wind farms may weaken the regional thermocline and affect heat storage, atmospheric CO_2 uptake, and benthic resupply of oxygen (Dorrell et al. 2022). This could, in turn, lead to more significant effects on prey and forage resources, but the extent and significance of these effects cannot be predicted based on currently available information. The best scientific information available on each of these effects associated with the presence of structures and wind turbine operations is provided in greater detail here.

The extraction of kinetic wind energy by turbine operations can potentially alter atmospheric forcings that could affect surface mixing and lead to changes in local water flow at a fine scale near the WTGs. This atmospheric or wind wake phenomenon, characterized by reduced downstream mean wind speed and turbulence, can affect oceanographic processes as follows.

- Energy extraction can affect advection and Ekman transport. Advection and Ekman transport are directly correlated with shear wind stress at the sea surface boundary. Vertical profiles from Christiansen et al. (2022) exhibited reduced mixing rates over the entire water column. As for the horizontal velocity, the deficits in mixing were more pronounced in deep waters than in well-mixed, shallow waters, which is likely favored by the influence of the bottom mixed layer in shallow depths. In both cases, the strongest deficits in mixing rates occur near the pycnocline depth.
- Additional mixing downstream has been documented from Kármán vortices and turbulent wakes due to the pile structures of wind turbines (Carpenter et al. 2016; Grashorn and Stanev 2016; Schultze et al. 2020; Dorrell et al. 2022).
- Upwelling and downwelling dipoles under contact of constant wind directions affecting average surface elevation of waters have been documented as the result of energy extraction from offshore wind farms (Brostörm 2008; Paskyabi and Fer 2012; Ludewig 2015; Floeter et al. 2022). Mean surface variability was between 1 and 10 percent.

- With sufficient salinity stratification, vertical flow of colder/saltier water to the surface occurs in lower sea surface level dipoles and warmer/less saline water travels to deeper waters in elevated sea surface heights (Ludewig 2015; Christiansen et al. 2022; Floeter et al. 2022). This observation also suggested impacts on seasonal stratification, as documented in Christiansen et al. (2022).

A study of atmospheric wake effects by Daewel et al. (2022) contains model results of a hypothetical build-out of 24,000 5 MW WTGs at a hub height of 295 feet (90 meters) in the North Sea (compared to the 2,945 WTGs and offshore substation platform foundations in the geographic analysis area). The modeling results showed that extremely large clusters of offshore wind turbines provoke large scale changes in annual primary productivity. Productivity was modeled to decrease in the center of large wind farm clusters but increased around these clusters in the shallow, near-coastal areas of the inner German Bight and Dogger Bank. These modeled changes in net primary production were found to reach up to 10 percent locally but remained below 1 percent both inside and outside of the offshore wind farm clusters when integrated over a larger scale. As a result of reduced average current velocities, model results also showed a reduction in bottom-shear stress leading to reduced resuspension of organic carbon, increased amounts of organic carbon in sediments, and changes to bottom water oxygen concentrations. While more pronounced, locally compared to the region-wide average, changes in sedimentation, seabed processes, and spatial distribution of primary production have the potential to affect higher trophic levels and ecosystem function. Therefore, this model showed that although very large numbers of WTGs may result in local changes in primary production from impacts on the forces driving the mixing of surface waters, region-wide averages in estimated annual primary productivity in the North Sea remained relatively unchanged. However, the authors indicate the need for more research to assess the combined effects of atmospheric wakes and turbulent wakes induced by wind turbine foundations, as the latter might counteract the stabilizing effect of the wind wakes (Daewel et al. 2022). While detectable changes to the atmospheric forces that affect sea surface mixing are likely to occur once wind farms on the Atlantic OCS become operational, the potential influence that these impacts would have on biological productivity remains uncertain given the different physical factors in the geographic analysis area compared to the North Sea, the much lower number of wind turbines, and the larger size of wind turbines (two to three times larger) planned for the Atlantic OCS compared to those modeled by Daewel et al. (2022).

In a modeling study focused on the build-out of larger-sized WTGs (up to 15 MW and 492-foot [150-meter] hub height) on the U.S. northeast shelf, on average, meteorological changes at the surface induced by next-generation extreme-scale offshore wind turbines (diameter and hub height greater than 492 and 328 feet [150 and 100 meters], respectively) would be nearly imperceptible (Golbazi et al. 2022). The authors simulated the potential changes to near-surface atmospheric properties caused by large offshore wind facilities in the summer and found significant wind speed reduction at hub height within the wind farm (up to 6.6 [feet] 2.0 meters per second or a 20 percent reduction) that decreased with downwind distance from the wind farm. However, at the surface, an average wind speed deficit of 1.6 feet (0.5 meter) per second or less (10 percent maximum reduction) was found to occur within the wind farm footprint along with a slight cooling effect (-0.06 Kelvin on average). In comparison, studies on the effects of WTG wind wakes in the North Sea have identified the reduction in wind-induced mixing as the catalyst to changes in upper ocean dynamics (Ludewig 2015; Christiansen et al. 2022) and biological productivity (Daewel et al. 2022). Given the lower wind speed reductions (10–20 percent) reported by Golbazi et al. (2022) for the larger wind turbines planned for the U.S. Atlantic OCS compared to a wind speed reduction of up to 43 percent for smaller turbines in the North Sea (Platis et al. 2020), it is plausible that the observed effects from the reduction in wind-induced mixing would also be lessened. However, more region-specific research is still needed to validate this assumption.

Christiansen et al. (2022) modeled the wake-related wind speed deficits that occur due to wind farms in the southern and central North Sea and the resulting larger-scale disturbances on hydrodynamics and thermodynamics. The results of this modeling study predicted surface wind speed reductions potentially extending over tens of kilometers downwind from offshore wind turbine arrays leading to reductions in sea surface currents and potential alterations to temperature and salinity distributions and stratification. Wind wakes and their impacts on hydrodynamic patterns that extend outside the borders of wind farm developments can potentially lead to broadscale effects on nutrient availability, primary production, and ecosystem dynamics (Christiansen et al. 2022; Dorrell et al. 2022; van Berkel et al. 2020). While observations and model scenarios of wind wakes associated with wind energy fields have been generated for wind farms in the North Sea (Schultze et al. 2020; Daewel et al. 2022; Christiansen et al. 2022), there is still uncertainty regarding the applicability of those models to the oceanographic environment of the northeastern U.S. continental shelf (van Berkel et al. 2020; Miles et al. 2021).

In consideration of the physical and biological factors present in the Project area, a recent report by NASEM (2024) evaluated the potential effects of offshore wind development on the oceanic physical processes and hydrodynamics of the Nantucket Shoals region of the U.S. northeast continental shelf with an emphasis on NARW foraging and prey resources. This report determined that potential ecological impacts due to the presence of wind turbines in this region is difficult to predict due to the lack of observational studies and the uncertainty of hydrodynamic effects at the turbine, wind farm, and regional scales. The report further concludes that the hydrodynamic impacts on zooplankton productivity and distribution would be difficult to isolate from the significant impacts of climate change or other influences on the Nantucket Shoals regional ecosystem. The report recommended further observational studies and monitoring throughout the various phases of wind energy development to better understand the potential influences of wind turbine structures on the factors shaping regional oceanography and ecology.

Hydrodynamic effects from presence of structures as static features in the water could affect the distribution and abundance of fish and planktonic prey resources for marine mammals. Studies of the mechanisms that may result in these potential impacts, however, have produced variable results. Vertical structures in the water column could increase the mixing of seasonally stratified outer continental shelf seas. Dorrell et al. (2022) state that offshore wind growth may fundamentally change shelf sea systems, particularly in seasonally stratified seas, but enhanced mixing could positively affect some marine ecosystems. The presence of wind turbine foundations could increase vertical mixing driven by currents flowing around the foundations (Christiansen et al. 2022; Carpenter et al. 2016; Schultze et al. 2020). During times of stratification (summer), increased mixing due to the presence of structures could alter marine ecosystem processes by possibly increasing pelagic primary productivity in local areas (English et al. 2017; Degraer et al. 2020). Increased productivity could be partially offset by the formation of abundant colonies of filter feeders on the foundations. However, biological changes in the demersal community due to increased local fecal pellet excretions from mussels on and around the structures have been observed over relatively small distances (less than 164 feet [50 meters]) (Maar et al. 2009). When the stratified water column is redirected around the structure, deeper, colder, nutrient-rich water mixes with warmer surficial nutrient-poor water. Installed structures pierce through separation barriers, such as the thermocline, increasing nutrient fluctuations similar to waves flowing over seafloor sand banks. The mass balance of the Lease Area may change as vertical mixing and transport would alter nutrient cycling and energy flow around structures, such as the uptake and benthic resupply of oxygen (Dorrell et al. 2022).

Hydrodynamic impacts associated with WTG foundations may also directly influence distribution of zooplankton and larval transport. In current shallow-water offshore wind farms, where levels of turbulence are high, in-water wakes have been observed due to the presence of the monopiles as cylindrical structures that affect flow (Dorrell et al. 2022). In the United States, two available studies, summarized in Hogan et al. (2023), modeled the effects of offshore wind in southern New England indicating that zooplankton may be affected by the presence of wind turbines. Chen et al. (2021) modeled sea scallop larval transport in the Vineyard Wind 1 project offshore of Massachusetts and found that the presence of the foundations altered local vertical mixing and horizontal advections. Specifically, the change in local hydrodynamics shifted larval dispersal to new locations that could affect sea scallop abundance in the region. Johnson et al. (2021a) modeled the effects on larval transport from the full build-out of the entire southern New England lease areas. This study showed that the changes to depth-averaged currents vary on the order of +11 percent to -8 percent, and many of the results on the higher ends of this range occurred in the regions north and south of the Lease Areas. Changes in currents east of the Lease Areas, in the region of Nantucket Shoals, were minor. Johnson et al. (2021a) also showed a relative deepening in the thermocline of approximately 3–7 feet (1–2 meters) and a retention of colder water inside the wind farm areas through the summer months compared to the situation where turbines were not present. Chen et al. (2016) assessed how wind turbines would affect oceanographic processes during storm events and found that the deployment of wind turbines in the proposed Massachusetts and Rhode Island offshore region would not have a significant influence on southward larval transport from the upstream Georges Bank and Nantucket Shoals areas to the Mid-Atlantic Bight, although it could cause increased cross-shelf larval dispersion. Therefore, potential effects on marine mammal prey species, and therefore marine mammals, from changes to oceanographic and hydrodynamic conditions caused by the presence of offshore structures are not fully understood at this time but potentially range from 328 feet (100 meters) to tens of kilometers (Dorrell et al. 2022; Christiansen et al. 2022) and are likely to vary seasonally and regionally.

The long-term presence of WTG structures could displace marine mammals from preferred habitats or alter movement patterns. 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). Other studies have documented apparent increases in marine mammal density around wind energy facilities. Russell et al. (2014) found clear evidence that seals were attracted to a European wind farm, apparently attracted by the abundant concentrations of prey created by the artificial reef effect.

In-water structures result in the conversion of open-water and soft-bottom habitat to hard-bottom habitat. This habitat conversion attracts and aggregates prey species (i.e., fish and decapod crustaceans) (Causon and Gill 2018; Taormina et al. 2018). The aggregation of prey at artificial reefs could result in increased foraging opportunities for some marine mammal species. Studies of artificial reefs have demonstrated potential increased biomass of larger predator species, including pelagic fish, birds, and marine mammals (Raoux et al. 2017; Pezy et al. 2018; 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). However, any increase in biomass is anticipated to be small and localized, and it is not expected that reef effect would result in an increase in species preyed on by NARWs, fin whales, or sei whales (NMFS 2021b).

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 would affect marine mammals in the future, and how those changes would interact with other human-caused impacts. The effect of the increased presence of structures on marine mammals and their habitats is likely to be negative, varying by species, and their significance is unknown.

The presence of structures could result in fishing vessel displacement, thereby shifting potential vessel strike exposure risk, or a shift in fishing gear types. If a shift from mobile gear to fixed gear occurs, there would be a potential increase in the number of vertical lines, resulting in an increased risk of marine mammal interactions with fishing gear. Discarded or lost commercial fishing nets may also become entangled around WTG foundations, which could further increase the potential for marine mammal entanglement leading to injury and mortality due to infection, starvation, or drowning (Moore and van der Hoop 2012). Entanglement in fishing gear has been identified as one of the leading causes of mortality in NARW and may be a limiting factor in the species' recovery (Knowlton et al. 2012). In recent reports, at least 85 percent of NARW have been entangled in fishing gears at least once (NMFS 2023b). Additionally, recent literature indicates that the proportion of NARW mortality attributed to fishing gear entanglement is likely higher than previously estimated from recovered carcasses (Pace 2021). Entanglement may also be responsible for high mortality rates in other large whale species (Read et al. 2006). 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 intensity and persist until decommissioning is complete and structures are removed.

Although effects from individual structures are highly localized, the presence of an estimated 2,945 structures could result in regional impacts. Depending on proximity and extent, hydrodynamic and reef effects from planned activities could influence the availability of prey and forage resources for marine mammals. Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant hydrodynamic effects and broader scales. An increase in offshore wind farms may weaken the regional thermocline and affect heat storage, atmospheric CO_2 uptake, and benthic resupply of oxygen gas (Dorrell et al. 2022). Broadscale hydrodynamic impacts could alter zooplankton distribution and abundance (van Berkel et al. 2020). This possible effect is primarily relevant to NARWs, as their planktonic prey (calanoid copepods) are the only listed species' prey in the region whose aggregations are primarily driven by hydrodynamic processes. As aggregations of plankton, which provide a dense food source for NARWs to efficiently feed upon, are concentrated by physical and oceanographic features, increased mixing may disperse aggregations and may decrease efficient foraging opportunities. Potential effects of hydrodynamic changes in prey aggregations are specific to listed species that feed on plankton, whose movement is largely controlled by water flow, as opposed to other listed species that eat fish, cephalopods, crustaceans, and marine vegetation, which are either more stationary on the seafloor or are more able to move independent of typical ocean currents (NMFS 2021b).

Based on available information the potential impacts of ongoing and planned offshore wind projects would be similar to those described for ongoing activities in Section 3.5.6.3, *Impacts of Alternative A – No Action for Marine Mammals*. 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. These beneficial effects have the potential to be offset by risk of entanglement in fishing gear for some marine mammal species. However, because of the uncertainty of the relative contribution of beneficial and adverse impacts on odontocetes and pinnipeds, the overall impact level determination is minor adverse. 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 2024b).

Port utilization: Development of an offshore wind industry in the geographic analysis area may incentivize the expansion or improvement of regional ports to support planned projects. Three main activities surrounding port utilization have the potential to affect marine mammals: port expansion/ construction, increased vessel traffic, and increased dredging. Several port expansion and improvement projects are proposed in New England and along the East Coast as described in Appendix D, *Planned*

Activities Scenario. For example, the Port of Massachusetts is implementing port upgrades to accommodate larger freight vessels, which includes dredging of Boston Harbor, construction of a new berth, and installation of new ship-to-share cranes (Glenn 2021). As described for the Proposed Action, offshore wind-related activities would make up a small portion of the total activities at these larger ports; therefore, offshore wind activities are likely to have a negligible impact on marine mammals through increased port utilization.

Increased port utilization and expansion would likely result in increased vessel traffic and noise (refer to the *traffic* and *noise* IPFs) during construction, O&M, and decommissioning activities. The realized impacts on marine mammals in the geographic analysis area from the activities described previously include potential increased vessel interaction, exposure to noise, and localized turbidity plumes from dredging. See the *noise*, *vessel traffic (vessel strike)*, and *cable emplacement and maintenance* IPFs for the discussion of impacts on marine mammals from underwater noise, vessel strike, and elevated turbidity that would also be associated with port utilization and expansion.

Except for NARW, impacts from port utilization from other offshore wind activities on mysticetes, odontocetes, and pinnipeds would likely be moderate and long term and result in population-level effects through detectable and measure impacts on the individual, but the population should sufficiently recover. For NARW, impacts from port utilization from other offshore wind activities would likely be major 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. 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. As such, port utilization would not be expected to appreciably contribute to cumulative impacts on marine mammals.

Traffic: Increased vessel traffic presents a potential increase in collision-related risks to marine mammals. Based on information available in COPs for planned offshore wind projects (e.g., Atlantic Shores 2024; Empire 2022), it is assumed that construction of each individual offshore wind project would generate approximately 20–65 simultaneous construction vessels operating in the geographic analysis area at any given time. Planned offshore wind projects on the OCS would be constructed between 2023 and 2030, contributing to increases in vessel traffic in the geographic analysis area. Vessels used during construction range in size from larger heavy-lift vessels and heavy transport vessels to smaller crew transfer vessels. BOEM anticipates that non-offshore wind vessel traffic would gradually increase over time. Once projects are operational, they would be serviced by crew transfer vessels and service operations vessels making routine trips between the wind farms and port-based O&M facilities. Crew transfer vessels 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 planned offshore wind projects (Revolution Wind 2022; Sunrise Wind 2022; Dominion Energy 2022; Empire 2022), it is assumed that annual O&M vessel trips could range from 76 crew transfer vessel 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.

The number and size of crew transfer vessels and number of trips per week required for unplanned maintenance would vary by project based on the number of WTGs. Vessel requirements for unplanned maintenance would also likely vary based on overall project size. Additionally, vessels required to complete monitoring programs at various stages of project development would add to the number of vessel trips undertaken by other projects. These planned activities would pose the same type of vessel-related collision risks to marine mammals as for planned trips, but the potential extent and number of animals potentially exposed cannot be determined without project-specific information.

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 marine mammals and are a known or suspected cause of UMEs in the geographic analysis area for cetaceans (e.g., NARW) (NMFS 2024b). 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 future offshore wind activities may pose a collision risk for marine mammals.

While marine mammal vessel strikes are possible, the risk would be negligible as developers would be required to abide by several vessel strike avoidance measures (e.g., speed restriction, separation distance, slow zones) during construction, operation, and maintenance. 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 depending on the speed and size of a vessel. Impacts from traffic (vessel strikes) from planned offshore wind activities would likely be long term and 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. The impacts of traffic (vessel strikes) on odontocetes and pinnipeds from planned non-offshore wind activities would be minor because population-level effects are unlikely, although consequences to individuals would be detectable and measurable. However, as described previously, offshore wind vessels would be required to abide by mitigation measures designed to avoid vessel strike. If those measures are successful in avoiding vessel strikes, there would be no impacts on marine mammal species from this IPF. As such, vessel traffic and strikes would not be expected to appreciably contribute to cumulative impacts on marine mammals.

Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, BOEM would not approve SouthCoast Wind's COP. As such, stressors from construction, operation, and maintenance of the Project would not occur. Baseline conditions of the existing environment would remain unchanged. Therefore, not approving the COP would have no additional direct and indirect effects on marine mammals. Similarly, NMFS's No Action Alternative (i.e., not issuing the requested incidental take authorization) would also have no additional direct and indirect impacts 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 (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. Impacts of climate change would likely be minor to moderate for most marine mammals. 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 construction of offshore wind structures would also result in moderate, detectable impacts on marine mammals; however, these impacts would be short term. Accidental release, discharges/intakes, EMFs, 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 all IPFs together for mysticetes (except for NARW), odontocetes, and pinnipeds. Considering all IPFs together, the No Action Alternative would result in **moderate adverse** 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 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. 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 adverse** impacts on NARW because the mortality and morbidity rates from existing and likely ongoing entanglement and vessel strikes are significantly exceeding birth rates, thereby 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 the No Action Alternative: 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 and include continued 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. Offshore wind activities would be responsible for a majority of the impacts associated with pile-driving noise, which could lead to moderate impacts on marine mammals in the geographic analysis area. Considering all the IPFs together, BOEM anticipates that the cumulative impacts of the No Action Alternative would be **moderate adverse** for mysticetes (except for NARW), odontocetes, and pinnipeds because impacts would be of medium intensity.

Cumulative impacts on NARW would be, in many cases, more severe than otherwise similar impacts on 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 Table 3.5.6-6. 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 previously.

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 adverse** 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 adverse** due to existing and likely ongoing entanglement and vessel strikes 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 impacts of the reasonable range of project designs that are described in the SouthCoast Wind COP by using the “maximum-case scenario” process. The maximum-case scenario analyzes the aspects of each design parameter that would result in the greatest impact and may have multiple maximum-case scenarios depending on the resource; 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.

- The number, size, foundation type, and location of WTGs and offshore substation platforms.
- The number and location of interarray cables, offshore substation platform cables, and offshore export cables.
- The number of simultaneous vessels, number of trips, and size of the vessels.

- The number, size, and location of WTGs as they relate to hardened structure.
- The vessels and gear utilized to sample environmental parameters in the Project area through HRG surveys, fisheries, and biological monitoring plans.
- Variability of the proposed Project design exists as outlined in Appendix C, *Project Design Envelope and Maximum-Case Scenario*.

A summary of potential variances in impacts is provided below.

- The number, size, and location of WTGs and offshore substation platforms installed by pile driving, which are factors that contribute to the intensity and duration of noise resulting in behavioral and physiological effects (TTS) or cause auditory injury (PTS) to marine mammals.
- Variability in installation methods of offshore substation platforms and cables.
- Number, size, and location of UXO detonations.
- The number of simultaneous vessels, number of trips, and size of the vessels could affect vessel collision risk to marine mammals due to vessels transiting to and from the Wind Farm Area during construction, operations, and decommissioning, and increased recreational fishing vessels.
- The number, size, and location of WTGs as they relate to hardened structure, which could cause both beneficial and adverse impacts on marine mammals through localized changes to hydrodynamic features, prey aggregation and associated increase or decrease in foraging opportunities, incidental hooking from recreational fishing around foundations, entanglement in lost and discarded fishing gear, migration disturbances, and displacement.

3.5.6.5 Impacts of Alternative B – Proposed Action on Marine Mammals

The analysis of impacts under the No Action Alternative, and references therein, applies to the following discussion of the Proposed Action. The most impactful IPFs associated with the Proposed Action are underwater noise from impact pile driving and the presence of structures, which would lead to permanent impacts that may be either adverse or beneficial.

Onshore Activities and Facilities

Upland activities for the construction of the Proposed Action would include installation of onshore cables and onshore converter stations and/or substation. From the landfall site options, the underground onshore export cables would be routed to a new onshore substation in Falmouth, Massachusetts, and up to two onshore converter stations in Somerset, Massachusetts. The underground Falmouth onshore export cables would consist of up to four circuits with three, single-core cables per circuit, for a total of 12 onshore export power cables. Additionally, there would be up to four smaller insulated single-core ground continuity cables for carrying fault currents, and up to five communications cables containing fiber optics (one per circuit plus one dedicated communications cable).

Several onshore cable route options are under consideration from the potential landfall site to one of two onshore substation options.

- Lawrence Lynch Substation (preferred): Worcester Avenue (2.0 miles [3.3 kilometers]), Shore Street (2.3 miles [3.6 kilometers]), Central Park (2.2 miles [3.5 kilometers])
- Cape Cod Aggregates Substation Site (alternate): Worcester Avenue (5.9 miles [9.4 kilometers]), Shore Street (6.4 miles [10.25 kilometers]), Central Park (6.1 miles [9.8 kilometers])

The underground Brayton Point onshore export cables would consist of up to four onshore export power cables. Additionally, there would be up to two communications cables containing fiber optics. Two onshore route options are under consideration from the landfall site to the converter station, and three route options are under consideration at the intermediate landfall at Aquidneck Island.

- Brayton Point Converter Station: Western (0.6 mile [1 kilometer]), Eastern (0.4 mile [0.6 kilometer])
- Aquidneck Island: All three route options are approximately 3.0 miles (4.8 kilometers)

The onshore export cables would be installed within existing roadways through open cut trenches.

Construction of the onshore converter station or substation and onshore cable installation, as well as onshore O&M and decommissioning under the Proposed Action are not expected to contribute to IPFs for marine mammals.

Offshore Activities and Facilities

Accidental releases: Accidental releases of fuels, fluids, hazardous materials, trash, and debris may increase as a result of the Proposed Action. The risk of any type of accidental release would increase, 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 activities. However, compliance with USCG regulations (International Convention for the Prevention of Pollution from Ships, Annex V, Public Law 100–200 [101 Stat. 1458]), would minimize the risk of accidental release of trash or debris, reducing risk of entanglement or ingestion risk. BOEM prohibits the discharge or disposal of solid debris into offshore waters during any activity associated with construction and operation of offshore energy facilities (30 CFR 250.300). Another potential impact related to vessels and vessel traffic is the accidental release of invasive species, especially during ballast water and bilge water discharges from marine vessels. Vessels are required to adhere to existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and USEPA National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim in preventing the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. All Project vessels would comply with USCG regulations for the prevention and control of oil spills (33 CFR Part 155), further reducing the likelihood of an accidental release. SouthCoast Wind has developed an Oil Spill Response Plan (OSRP) (COP Appendix AA; SouthCoast Wind 2024) along with mitigation measures (Appendix G, Table G-1) to avoid accidental releases and a protocol to respond to a release if one occurs. Further, SouthCoast Wind’s Storm Water Pollution Prevention Plan (SWPPP) will include a Project-specific Spill Prevention, Control and Countermeasure (SPCC) Plan to prevent inadvertent releases of oils and other hazardous materials to the environment to the extent practicable.

Direct and indirect impacts of the Proposed Action would not increase the risk of accidental releases beyond that described under the No Action Alternative. Potential impacts on marine mammals from exposure to accidental releases are expected to be sublethal due to quick dispersion, evaporation, and emulsification, which would limit the amount and duration of exposure. The combined regulatory requirements and applicant-proposed measures would effectively minimize accidental releases and avoid and minimize the impacts from accidental spills such that adverse effects on marine mammals would be unlikely to occur. Therefore, any impacts on mysticetes (including NARW), odontocetes, and pinnipeds from accidental releases and discharges due to the Proposed Action would be negligible, with no perceptible population-level consequences.

Cable emplacement and maintenance: The Proposed Action's contribution of up to 3,888 acres (1,573 hectares) of seafloor disturbance by cable installation would result in turbidity effects with the potential to have temporary impacts on marine mammals, as described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals*.

Elevated suspended sediment may cause marine mammals to alter their normal movements, but such alterations are expected to be too small to be meaningfully measured or detected (Johnson 2018; Todd et al. 2015). Suspended sediment is most likely to affect marine mammals if the area of elevated concentrations acts as a barrier to normal behaviors. However, behavioral impacts such as avoidance or changes in behavior, increased stress, and temporary loss of foraging opportunity, would occur only at high suspended sediment levels (Johnson 2018). If elevated turbidity causes any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, these behaviors would be temporary, and any negative impacts would be short term (Todd et al. 2015). As described in Johnson (2018), NMFS has determined that elevated levels of suspended sediment could result in adverse effects under specific circumstances (e.g., high suspended sediment levels over long periods during dredging operations). In these cases, marine mammals are not subject to the same impact mechanisms that injure fish (e.g., gill clogging, smothering of eggs and larvae), so injury-level effects are unlikely. Marine mammals are also expected to swim through sediment plumes or avoid areas of increased turbidity.

Todd et al. (2015) postulated that dredging and related turbidity impacts could affect the prey base for marine mammals, but the significance of those effects would be highly dependent on site-specific factors. Rates of recolonization of disturbed benthic communities varies and may take anywhere from several months to up to 4 years to recover to a pre-disturbance state (Dernie et al. 2003; Van Dalfsen and Essink 2001). The main prey items of marine mammals in this area (e.g., copepods, krill, schooling fish) are pelagic rather than benthic. Because these prey items, even at depth, are not in contact with the substrate, no burial or loss of prey is anticipated during installation of the cable. While Cronin et al. (2017) suggest that NARWs may use vision to find copepod aggregations, particularly if they locate prey concentrations by looking upward, NARWs may also rely on other sensory systems (e.g., vibrissae on the snout) to detect dense patches of prey in very dim light (at depths greater than 525 feet [160 meters] or at night) (Fasick et al. 2017) or otherwise turbid conditions. If turbidity from cable installation caused foraging marine mammals to leave the area, there would be an energetic cost of swimming out of the turbid area. However, marine mammals could resume foraging behavior once they were outside of the turbidity zone.

Project-specific sediment dispersion modeling was completed using proposed cable installation methods, site-specific sediment grain size and bathymetric data, and a high-resolution wave and current model for each ECC and interarray cables (COP Appendices F1 and F3; SouthCoast Wind 2024). Results showed that redeposition of suspended sediments occurs quickly before being transported long distances. Total suspended sediment concentrations above 0.0008 pound per gallon (lb/gal) (100 mg/L) extended a maximum of 1,214 feet (370 meters) for any scenario except for nearshore areas of the Brayton Point corridor where they extended to just over 0.62 mile (1 kilometer). The maximum total suspended sediment level dropped below 0.00008 lb/gal (10 mg/l) within 2 hours for all simulated scenarios and dropped below 0.000008 lb/gal (1 mg/l) within 4 hours for any scenario except for nearshore areas of the Brayton Point corridor where 100mg/L and 10 mg/L concentrations lasted for less than 5 hours and a little over 2 days, respectively. Deposition thicknesses exceeding 0.20 inch (95 millimeters) were generally limited to a corridor with a maximum width of 79 feet (24 meters) around the cable routes but reached a maximum of 590 feet (180 meters) from the centerline for the interarray cables (COP Appendices F1 and F3; SouthCoast Wind 2024). Based on these modeling results, BOEM anticipates short-term and localized water quality impacts from interarray cable installation and negligible impacts on marine mammals from turbidity. Suspended sediment concentrations during activities other than dredging would be within the range of natural variability for this location. Additionally, SouthCoast Wind would use HDD for sea-to-shore transition to minimize sediment mobilization and seabed sediment alteration for cable burial operations.

Due to their relatively large body size, marine mammals that may occur in the Project area are not expected to face a risk of entrainment, impingement, or capture in dredging equipment. Additionally, standard vessel strike avoidance mitigation measures that require minimum separation distances would further reduce such risks. The physical presence of dredging vessels and equipment could 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 localized and temporary nature of potential impacts, individual marine mammals, if present, would be expected to successfully forage in nearby areas not affected by increased sedimentation. Therefore, potential impacts from cable emplacement and maintenance (including entrainment, displacement, and impacts on prey species) on mysticetes (including NARW), odontocetes, and pinnipeds are expected to be negligible.

Discharges/intakes: The Proposed Action would result in the ballast water and bilge water discharges from marine vessels, as described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals*. During operation, there would be increased intake and discharge from the HVDC converter OSP CWIS in the Lease Area, which requires continuous cooling water withdrawals and subsequent discharge of heated effluent back into receiving waters. SouthCoast Wind has selected an HVDC converter OSP design for Project 1 (Appendix B, Figure B-2); if HVDC technology is selected for Project 2, similar impacts would occur associated with a CWIS in the southern portion of the Lease Area. Marine mammals would not be at risk for entrapment or impingement but could experience indirect effects during water withdrawals if prey species become entrained in very large numbers. Marine mammal prey may be affected further due to thermal impacts from subsequent heated discharge effluent released back into receiving waters. A comparable entrainment analysis for the CWIS at the Sunrise Wind Farm offshore converter station, with an intake volume of 8.1 million gallons per day, estimated an annual entrainment of 1.1 billion individuals of *Calanus finmarchicus* (TRC 2022). This level of entrainment loss constituted less than 0.1 percent of the estimated local population of this species in the Sunrise Wind Farm Lease Area. Thus, while copepods are subject to entrainment through the CWIS, the number of copepods lost represent a small fraction of the entire population stock in the region and any individuals entrained through the intake are returned to the source water via the discharge pipe and may still remain available as prey items to NARW and other marine organisms.

Assessing the magnitude of copepod entrainment impacts on whales may be achieved by comparison to assessments completed by other facilities that use seawater cooling systems in the region. The Northeast Gateway Offshore LNG Terminal Project offshore of Massachusetts has comparatively similar types of entrainment impacts as those that are anticipated by the SouthCoast Wind CWIS. As part of the impact assessment for the Northeast Gateway Project, Dr. Robert Kenney developed a bioenergetic model to address the impacts of the removal of zooplankton and small fish on marine mammals and whether cooling water system entrainment would remove excessive biomass of prey beyond natural variability and recovery rates (Northeast Gateway 2012). Based on whale metabolism research by Kenney et al. (1985) and Trites and Pauly (1998), the estimated daily and annual prey consumption rates for an individual NARW are from 1,142 to 1,706 pounds (518 to 774 kilograms) per day and 102,707 to 154,291 pounds (46,587 to 69,985 kilograms) per year while present off the coast of Massachusetts (Northeast Gateway 2012). The Northeast Gateway Project operations were estimated to potentially remove approximately 3,748 pounds (1,700 kilograms) per year of zooplankton and small fish (while using up to 56 million gallons per day), which was considered a negligible volume of prey items relative to individual and population requirements of whales occurring in the region. Therefore, the SouthCoast Wind CWIS operations, which would intake considerably less cooling water of 9.9 million gallons per day compared to 56 million gallons per day at Northeast Gateway would be expected to entrain proportionally much lower numbers of prey.

In addition to secondary impacts, the HVDC converter OSP would discharge warmer water into the surrounding ocean, which could have localized impacts on marine mammals. Discharge would occur at one 36-inch (0.91-meter) diameter vertical-shaft discharge caisson, located in the middle portion of the water column at a depth of 42.7 feet (13 meters) below the surface, set perpendicular to the seafloor, and located within the jacketed foundation structure (TetraTech and Normandeau Associates, Inc. 2023; Table B-11, Appendix B). SouthCoast Wind modeled thermal plumes from the HVDC cooling water discharge to evaluate the spatial extent of the rise in temperatures of the receiving water in the vicinity of the discharge location based on the highest temperature differences between ambient (intake) and effluent (discharge) conditions in the fall, winter, spring, and summer using a thermal mixing zone analysis in CORMIX v12.0GTD Advanced Tools (TetraTech and Normandeau Associates, Inc. 2023; Appendix B). The plume dynamics were evaluated during four separate seasons to determine potential zones of initial dilution during those periods.

From four modeled maximum temperature delta scenarios, the distance from the discharge point where the temperature delta reached (1.8°F (1°C) was 41.9 feet (12.8 meters) in the fall, 84.9 feet (25.9

meters) in the winter, 67.5 feet (20.6 meters) in the spring, and 46.6 feet (14.2 meters) in the summer. The effluent plume area was highest in the winter at 792.1 square feet (73.6 square meters) and lowest in the fall at 407.0 square feet (37.8 square meters). These results indicate that impacts on the ocean temperature are localized and minimal when the maximum temperature increases occur and that the water quality standard allowed for by the Ocean Discharge Criteria is expected to be met well within the 330-foot (100-meter) radius mixing zone for initial dilution of discharges. Thus, potential thermal effects from cooling water discharge at the HVDC converter OSP would not be expected to affect marine mammals due to the relatively small discharge plume and localized temperature increase within the mixing zone in comparison to larger CWISs at other coastal facilities. Similar results would be anticipated if SouthCoast Wind selects an additional HVDC converter OSP for the southern portion of the Lease Area. Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, and Section 3.5.3, *Benthic Resources*, details the impact of the HVDC converter offshore substation platform on marine mammal prey species based on NPDES permit application modeling.

Bleach (sodium hypochlorite) would be used to inhibit marine growth in the HVDC cooling equipment. A hypochlorite generator would produce the bleach by seawater electrolysis. These generators are designed to achieve a hypochlorite solution flow rate of sufficient concentration, corresponding with a 0 to 2 parts per million equivalent free chlorine concentration in the seawater intake lines (TetraTech and Normandeau Associates, Inc. 2023; Appendix B). This concentration is small and is equivalent to 0.0002 percent per unit volume. Residual free chlorine within discharged effluent would be negligible and oxidized in the water with no negative impact.

Entrainment mitigation measures that may be used at the converter station facility include single pump operation, dual pump operation at reduced capacity via three-way valve or variable frequency drives, and a fixed depth of water withdrawal (TetraTech and Normandeau Associates, Inc. 2023, Appendix B). With the extent of entrainment being directly proportional to the intake flow volume, the likely scenario of running two pumps at 50 percent capacity reduces the cooling intake flow volume leading to a proportional reduction in entrainment levels. Variable frequency drives may be used in the CWIS to control flow and minimize the total flow volume required. This allows for the maintenance of safe operational parameters in the HVDC converter while reducing the water intake volume and entrainment impact. Water withdrawal from the middle portion of the water column may also minimize entrainment impacts compared to surface withdrawal. To further minimize potential impacts on zooplankton from entrainment and thermal discharge, the northernmost HVDC converter offshore substation platform would be located outside of a 6.2-mile (10-kilometer) buffer of the 98-foot (30-meter) isobath from Nantucket Shoals, which is an area of high productivity and foraging value for several marine species (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

Given the low proportion of potentially entrained prey items, the small and localized effects from thermal discharge, and the mitigation measures in place to reduce potential risks, indirect impacts due to the Proposed Action from the HVDC converter offshore substation platform are expected to be long term but minor with no perceptible population-level consequences for mysticetes (including the NARW), odontocetes, and pinnipeds.

During installation of up to 85 suction-bucket jacket WTG foundations in the southern portion of the Lease Area as part of Project 2, planktonic organisms may also become entrained as water is pumped out of the buckets during the embedding process. RPS (2024) conducted an entrainment assessment to estimate the potential impact this construction activity may have on zooplankton and ichthyoplankton species present in the installation area. The presence and abundance of plankton species in the SouthCoast Wind suction-bucket jacket installation area was determined using NOAA-NEFSC Ecosystem Monitoring (EcoMon) survey program plankton data (NEFSC 2019) limited to within 3 miles (5 kilometers) of the foundation installation area. This analysis area was used on the assumption that foundation installation is a one-time localized action with short-term entrainment impacts. Monthly entrainment estimates for suction-bucket foundation installations were calculated using a per foundation one-time total seawater displacement volume of 27,200 cubic meters (6,800 cubic meters per bucket by 4 buckets per foundation), the assumption that the installation of 85 suction-bucket jacket foundations would occur evenly over a 16-month period from April 2030 to July 2031, and the taxa-specific EcoMon plankton density data averaged by month.

A total of 91 plankton taxa were found to occur in the suction-bucket jacket entrainment analysis area of which 55 were zooplankton and 36 were ichthyoplankton (RPS 2024). Calanoid copepods, the preferred prey species of NARW, were the most abundant of the zooplankton taxa present in the entrainment analysis area. *Centropages typicus, Calanus finmarchicus, Pseudocalanus* spp., and *Temora longicornis* had the highest mean monthly densities at 132,995.40 (October), 125,988.43 (May), 56,569.62 (May), and 76,906.81(June) individuals per 3,531 cubic feet (100 cubic meters), respectively. Excluding unidentified fish (*Pisces*), the most abundant ichthyoplankton species were the sand lance (*Ammodytes* spp.), gulf stream flounder (*Citharichthys arctifrons*), Atlantic mackerel (*Scomber scombrus*), and hake (*Urophycis* spp.). Sand lances, a prey species for fin whales and sei whales, showed peak abundance in January with a mean density of 290.39 individuals per 3,531 cubic feet (100 cubic meters) while gulf stream flounder, Atlantic mackerel, and hake had peak mean monthly densities of 182.80 (September), 315.67 (June), and 158.74 (August) individuals per 3,531 cubic feet (100 cubic meters), respectively (RPS 2024).

The highest estimated total entrainment for all ichthyoplankton and zooplankton taxa combined occurred in May and June, which coincided with peak abundance for Calanoid copepods and the months where the most suction-bucket jacket foundation installations occurred (RPS 2024). Entrainment estimates generally followed monthly plankton density trends given that these calculations are density dependent with the exception of April, May, June, and July where foundation installations were double that of the other months. Among zooplankton species, *C. finmarchicus* had the highest estimated entrainment at 342,688,524 individuals in May. For ichthyoplankton species identified to at least genus, Atlantic mackerel had the highest estimated entrainment in June at 944,475 individuals. Total estimated entrainment (number of individuals) by taxa from start to completion of suction-bucket jacket foundation installation was highest for *C. finmarchicus* (874,641,271), *C. typicus* (820,148,482), *Pseudocalanus* spp. (609,183,491) and *T. longicornis* (308,384,062) among zooplankton taxa and Atlantic mackerel (954,383), sand lance (869,447), gulf stream flounder (507,854), and hake (488,465) among ichthyoplankton taxa (RPS 2024).

While entrainment estimates were generated from the best available data, these estimates may not reflect the current species composition in the study area, seasonality, population dynamics, or natural variability due to the limitations of the data set used and given that no project-specific studies have been conducted to characterize the local composition of plankton species in the vicinity of the suction bucket installation area and the susceptibility of these species to the impacts of entrainment. Because the installation of suction-bucket jacket foundations is a one-time localized action, entrainment impacts are considered short term and limited to the immediate vicinity of the installation activity. In a similar entrainment assessment conducted for the CWIS of the Sunrise Wind Farm offshore converter station with an intake volume of 8.1 million gallons per day and an estimated annual entrainment for *C. finmarchicus* of 1.1 billion individuals, TRC (2022) reported that this magnitude of entrainment loss represented less than 0.1 percent of the estimated local population of this species in the Sunrise Wind Farm Lease Area. In comparison, plankton entrainment estimates from suction-bucket jacket installations are considerably less, would be a one-time event, and would impact an even smaller percentage of the plankton population in the vicinity of the SouthCoast Wind suction bucket foundation installation area. Therefore, the impacts associated with the entrainment of zooplankton and ichthyoplankton prey of marine mammals are considered short-term and negligible.

EMFs and cable heat: During operations, the Proposed Action would result in the production of EMF, which may be detectable by marine mammals, as described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals*. Studies documented electric or magnetic sensitivity up to 0.05 microTesla (0.5 milligauss) for fin whale, humpback whale, sperm whale, bottlenose dolphin, common dolphin, long-fin pilot whale, Atlantic white-sided dolphin, Risso’s dolphin, and harbor porpoise (Tricas and Gill 2011). However, evidence used to make the determinations was only observed behaviorally/physiologically for bottlenose dolphins, and the remaining species were concluded based on theory or anatomical details. Recent reviews by Bilinski (2021) of the effects of EMFs 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. Exponent Engineering, P.C. (2018) modeled EMF levels that could be generated by the South Fork Wind Farm 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 South Fork Wind Farm export cable and 9.1 to 65.3 milligauss above the interarray cable, respectively. Induced field strength would decrease effectively to 0 milligauss within 25 feet (7.6 meters) of each cable.

BOEM performed literature reviews and analyses of potential EMF effects from offshore renewable energy projects (CSA Ocean Sciences, Inc. 2021; INSPIRE 2019; Normandeau et al. 2011). These and other available reviews and studies (Gill et al. 2005; Kilfoyle et al. 2018) suggest that most marine species cannot sense low-intensity EMFs generated by the HVAC power transmission cables commonly used in offshore wind energy projects. Normandeau et al. (2011) concluded that marine mammals are unlikely to detect magnetic field intensities below 50 milligauss, suggesting that these species would be insensitive to EMF effects from the Project’s electrical cables. SouthCoast Wind modeled EMF levels that could be generated by the Project’s submarine cables. The model estimated induced magnetic field levels ranging from 85 milligauss (6.6-foot [2-meter] burial depth) to 1,859 milligauss (unburied, covered with 1-foot-thick [0.3-meter-thick] concrete mattress) directly above the cable centerline (COP Appendix P1, Table ES.1; SouthCoast Wind 2024). The modeled EMF levels are greater than the 50 milligauss detection threshold for marine mammals identified by Normandeau et al. (2011), indicating that marine mammals may be able to detect elevated EMF levels in proximity to the Proposed Action cables. However, EMF levels attenuate rapidly with distance, and at 10 feet, the modeled magnetic field levels would be below 50 milligauss. Marine mammal species that are more likely to forage near the benthos, such as certain delphinids, have more potential to experience EMFs above baseline levels (Tricas and Gill 2011). 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 due to the Proposed Action on mysticetes (including NARW), odontocetes, and pinnipeds would be at the lowest level of detection and considered to be negligible, with no perceptible population-level consequences.

While considered a localized phenomenon, electricity produced during operation may further increase temperatures within the surrounding sediment and water where benthic resources that serve as prey for marine mammals may reside (Riefolo et al. 2016; Tabassum-Abbasi et al. 2014). Increased heat in the sediment could affect benthic organisms that serve as prey for fish species that forage in the benthos, consequently affecting piscivorous marine mammals. Based on the narrow width of the cable corridors and estimated area of thermal radiation, impacts on benthic organisms are not expected to be regionally significant (Taormina et al. 2018) and would be limited to a small area around the cables. Considering the anticipated cable burial depths, thermal effects are not expected to occur at the surface of the seabed. Therefore, any effects from cable heat due to the Proposed Action on mysticetes (including NARW), odontocetes, pinnipeds, and their prey are expected to be negligible, with no perceptible population-level consequences**.**

Gear utilization: SouthCoast Wind’s fisheries and benthic monitoring plans (SMAST 2024; INSPIRE 2023, 2024) propose a variety of survey methods to evaluate the effects of construction and operations on benthic habitat structure and composition and economically valuable fish and invertebrate species. The survey methods are explained in detail in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, which includes a discussion on the effects of gear utilization on fish prey. The proposed survey methods include acoustic telemetry, drop camera, demersal trawl, ventless trap/pot, Neuston net sampling, video/photography surveys, sediment grab sampling, and sediment profile and plan view imaging. In addition to specific requirements for monitoring during the construction period, periodic PAM deployments may occur over the life of the Project for other scientific monitoring needs. All requirements of the Proposed Action would follow BOEM’s 2021 *Project Design Criteria and Best Management Practices* (BOEM 2021c) to limit interactions with protected species.

A demersal otter trawl survey would be used to assess the abundance and distribution of target fish and invertebrate species in the offshore Project area and will follow similar surveys for other wind farms. These tows are typically shorter in duration (20 minutes) than conventional commercial trawl tows, and less frequent for research fishing versus commercial fishing, often spread out over a much larger area.

Additionally, the slow speed of mobile gear (3 knots) further reduces the potential for marine mammal entanglements or other interactions. Observations during mobile gear use have shown that entanglement or capture of large whale species is extremely rare and unlikely (NMFS 2016). Although the trawl methods for commercial fisheries are comparable to the fishery monitoring methods proposed, the proposed trawl effort and tow durations (20 minutes) are less than that previously considered by NMFS for commercial trawling activities. Thus, the potential for entanglement of marine mammals in bottom trawl equipment is, therefore, considered extremely unlikely to occur.

A ventless trap survey would be used to sample crab, lobster, and fish species present in the Project area (SMAST 2024). To reduce the risk of vertical line entanglement, ropeless gear would be deployed in lieu of traditional downlines. The primary method for retrieving trap strings would be grappling, though on-demand systems would continue to be tested and potentially phased into the survey as the technology progresses and becomes logistically feasible. Ventless trap surveys would sample 30 random depth-stratified stations and would occur from May through October when NARW are less likely to be in the Project area. Surveys would involve two hauling periods planned per month, and gear soak time would be limited to 3 days after which all trap and pot gear would be hauled out. Based on the applicant-proposed risk-reduction measures (Appendix G, *Mitigation and Monitoring*), the limited gear soak time, and the seasonal deployments of traps, the risk of entanglement in gear to marine mammals would be extremely unlikely to occur.

Acoustic telemetry monitoring would collect data and evaluate changes to the movements, presence, and persistence of several commercially and recreationally important species in the Rhode Island state waters portion of the Brayton Point ECC (INSPIRE 2024). Acoustic telemetry surveys would employ fixed station acoustic receivers to monitor fish presence and movement (INSPIRE 2024). Continuous marine mammal observational periods would be implemented, which would reduce the risk of entanglement and interactions to marine mammals. The potential for entanglement of marine mammals in acoustic telemetry survey equipment is considered extremely unlikely to occur.

Neuston net sampling involves towing a plankton net at slow speeds (4 knots) for brief periods (10 minutes) in the upper 1.6 feet (0.5 meter) of the water column. As the Neuston net frame measures 7.9 by 2 by 19.7 feet (2.4 by 0.6 by 6 meter) and features a mesh size of 0.5 inch (1,320 micrometers) and deployed off the stern of the vessel, this would not pose as an entanglement risk to marine mammals. Similar to Neuston net sampling, drop-camera sampling occurs directly from the vessel's stern, with continuous seabed monitoring. As part of benthic monitoring surveys, an ROV stereo-camera system would be used to assess the effect of the introduction of hard-bottom novel surfaces while sediment grab samples and sediment profile and plan view imaging would be used to evaluate structure-oriented enrichment and measure changes in benthic function over time (INSPIRE 2023). As these surveys avoid gear that could entangle marine mammals, the risk of entanglement from Neuston net, drop camera, and benthic habitat monitoring surveys to marine mammals is considered extremely unlikely to occur.

PAM systems or mobile PAM platforms may also be used prior to, during, and following construction to record ambient noise and characterize the presence of marine mammals through passive detection of vocalizations in the Lease Area to monitor project impacts. PAM systems would use best available technology to reduce any potential risks of entanglement. To further minimize the risk of entanglement, moorings attached to the seafloor would use buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs that prevent any potential entanglement of listed species, while ensuring the safety and integrity of the structure or device. All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak links, chains, cables, or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species. Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose. With these mitigation measures in place, the potential for entanglement of marine mammals in PAM survey equipment is considered extremely unlikely to occur.

Given the short-term, low-intensity, and localized nature of the anticipated survey activities, as well as the proposed mitigation and minimization measures (Appendix G, *Mitigation and Monitoring*), it is unlikely that marine mammals would be entrapped or entangled from the gear anticipated to be used during the surveys. Therefore, the impact of gear utilization under the Proposed Action is expected to be negligible 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. SouthCoast Wind would light WTGs and OSPs in compliance with FAA and USCG standards and BOEM guidelines and would avoid intentionally illuminating the water surface. SouthCoast Wind has additionally proposed the use of an ADLS to minimize the time that FAA-required lighting is illuminated on the offshore structures associated with the Proposed Action. 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 NARW), odontocetes, and pinnipeds would be non-measurable and would be negligible with no perceptible individual or population-level consequences.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on marine mammals are impact pile driving (installation of WTGs and OSPs), vibratory pile driving, geophysical surveys (HRG surveys), geotechnical drilling surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and dredging during construction and WTG operation. While all of these noise sources occur during construction, only WTG operation, HRG surveys, vessel traffic, and cable laying or trenching for cable repairs, if necessary, would occur during operation. Decommissioning activities related to noise would likely be similar to or less than those outlined for construction activities (with the exception of impact pile driving for foundations). Project construction activities could generate underwater noise and result in auditory injury, behavioral disturbance, and masking effects on marine mammals. WTG operations have the potential to result in long-term behavioral disturbance and masking effects on marine mammals. Underwater noise from these activities may also affect the distribution and abundance of prey items. Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, summarizes the effects of impact pile driving on fish, which are expected to be negligible to moderate.

Assessment of the potential for underwater noise to injure or disturb a marine mammal requires acoustic thresholds against which received sound levels can be compared. Sound levels that meet or exceed these thresholds could result in impacts on marine mammals exposed to those sound levels. However, sound levels are not the only component that is important in assessing potential impacts; noise with frequencies that are within the hearing sensitivities of an animal are more likely to cause disturbance or auditory injury. Animals exposed to noise with frequencies outside their hearing ranges are unlikely to be affected, even if the noise intensity (i.e., “loudness”) is high. Regulatory thresholds used for the purpose of predicting the extent of potential noise impacts on marine mammals and subsequent management of these impacts aim to account for the duration of exposure and the differences in hearing acuity among marine mammal hearing groups (Finneran 2016; NMFS 2018). Auditory thresholds for underwater noise are expressed using three common metrics: SPL (or L_{rms}) and L_{pk}, both measured in dB re 1 µPa, and SEL, a measure of cumulative energy in dB re 1 μPa^2s.

The assessment of underwater noise in this EIS uses modeling, exposure estimates, and take numbers presented in the *Petition for Incidental Take Regulations for the Construction and Operations of the SouthCoast Wind Project* dated March 2024 and October 2024. In total, 16 marine mammal species are likely to be affected by construction-related noise activities (MMPA ITA Application, Section 6.7 and Table 56; LGL 2024b) (Appendix G, Attachment G-3).

Noise - pile driving: Noise from impact pile driving for the installation of WTGs and offshore substation platform foundations would occur intermittently during the installation of offshore structures. Up to 147 WTGs and up to 5 offshore substation platforms at a maximum of 149 WTG/offshore substation platform positions are anticipated for the Proposed Action. Each WTG requires one monopile or four pin piles for jacket foundations. Each monopile requires 1 hour for pre-start clearance period and 4 hours of piling (including 20 minutes of vibratory piling) and each pin pile requires 2 hours of piling (including 90 minutes of vibratory piling) to install; thus, a maximum of two monopile substructures (although typical installation would be one pile per day) or eight individual pin pile foundations could be installed in a 24-hour day under ideal conditions with two vessels working simultaneously. An estimated 774 hours of installation time would be needed for 85 WTG foundations and 1 OSP in one construction season, with no pile driving occurring between January 1 through May 14 (MMPA ITA Application, LGL 2024a; Appendix G, Attachment G-3).

Each OSP requires a different number of foundations and piles depending on the option chosen and may have up to six legs, and each leg could be anchored by up to four pin piles. Option A (modular) would include three to four legs with one to two pin piles per leg (three to eight total pin piles per pile jacket); Option B (integrated) would include four to six legs with one to three piles per leg (4 to 12 total pin piles per jacket); and Option C (DC Converter) would include four legs with three to four pin piles per leg (up to 16 total pin piles per jacket). While the PDE includes up to five OSPs, the most likely scenario is two HVDC OSPs, one for Project 1 (Brayton Point) and one for Project 2 (Brayton Point or Falmouth).

Acoustic source level, propagation, and animal movement modeling of the impact and vibratory pile-driving activities for the Proposed Action was undertaken by JASCO Applied Sciences to determine monitoring distances (exposure and acoustic ranges) to regulatory-defined acoustic thresholds associated with injury and behavioral disturbance for marine mammals (Limpert et al. 2024 in LGL 2024a). As of 2024 NMFS has produced updated criteria for assessing the effects of anthropogenic sound on marine mammal hearing during sound-producing underwater projects (NMFS 2024f). The exposure metrics specific to the Project were initially calculated based on an older, 2018 criteria (NMFS 2018). The updated criteria contain new thresholds and new weighting functions for evaluating the onset of auditory injury and temporary threshold shifts. Exposure estimates used for the Project were re-evaluated to create new metrics in line with the updated criteria. The re-evaluation was conducted using an approach that considered the new weighting functions, their effect on the source spectra, and the resulting propagation for each sound source in a project. This method adjusts and updates Level A exposure estimates and ranges using a "decibel difference" approach between 2018 and 2024 weighted sound fields (Kusel et al. 2024 in LGL 2024b). The broadband amplitude differences that occurred over the relevant ranges were then calculated. The output of the re-evaluation incorporates the changes in weighting functions and include their interaction with the propagation of individual frequencies used to make up the broadband level in sound fields. Further details on the re-evaluation methods used to generate the exposure estimates can be found in the *Technical Memo: Acoustic and exposure ranges to updated 2024 NMFS criteria for marine mammal injury thresholds* (Kusel et al. 2024 in LGL 2024b).

Unlike marine mammals and sea turtles for which animal movement modeling was performed, fish were considered static (not moving) receivers; therefore, only the acoustic ranges to fish regulatory thresholds were calculated. Sound generated during pile driving was modeled by characterizing the sound produced at the pile and then calculating how the sound propagates within the surrounding water column. For impact pile-driving sounds, time-domain representations of the acoustic pressure waves generated in the water are required to calculate the metrics—sound pressure level (SPL), sound exposure level (SEL), and zero-to-peak pressure level (PK)—used to evaluate potential impacts. JASCO's animal movement modeling software, JASMINE, was used to integrate the computed sound fields with species-typical movement (e.g., dive patterns) to estimate received sound levels for the modeled marine mammals. Two types of piles representing the largest of potential foundation diameters in the PDE were modeled: 52-foot- (16-meter)-diameter monopiles and 15-foot- (4.5-meter)-diameter pin piles as part of the four-legged jacket foundations. Sound fields from monopiles and pin piles were modeled at two representative locations in the Offshore Project area representing the variation in water depth in the Lease Area using a Menck MHU 3500S impact hammer for the pin piles and theoretical 6,600-kilojule impact hammer for the monopiles. The use of one or more noise abatement system (NAS) is reasonably expected to achieve greater than 10 dB broadband attenuation of impact and vibratory pile driving sounds, therefore NAS performance of 10 dB broadband attenuation was assumed when calculating ranges to threshold levels and potential exposures. For comparison, exposure-based radial distance estimates assuming no attenuation, 6 dB attenuation, and 15 dB attenuation were also calculated with the full results available in the MMPA ITA application (Appendix G, Attachment G-3; LGL 2024b).

Acoustic and animal exposure modeling was conducted for different construction scenarios. The primary assumptions used in the modeling of each scenario are summarized in Table 3.5.6-7 and also listed here. Year 1 (corresponding to Project 1) assumes WTG foundation installations would use impact pile driving only (no vibratory pile driving). Year 2 (corresponding to Project 2) assumes WTG foundation installations would use either a combination of vibratory and impact pile driving or impact pile driving only. The modeling assumes that WTG foundation installation would progress in a sequential manner, whereby one foundation is installed completely before installation of the next foundation begins. For jacket foundations, the jacket piles are installed sequentially and all piles for a single foundation are installed before installation of the next foundation begins. The modeling also includes concurrent installation of WTG foundations and OSP foundations whereby installation of the two foundation types occurs at the same time. For these cases, only impact pile driving was assumed. Project-level exposure estimates used average sound speed profiles for summer months (April–November) and winter months (December–March). Installation of WTGs was modeled between May and December for Year 1 and Year 2. SouthCoast Wind does not intend to conduct pile driving from January 1–May 14 each year to reduce impacts on NARWs and other marine mammals (COP Volume 2, Table 16-1, SouthCoast Wind 2024).

1. **Year 1 – WTG monopiles, or WTG piled jackets, impact piling only with concurrent OSP installations**
    a. Scenario 1: Sequential installation of 68 WTG monopile foundations (9/16 meters; assuming 1 pile per day for 44 of the monopiles and 2 piles per day for 24 of the monopiles) plus concurrent installation of OSP jacket (12 4.5-meter pin piles) and 3 WTG monopile (9/16 meters; 1/day) foundations for a total of 71 WTG monopiles and 1 OSP jacket foundation.

    b. Scenario 2: Sequential installation of 81 WTG jacket foundations (1 jacket per day with 4, 4.5 m pin piles per jacket) plus concurrent installation of OSP jacket (16, 4.5-meter pin piles) and 4 WTG jacket (1 jacket per day with 4, 4.5-meter pin piles per jacket) foundations for a total of 85 WTG jacket foundations and 1 OSP jacket foundation.

2. **Year 2 – WTG monopiles or WTG piled jackets, vibratory and impact piling with concurrent OSP installations.**
    a. Scenario 1: Sequential installation of 65 WTG monopile foundations (9/16 meters; assuming 1 pile per day for 35 of the monopiles and 2 piles per day for 30 of the monopiles) plus concurrent installation of OSP jacket (12 4.5-meter pin piles) and 3 WTG monopile (9/16 meters; 1/day) foundations, all using only impact pile driving for a total of 68 WTG monopiles and 1 OSP jacket foundation.

    b. Scenario 2: Sequential installation of 67 WTG monopile foundations (9/16 meters; assuming 1 pile per day for 19 monopiles and 2 piles per day for 48 of the monopiles) using vibratory and impact piling plus concurrent installation of OSP jacket (12 4.5-meter pin piles) and 3 WTG monopile (9/16 meters; 1/day) foundations using only impact pile driving, as well as 3 WTG monopile (9/16 meters; assuming 1 pile per day) foundations using only impact pile driving, for a total of 73 WTG monopiles and 1 OSP jacket foundation.

c. Scenario 3: Sequential installation of 48 WTG jacket foundations (1 jacket per day with 4 4.5-meter pin piles per jacket) using vibratory and impact piling and 10 WTG jacket foundations using only impact pile driving (1 jacket per day with 4 4.5-meter pin piles per jacket) plus concurrent installation of OSP jacket (16 4.5-meter pin piles per jacket) and 4 WTG jacket (4 4.5-meter pin piles per jacket) foundations using only impact pile driving, for a total of 62 WTG jacket foundations and 1 OSP jacket foundation.

Table 3.5.6-7. Assumptions used in WTG and OSP foundation installation scenarios for which acoustic and sound exposure modeling was conducted to estimate potential incidental take of marine mammals

	Year 1			Year 2			
	WTG Monopiles (Scenario 1)	WTG Jackets (Scenario 2)	OSP Jackets	WTG Monopiles (Scenario 1)	WTG Monopiles (Scenario 2)	WTG Jackets (Scenario 3)	OSP Jackets
Foundations	71	85	1	68	73	62	1
Piles per foundation	1	4	12–16	1	1	4	12–16
Pile diameter (m)	9/16	4.5	4.5	9/16	9/16	4.5	4.5
Target penetration depth (m)	35	60	60	35	35	60	60
Maximum hammer energy (kJ) [a]	6,600	3,500	3,500	6,600	6,600	3,500	3,500
Impact or vibratory	Impact	Impact	Impact	Impact	Both	Both	Impact
Impact piling strikes per pile [b]	7,000	4,000/NA	4,000	7,000	7,000/5,000	4,000/2,667	4,000
Impact piling duty cycle [c]	30	30	30	30	30	30	30
Piling duration (hours) per foundation type	4	8	4	4	4	8	4
Piles per day	1 or 2	4	4	1 or 2	1 or 2	4	4
Total pile installation days	59	85	3/4	53	49	62	3/4
Installation years	1	1	1	1	1	1	1
Installation months	May–Dec	May–Dec	Oct	May–Dec	May–Dec	May–Dec	Oct

m = meter; kJ = kilojoule
[a] The acoustic modeling assumed the maximum hammer energy was used for all strikes (Limpert et al. 2024, Tables 1–4)
[b] The first value shows the number of strikes if only impact pile driving is used while the second value shows the number of strikes if both vibratory and impact pile driving are used. For Year 1, even though a vibratory plus impact scenario was modeled this is not applicable (NA) because vibratory piling is no longer being considered in Year 1.
[c] Value shows the number of strikes per minute.
Note: Year 1 corresponds to Project 1 and Year 2 corresponds to Project 2.
Source: LGL 2024a: Table 11.

Each of the scenarios included an assumed distribution of installation days per month (Table 3.5.6-8). Additional details regarding the installation scenarios, associated assumptions, and take requests for both Years 1 and 2 are available in SouthCoast Wind's *Petition for Incidental Take Regulations* (Appendix G, Attachment G-3; LGL 2024a, 2024b).

Table 3.5.6-8. Number of installation days required for each modeled pile driving scenario

Scenario [a]	Vibratory with Impact (# days)	Concurrent WTGs and OSPs (# days)	Sequential WTGs (# days)	Total # Days Pile Driving	Total # Piles per Scenario and Year
Year 1, Scenario 1 Monopile WTGs and OSPs	0	3	56	59	83
Year 1, Scenario 2 Jacket WTGs and OSPs	0	4	81	85	356
Year 2, Scenario 1 Monopile WTGs and OSPs	0	3	50	53	80
Year 2, Scenario 2 Monopile WTGs and OSPs	43	3	3	49	85
Year 2, Scenario 3 Jacket WTG and OSPs	48	4	10	62	264

[a] Source: LGL 2024a: Tables 12–16.

To estimate radial distances to AUD INJ (i.e., Level A harassment) for impact pile driving, NMFS (2018, 2024f) hearing-group-specific, dual-metric thresholds for impulsive noise were used and marine mammal auditory weighting functions were applied. To estimate radial distances to behavioral thresholds, NMFS' impulsive noise threshold (NMFS 2018) for Level B harassment under the MMPA was used (SPL_{RMS} of 160 dB re 1 µPa) (Table 3.5.6-9).

Table 3.5.6-9. Marine mammal acoustic thresholds (dB) for impulsive and non-impulsive noise sources

Faunal Group	Injury -AUD INJ/PTS			Impairment - TTS			Behavioral Disturbance	
	Impulsive L_{pk}	Impulsive L_E	Non-impulsive L_E	Impulsive L_{pk}	Impulsive L_E	Non-impulsive L_E	Intermittent L_p	Continuous L_p
LFC	222	183	197	216	168	177	160	120
HFC	230	193	201	224	178	181	160	120
VHFC	202	159	181	196	144	161	160	120
PPW	223	183	195	217	168	175	160	120

AUD INJ = auditory injury; dB = decibels; LFC = low-frequency cetaceans; HFC = high-frequency cetaceans; VHFC = very high-frequency cetaceans; PPW = phocid pinnipeds (in-water); PTS = permanent threshold shift; TTS= temporary threshold shift
L_{pk} = peak sound pressure level in decibels (dB) referenced to 1 microPascal squared; also written SPL_{pk}
L_E = weighted cumulative sound exposure level in dB referenced to 1 microPascal squared second; also written SEL_{cum}
L_p = root mean squared sound pressure level in dB referenced to 1 microPascal squared; also written SPL_{RMS} or L_{rms}
Sources: GARFO 2020; NMFS 2018, 2024f.

The ranges-to-threshold levels resulting from the acoustic modeling are reported using two different terminologies to reflect the underlying assumptions of the modeling. The term *acoustic range* (R95%) refers to acoustic modeling results that are based only on sound propagation and sound source modeling. Since receivers are likely to move in and out of the threshold distance over the course of an exposure, animal movement modeling was used to estimate an *exposure range* (ER95%). This involves analyzing the species-specific movements of simulated animals (animats) and the horizontal distance that includes 95 percent of the closest point of approach of animats exceeding a given impact threshold is determined. This provides a more realistic assessment of the distances within which animals would need to occur to accumulate enough sound energy to cross the applicable SEL_{cum} threshold. Exposure ranges to injury (Level A SEL_{cum}) and behavioral (Level B SPL_{rms}) thresholds to noise from pile driving were calculated and are presented in Table 3.5.6-10 and Table 3.5.6-11, respectively. Sound exposure was modeled for Years 1 and 2 assuming 10 dB of attenuation in the summer and winter.

Table 3.5.6-10. Exposure ranges [a] ($ER_{95\%}$) to injury (Level A SEL_{cum}[b]) thresholds for marine mammals during different WTG and OSP pile driving installation scenarios, assuming 10 dB of noise attenuation

Species/Faunal Group	Year 2		Years 1 and 2		Years 1 and 2			
	Combined [c] (impact + vibratory)		Concurrent (impact only)		Sequential (impact only)			
	16 m WTG Monopile 2 piles/day	4.5 m WTG JPP 4 piles/day	16 m WTG Monopile and 4.5 m OSP JPP 4 piles/day	4.5 m WTG JPP and 4.5 m OSP JPP 4 piles/day	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG JPP 4 piles/day	4.5 m OSP JPP 4 piles/day
Exposure Ranges (km) during Winter								
LFC: Fin whale	—	—	—	—	4.97	—	3.12	—
LFC: Humpback whale	—	—	—	—	4.04	—	2.39	—
LFC: Minke whale	—	—	—	—	3.42	—	1.57	—
LFC: NARW	—	—	—	—	3.61	—	2.01	—
LFC: Sei whale	—	—	—	—	3.88	—	2.61	—
HFC	—	—	—	—	0	—	0	—
VHFC	—	—	—	—	0	—	0	—
PPW	—	—	—	—	0.01	—	3.12	—
Exposure Ranges (km) during Summer								
LFC: Fin whale	5.02	2.82	4.64	4.09	4.57	4.61	2.69	3.52
LFC: Humpback whale	4.18	2.21	3.93	2.99	3.68	4	2.10	2.58
LFC: Minke whale	3.07	1.52	2.59	1.78	3.02	2.91	1.39	1.91
LFC: NARW	3.38	1.91	3.24	2.52	3.31	3.28	1.89	2.27
LFC: Sei whale	3.68	2.23	3.72	2.89	3.43	3.58	2.30	2.77
HFC	0	0	0	0	0	0	0	0
VHFC	0	0	0	0	0	0	0	0
PPW	0.04	0.41	0.45	0.26	0.01	0.04	0.41	0.52

dB = decibel; JPP = jacket pin piles; km = kilometer; HFC = high-frequency cetacean; LFC = low-frequency cetacean; VHFC = very high-frequency cetacean; PPW = phocid pinniped (in-water); m = meter; NARW = North Atlantic right whale; OSP = offshore substation platform; WTG = wind turbine generator

dash (—) = no results because potential combined, concurrent or sequential installation would only occur in the summer months

[a] Exposure ranges are a result of animal movement modeling

[b] SEL_{cum} = weighted cumulative sound exposure level in dB referenced to 1 microPascal squared second; also written L_E

[c] Combined vibratory and impact pile driving would only occur in the summer months of Year 2

Source: LGL 2024b: Tables 41–51.

For impact pile driving, the exposure ranges to Level A (AUD INJ/PTS) thresholds varied by species for LFCs, sometimes up to 500 meters, so each LFC species was evaluated separately. Depending on their proximity to the pile, individuals remaining within these distances for an extended period could experience Level A exposure without additional mitigation beyond the 10 dB noise attenuation assumption included in the modeling (LGL 2024b). The modeling results (Table 3.5.6-10) show that exposure ranges were larger in the winter than in the summer. Under the sequential, impact-only pile driving scenario, exposure ranges were larger for fin, sei, and humpback whales when pile driving two WTG monopiles per day versus one WTG monopile per day, and smaller for NARW and sei whales for the same scenarios. Distances to Level A exposure ranged from 0.02 mile (0.04 kilometer) for phocid pinnipeds to as much as 2.86 miles (4.61 kilometers) for fin whales. The combined impact and vibratory installation of two WTG monopiles per day yielded similar exposure ranges from 0.02 mile (0.04 kilometer) for phocid pinnipeds to 3.12 miles (5.02 kilometers) for fin whales. Exposure ranges were also similar between the sequential, impact-only installation of one or two WTG monopiles per day and combined impact and vibratory installation of two WTG monopiles per day. For all scenarios including installation of jacket pin piles (i.e., sequential or concurrent with one monopile or four OSP pin piles two/day, using impact or combined pile driving methods), exposure ranges were similar, and an order of magnitude longer than those estimated for monopile scenarios. No Level A exposures were calculated for both HFCs and VHFCs as both groups did not exceed Level A thresholds at any distance.

The acoustic ranges (i.e., where 95 percent of the individuals would be exposed to a threshold from one pile driving event) were calculated to the unweighted 160 dB re 1 µPa sound pressure level (SPL_{rms}) Level B behavioral thresholds from impact pile driving and 120 dB re 1 µPa from vibratory pile driving, assuming 10 dB of noise attenuation (Table 3.5.6-11). Although the overall sound levels associated with vibratory hammering are typically less than impact hammering, the lower disturbance threshold (120 dB re 1 µPa SPL_{rms}) for continuous sounds means that vibratory pile driving activity will often result in a larger area ensonified above that threshold and, therefore, a larger number of potential Level B exposures.

Modeled results show that for vibratory pile driving, which would only occur in Year 2, the largest unweighted acoustic range was 52.59 miles (84.63 kilometers) during the modeled installation of WTG monopiles (at two piles per day) in the winter, while the smallest unweighted acoustic range was 9.84 miles (15.83 kilometers) during the installation of WTG jacket pin piles in the summer. Distances to Level B harassment thresholds for each hearing group were also calculated for impact-only pile driving installation scenarios. Individuals remaining within these distances from pile driving could experience behavioral effects without additional mitigation beyond the assumed 10-dB noise attenuation included in the modeling (LGL 2024a). For these results, acoustic ranges were larger in the winter than in the summer and was largest during the modeled installation of WTG monopiles (at two piles per day). Under this installation scenario, individuals within 5.36 miles (8.63 kilometers) of active impact pile driving could experience behavioral effects. The smallest acoustic ranges occurred during the modeled installation of WTG jacket pin piles as individuals would have to be within 2.60 miles (4.18 kilometers) of active impact pile driving to experience behavioral effects (Table 3.5.6-11).

Table 3.5.6-11. Unweighted acoustic ranges (R95%) to the Level B, 160 dB re 1 µPa sound pressure level (SPL_{RMS}) threshold from impact pile driving and Level B, 120 dB re 1 µPa SPL_{rms} from vibratory pile driving under Year 2 scenarios, assuming 10 dB of noise attenuation

Acoustic Ranges (km) to Behavioral Threshold	Years 1 and 2			Year 2	
	Impact (160 dB SPL_{rms})			Vibratory (120 dB SPL_{rms})	
	16 m WTG Monopile 2 piles/day	4.5 m WTG JPP 4 piles/day	4.5 m OSP JPP 4 piles/day	16 m WTG Monopile 2 piles/day	4.5 m WTG JPP 4 piles/day
Winter	8.63	4.41	5.24	84.63	21.92
Summer	7.44	4.18	4.88	42.02	15.83

dB = decibel; JPP = jacket pin pile; km = kilometer; m = meter; OSP = offshore substation platform; WTG = wind turbine generator; SPL_{RMS} = root mean squared sound pressure level in dB referenced to 1 microPascal squared; also written L_p or L_{rms}
Source: LGL 2024a: Table 23.

The numbers of individual marine mammals predicted to receive sound levels above thresholds were determined using animal movement modeling in the same modeling exercise (LGL 2024b). Based on the modeled results (Table 3.5.6-12), the greatest Level A exposure would occur during the installation of 73 WTG monopiles and 12 OSP jacket pin piles (under Scenario 2 of Year 2). Under this installation scenario, 60 minke whales, 18 fin whales, 14 humpback whales, 3 NARWs, 2 sei whales, 1 harbor seal, and 1 gray seal may be exposed to cumulative sound exposure levels over a period of 24 hours that exceed Level A injury thresholds, should these species occur in the Project area. Exposures were marginally lower during the modeled installation of 62 WTG jackets and 16 OSP jacket pin piles (under Scenario 3 of Year 2) as estimates for individuals exposed to Level A injury thresholds were reported to be 47 minke whales, 11 fin whales, 11 humpback whales, 4 NARWs, 3 sei whales, 2 gray seals, and 1 harbor seal.

Similarly, the greatest Level B exposure would occur during the installation of 73 WTG monopiles and 12 OSP jacket pin piles ranging from 1 blue whale to as many as 41,093 common dolphins that could be exposed to sound pressure level (SPL_{rms}) exceeding the Level B threshold for behavioral impacts. When these values are compared to installation scenarios involving WTG jacket pin piles, the number of exposed individuals were reported to be smaller. This suggests that the installation of WTGs and OSPs with jacket pin piling may lessen the extent of behavioral impacts compared to those caused by the installation of monopile WTGs. Beyond the assumed 10 dB attenuation included in the modeling, the exposure estimates are calculated in the absence of the planned monitoring and mitigation measures, which are designed to prevent most Level A and Level B exposures.

Table 3.5.6-12. Estimated Level A and Level B exposures under different installation scenarios for Years 1 and 2, assuming 10 dB of noise attenuation. Level B exposure modeling take estimates are based on distances to the unweighted 160 dB or 120 dB threshold

Species	Exposure Estimates (# of individuals)									
	Year 1				Year 2					
	Scenario 1: [a] 71 WTG monopiles and 12 OSP JPP		Scenario 2: [a] 85 WTG jackets and 16 OSP JPP		Scenario 1: [a] 68 WTG monopiles and 12 OSP JPP		Scenario 2: [b] 73 monopiles and 12 OSP JPP		Scenario 3: [b] 62 WTG jackets and 16 OSP JPP	
	Total Level A (SEL_{cum})	Total Level B (SPL_{rms})	Total Level A (SEL_{cum})	Total Level B (SPL_{rms})	Total Level A (SEL_{cum})	Total Level B (SPL_{rms})	Total Level A (SEL_{cum})	Total Level B (SPL_{rms})	Total Level A (SEL_{cum})	Total Level B (SPL_{rms})
Mysticetes										
Blue whale [c]	0	1	0	1	0	1	0	1	0	1
Fin whale [c]	17	39	13	23	14	32	18	481	11	113
Humpback whale	12	33	14	37	12	32	14	282	11	98
Minke whale	55	169	59	197	54	164	60	869	47	492
NARW [c]	3	9	5	12	3	10	3	100	4	40
Sei whale	2	5	3	7	2	6	2	42	3	19
Odontocetes										
Atlantic spotted dolphin	0	29	0	29	0	29	0	320	0	75
Atlantic white-sided dolphin	0	521	0	728	0	551	0	3,045	0	1,648
Bottlenose dolphin	0	268	0	304	0	250	0	2,342	0	830
Common dolphin	0	6,976	0	8,553	0	6,913	0	41,093	0	20,177
Harbor porpoise	0	313	0	378	0	305	0	2,382	0	1,002
Pilot whales	0	61	0	40	0	58	0	635	0	195
Risso's Dolphin	0	37	0	30	0	32	0	1,760	0	136
Sperm whale [c]	0	13	0	10	0	11	0	122	0	36
Pinnipeds										
Gray seal	1	210	2	225	1	235	1	8,331	2	993
Harbor seal	1	31	1	35	1	30	1	432	1	71

SEL_{cum} = weighted cumulative sound exposure level in decibels (dB) referenced to 1 microPascal squared second; also written L_E
SPL_{rms} = root mean squared sound pressure level in dB referenced to 1 microPascal squared; also written L_p or L_{rms}
dB = decibels; JPP = jacket pin piles; NARW = North Atlantic right whale; OSP = offshore substation platform; WTG = wind turbine generator
[a] Impact only pile driving
[b] Combined vibratory and impact pile driving
[c] Denotes species listed under the Endangered Species Act
Source: LGL 2024b: Table 28–32.

Considering the results of the underwater noise modeling and the extent of radial distances to AUD IN/PTS and behavioral thresholds, individual fitness-level impacts could occur due to pile driving. To help mitigate these impacts, SouthCoast Wind has proposed measures to minimize or avoid impacts of pile-driving noise and has developed a Marine Mammal and Sea Turtle Monitoring and Mitigation Plan for the Proposed Action (COP Appendix O; SouthCoast Wind 2024) along with applicant-proposed measures outlined in Appendix G, *Mitigation and Monitoring*. Measures being considered for this plan include but are not limited to the use of protected species observers and PAM systems to monitor and enforce appropriate monitoring and exclusion zones, ramp-up/soft-start procedures to deter marine mammals from pile driving, shutdown procedures, noise-attenuation technologies, reduced-visibility and night monitoring tools/technologies (e.g., night vision, infrared, thermal cameras), and the use of software to share visual and acoustic detection data among platforms in real time.

NAS can be particularly effective in reducing the overall acoustic energy that is introduced in the environment and have shown that broadband sound levels can likely be reduced by 7 to 17 dB, depending on the environment, pile size, and configuration of the systems used (Buehler et al. 2015; Bellmann et al. 2020). While the type and number of NAS to be used during construction have not yet been determined, it can be expected that a combination of systems (e.g., double big bubble curtain, hydrosound damper plus single bubble curtain) are reasonably expected to achieve more than a 10 dB broadband attenuation from impact pile-driving sounds such that exposures would likely be lower than the modeled results. SouthCoast Wind would operate NAS to meet noise levels modeled (10 dB attenuation) and would not exceed these levels. However, if Sound Source Verification suggests noise levels are louder than modeled, additional noise attenuation measures will be implemented to further reduce noise levels to at least those modeled.

Shutdown procedures would also be implemented should a marine mammal be detected entering the respective shutdown zone. Shutdown zones, as presented in MMPA ITA application (LGL 2024b), Section 11.2.9.1, are based on the Level A exposure ranges with 10 dB noise attenuation for foundation installation across Year 1 and Year 2. If the shutdown zone is equivalent to the NAS perimeter, this means the outside perimeter of the NAS. Therefore, any animals occurring within the NAS would trigger a shutdown. The shutdown zones, ranging from 656–13,780 feet (200–4,200 meters), are the largest zone sizes expected to result from foundation installations for each installation schedule. However, the NARW shutdown zones are based on the requirement that a visual or acoustic observation of a NARW at any distance would result in immediate shutdown measures. If SouthCoast Wind selects foundation installation parameters that result in smaller modeled exposure ranges (e.g., smaller diameter piles, lower maximum hammer energies or total strikes per pile, or a more effective NAS) or if sound field verification consistently indicates that measured ranges are smaller than those modeled, shutdown zones may be reduced relative to those based on the current maximum pile size and energy assumptions. However, NARW shutdown zones may not be reduced.

The proposed requirement that impact pile driving can only commence when the pre-clearance zones are fully visible to PSOs allows for a high marine mammal detection capability and enables a high rate of success in implementing these zones to avoid serious injury to marine mammals. A pre-start clearance period would be implemented for all foundation installations inside and outside the NMFS 12.4-mile

(20-kilometer) area of concern. Foundations installed within the 12.4-mile (20-kilometer) area of concern (June 1–October 15) would have a minimum visibility zone[6] of 3 miles (4,900 meters) for pin pile and 4.7 miles (7,500 meters) for monopile installation implemented. OSP foundations (and WTG jacket foundations, if installed) installed throughout the rest of the Lease Area (outside the area of concern), would have a minimum visibility zone[7] of 1.62 miles (2,600 meters) for pin pile and 2.3 miles (3,700 meters) for monopile and pin pile installation implemented. Acoustic PSOs would be conducting acoustic monitoring in coordination with the visual PSOs, during all pre-start clearance, piling, and post-piling monitoring periods (daylight, reduced visibility, and nighttime monitoring).

SouthCoast Wind has proposed nighttime pile driving to complete installation within as few years as possible during the multi-year installation campaign. As outlined in the MMPA ITA, piling during the night would reduce the total duration of construction activities, limit crew transfers and vessel trips, and concentrate construction when NARW are less likely to be present in the Project area (May 15–December 31), thereby, reducing the overall potential impact on this species. Operations during periods of low visibility or nighttime, monitoring will include the use of night vision equipment (e.g., night vision goggles) and infrared/thermal imaging technology. An Alternative Monitoring Plan (AMP) and Nighttime Pile Driving Plan (NPDP) would be submitted to BOEM and NMFS for review. These plans would describe the methods, technologies, and mitigation requirements for any low-visibility or nighttime pile-driving activities. The NPDP should sufficiently demonstrate the efficacy of the alternative technologies and methods in monitoring the full extent of clearance and shutdown zones to obtain approval for nighttime pile-driving activities. In the absence of an approved NPDP, nighttime pile driving would only occur if unforeseen circumstances prevented the completion of pile driving during daylight hours and it was deemed necessary to continue piling during the night to protect asset integrity or safety.

Since visual observations within the applicable shutdown zones can become impaired at night or during daylight hours due to fog, rain, or high sea states, visual monitoring with thermal and night vision devices would be supplemented by a real-time PAM system during these periods. The use of PAM (or alternative) would supplement visual observations during pre-start clearance, piling and post-piling monitoring periods. A combination of alternative monitoring measures, including PAM, has been demonstrated to have comparable detection rates (although limited to vocalizing individuals) to daytime visual detections for several species (Smith et al. 2020). A Pile-Driving Monitoring (PDM) Plan would be submitted to BOEM, BSEE, and NMFS for review, which would describe the visual and PAM components including all equipment, procedures, and protocols. The PAM system would be designed to detect vocalizations from all marine mammals potentially present in the region, including LFCs such as NARW

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[6] The minimum visibility zone sizes implemented during foundation installation of pin piles and monopiles within the 20-kilometer area of concern are set equal to the largest Level B harassment zone (unweighted acoustic ranges to 160 dB re 1 µPa sound pressure level in summer) modeled at for each substructure type assuming 10 dB of noise attenuation.

[7] The minimum visibility zone sizes implemented during foundation installation of pin piles and monopiles occurring throughout the rest of the Lease Area (outside the area of concern) are set equal to the second largest low-frequency Level A SEL_{cum} exposure ranges (ER95%) with 10 dB of noise attenuation for foundation installation across Year 1 and Year 2.

and fin whale, and should demonstrate detection capability in monitoring the full extent of the 120 dB (for vibratory pile driving) 160 dB (for impact pile driving) distance from the pile-driving location.

In response to concerns related to NARW habitat use of the Nantucket Shoals region, SouthCoast Wind has proposed additional mitigation and monitoring plans for pile driving (Appendix G, Attachment G-3). These specific measures include increased monitoring coverage for impact pile driving especially within the 12.4-mile (20-kilometer) NMFS area of concern. This plan intends to increase the probability of NARW detection and describes the methods that would be used to monitor the pre-start clearance and shutdown zones, as well as the Level B disturbance zones during installation of Project foundations that occur in the area of concern. The pre-start clearance and shutdown zone for NARW would be extended to include a visual detection of a NARW at any distance from the pile being installed. This includes increasing the number of PSOs on duty (three PSOs on each monitoring vessel) and the number of monitoring vessels (three in the Lease Area, four in the 12.4-mile [20-kilometer] area of concern), as well as in the rest of the Lease Area from May 15–31 and the entire month of December. Within the 12.4-mile (20-kilometer) area of concern, the minimum visibility zone (required to be completely visible to initiate pile driving) would be equivalent to the Level B harassment zone for monopiles (24,606 feet [7,500 meters]) and pin piles (16.076 feet [4,900 meters]). Visual monitoring would then be conducted to cover double the relevant Level B harassment zone for the installation of monopiles (9.3 miles [15 kilometers]) and pin piles (6.2 miles [10 kilometers]). Similarly, a distance larger than the Level B harassment zones would be acoustically monitored by deploying a PAM array to cover a 9.3-mile (15-kilometer) zone for monopile installation and a 6.2-mile (10-kilometer) zone for pin pile installation. Prior to the initiation of pile driving, NARW calls localized within the relevant PAM clearance zone would result in a delayed start or shutdown of pile driving. Once pile driving begins, the PAM shutdown zone, which is an acoustic observation of a NARW at any distance, would result in immediate shutdown measures. If a delay or shutdown of pile driving is triggered by an acoustic detection localized within the 9.3-mile (15-kilometer) zone for monopiles or the 6.2-mile (10-kilometer) zone for pin piles, pile installation may not resume until the following day and must be preceded by a vessel-based survey in each respective zone to ensure no NARWs are detected. A delay or shutdown of pile driving triggered by visual detection of fewer than three NARWs will postpone the installation for one day preceded by a vessel-based survey, while a visual detection of three or more NARWs will postpone the installation for two days. Additionally, no pile driving for WTG or OSP foundation installations will occur within the 12.4-mile (20-kilometer) area of concern during the month of May or after October 15.

Because Nantucket Shoals is a known area of high primary productivity and a NARW winter foraging ground, implementing mitigation measures within this area is particularly crucial in minimizing the effects of Project activities on NARWs. Other measures to be implemented to further reduce such effects include adherence to pile driving time-of-year restrictions and to only use impact pile driving for foundation installations of Project 1 (Year 1) due to concerns of the larger ensonified area associated with vibratory piling.

While behavioral and masking effects are more difficult to mitigate and are, therefore, still considered likely for activities with large acoustic disturbance areas such as impact pile driving, implementation of a 30-minute pre-start clearance period where the shutdown zones are monitored would limit the potential for behavioral disturbance to all marine mammal species. Exposure to noise above behavioral thresholds may result in displacement; however, this displacement would be temporary for the duration of activity, which would be a maximum of 4 hours per pile, for two piles per day, with a 4-hour break before another pile would be driven during monopile installation. NARW (and any LFCs) could be expected to resume their previous behavior (e.g., pre-construction activities) following this 12-hour period. The energetic consequences of any avoidance behavior and potential delay in resting or foraging are not expected to affect any individual's ability to successfully obtain enough food to maintain their health or impact the ability of any individual to make seasonal migrations or participate in breeding or calving. Any physiological effects resulting from changes in behavior would be expected to resolve within hours to days of exposure and are not expected to affect the health of any individual or its ability to migrate, forage, breed, or calve.

The potential for serious injury is minimized by the implementation of known and highly effective mitigation measures as discussed above. Slight PTS (i.e., minor degradation of hearing capabilities at some hearing thresholds) may be expected but as the shutdown and clearance zones would cover the majority of the largest PTS zone of influence. Although the likelihood of exposure leading to PTS would be greatly reduced, some PTS of fin whales would be authorized under the Letter of Agreement (LOA) issued under the MMPA. Given a marine mammal's transient nature and ability to move away from noise disturbance, the potential for exposure of these species to noise levels leading to behavioral disruption would also be reduced at the level of the individual animal and would not be expected to have population level effects.

As the shutdown zones and clearance zones would cover the majority of the largest PTS zones modeled for each species group, PTS exposures and the effects of noise exposure from Project pile driving leading to auditory injury are considered moderate for mysticetes (fin whales), odontocetes (harbor porpoises), and pinnipeds (harbor seals and gray seals). Because of the transitory nature of marine mammals and the short duration of noise disturbance resulting in behavioral effects, pile-driving activity leading to behavioral disturbance would not result in long-term or population-level effects, and is, therefore, considered minor for all species groups.

Noise - cable laying: Noise-producing activities associated with cable laying during construction include route identification surveys, trenching, jet plowing, backfilling, and installation of cable protection. There is limited information regarding underwater noise generated by cable-laying and burial activities in the literature. Johansson and Andersson (2012) recorded underwater noise levels generated during a comparable operation involving pipelaying and a fleet of nine vessels. Mean noise levels of 130.5 dB re 1 μPa were measured at 4,921 feet (1,500 meters) from the source. Reported noise levels generated during a jet trenching operation provided a source level estimate of 178 dB re 1 μPa measured at 3.3 feet (1 meter) from the source (Nedwell et al. 2003).

Noise from cable laying activities is not expected to reach levels that would cause PTS, TTS, or injury to marine mammals though it might reach levels that exceed thresholds for behavioral effects (120 dB re 1 uPa2 s) similar to vessel noise. 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 and are not expected to have population level effects. 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. Therefore, effects from cable-laying noise from the Proposed Action is considered to be minor for mysticetes (including NARW), odontocetes, and pinnipeds.

Noise - dredging: Dredging would not be required for any foundation type in the Lease Area and is not anticipated for the interarray cable installation. For the export cable installation, dredging is anticipated for the purpose of seabed preparation (sand wave clearance) within 5 percent of the Falmouth ECC (associated with the Muskeget Channel and Nantucket Sound). Sand wave clearance would be accomplished with a trailing suction hopper dredger or water injection dredge (both hydraulic dredge types). Dredging is also expected at HDD offshore exit pits at landfall locations within the Falmouth ECC and Brayton Point ECC. The frequency of the sounds produced by hydraulic suction dredging ranges from approximately 1 to 2 kilohertz, with reported source levels of 172 to 190 dB re 1 µPa at 3.3 feet (1 meter) (Robinson et al. 2011; Todd et al. 2015; McQueen et al. 2019). Noise produced by mechanical dredging is emitted from winches and derrick movement, bucket contact with the substrate, digging into substrate, bucket closing, and emptying of material into a barge or scow (Dickerson et al. 2001). Reported sound levels of clamshell dredges include 176 dB re 1 µPa Lrms (BC MoTI 2016) and 107 to 124 dB re 1 µPa at 505 feet (154 meters) from the source with peak frequencies of 162.8 Hz (Dickerson et al. 2001; McQueen et al. 2019).

Based on the available source level information presented above, hydraulic and mechanical dredging are unlikely to exceed marine mammal PTS thresholds. However, if dredging occurs in one area for relatively long periods, behavioral thresholds could be exceeded along with masking of marine mammal communications (NMFS 2018; Todd et al. 2015). Mysticetes and pinnipeds are more likely to experience acoustic masking due to the low frequency of dredging noise and the low frequencies utilized by these species. However, dredging for the Proposed Action is not expected to occur for long periods and any potential behavioral effects would be temporary. Therefore, effects from dredging noise due to the Proposed Action is considered minor for mysticetes (including NARW), odontocetes, and pinnipeds.

Noise - drilling: Monopiles are expected to be installed to their design depth using hammers. In the event hammering alone cannot reach the required installation depth due to the presence of boulders or dense soils, relief drilling may be utilized to remove soil to achieve the required pile penetration depth. Upon completion of relief drilling to free up the pile, normal pile hammering would resume until the pile has reached target penetration depth. The total number of piles that may require relief drilling are not currently available, but only a small number of foundations, if any, would require relief drilling. Consequently, the overall duration for this activity is expected to be shorter than the time required for impact pile driving during foundation installation. Although noise from relief drilling was not modeled as part of JASCO's Underwater Acoustic Modeling Scenarios (LGL 2024a, 2024b), it is expected that the generated noise would be similar during dredging or cable laying operations as previously discussed under *Noise – Dredging* and *Noise – Cable Laying*. Based on source levels from similar drilling activities, relief drilling could generate SPLs of 140 dB re µPa at a distance of 3,280 feet (1,000 meters) from the pile (Austin et al. 2018). Drilling-related activities are expected to be short term, which limits noise exposure to marine mammals potentially present during construction. While behavioral responses may occur from relief drilling, they are expected to be short-term and of low intensity. Impacts from potential relief drilling activities on all marine mammals would, therefore, be minor.

Noise - G&G survey (HRG surveys and geotechnical drilling activities): Acoustic signals produced by HRG sources can be subdivided into impulsive signals used for sub-bottom profiling (e.g., boomers, bubble guns, airguns, sparkers, chirp sub-bottom profilers) or non-impulsive signals used for bottom mapping (e.g., multi-beam echosounders, side-scan sonar) (Crocker and Fratantonio 2016). JASCO Applied Sciences estimated distances to threshold levels based on manufacturer provided source levels and operational parameters for HRG equipment that are currently being considered under the Proposed Action (Li and Denes 2020; LGL 2024a, 2024b). Representative geophysical survey equipment that may be used by SouthCoast Wind that reflects the largest horizontal impact distances in marine mammals are shown in Table 3.5.6-13.

Based on the modeling output, the largest distance to AUD INJ/PTS (Level A) threshold from a sparker, sub-bottom profiler, or boomer source for LFCs, HFCs, and pinnipeds are less than 33 feet (10 meters). For VHFCs, the largest modeled distance is 187 feet (57 meters) from a sub-bottom profiler. The largest modeled distance to the behavioral harassment threshold (Level B) was 656 feet (200 meters) from a sparker. Although a sparker may not be used at all times during HRG surveys, this distance was used in calculating the area exposed to sounds above 160 dB SPL_{rms} for all HRG survey activity. This was done by assuming an average of 50 miles (80 kilometers) of survey activity would be completed daily by each survey vessel when active. A 656-foot (200-meter) perimeter around 50 miles (80 kilometers) of survey line was calculated to estimate a daily ensonified area of 12.39 square miles (32.1 square kilometers).

Because of the range of frequencies emitted during HRG surveys, behavioral disturbance and masking is considered possible in all functional hearing groups. This is particularly the case for omnidirectional and high-amplitude sources such as boomers and sparkers. However, for most HRG survey equipment, the restricted beam shape and directionality (i.e., energy is pointed downward) of the signals and the brief period when an individual mammal may be within its beam may reduce the potential for behavioral disturbance (NMFS 2021b). Masking of LFC communications is considered more likely due to the overlap of these surveys with lower-frequency signals produced by these species. Masking of high-frequency echolocation clicks used by HFCs and VHFCs is not anticipated; however, some masking of other communication used by these species is possible. Because of the number of survey days expected for the Proposed Action, masking is considered moderate for LFCs and minor for all other functional hearing groups.

Table 3.5.6-13. Summary of Level A (SELcum) and Level B (SLPrms) horizontal impact distances

Equipment	System	Operating Frequency	Beamwidth	Source Level		Level A horizontal impact distance (m)								Level B horizontal impact distance (m)
						LFC		HFC		VHFC		PPW		
				L_{pk}	L_P	L_{pk}	L_E	L_{pk}	L_E	L_{pk}	L_E	L_{pk}	L_E	
Sparker	Applied Acoustics Dura-Spark UHD	0.01–1.9	180 [a]	213	206	-	1	-	< 1	4	< 1	-	< 1	200
Sub-bottom profiler	Teledyne Benthos Chirp III	2–7	82	204	199	-	2	-	< 1	-	57	-	1	66
Boomer	Applied Acoustics S-boom @ 700 J	0.01–5	61	211	205	-	< 1	-	< 1	1	< 1	-	< 1	90

[a] Assumed omnidirectional.
dash (—) indicates the HRG equipment source level is below the relevant threshold level.
HFC = high-frequency cetaceans; LFC = low-frequency cetaceans; VHFC = very high-frequency cetaceans; PPW = phocid pinniped (in-water); m = meters
L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}
L_p = root mean squared sound pressure level in decibels referenced to 1 microPascal squared; also written as SPLrms or Lrms
L_E = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written SEL_{cum}
Sources: LGL 2024a: Tables 35 and 38; Li and Denes 2020: Tables 2, 4, and 6; LGL 2024b.

To calculate potential Level B exposures from HRG surveys in the Lease Area and the ECC, the annual average marine mammal densities from Tables 35 and 37 of the MMPA ITA (LGL 2024a) were multiplied by the total expected ensonified area. This value was then compared against the PSO data take estimate and the mean group size of each species and the largest value was selected as the annual estimated exposure (Years 1 and 2). The annual estimated exposure was then multiplied by three to calculate the total exposures over the 3 years of operations (Years 3 to 5). The estimated exposure for marine mammal species during construction and operations are shown in Table 3.5.6-14 and Table 3.5.6-15, respectively. While AUD INJ/PTS could occur if marine mammals are close to survey activities, HRG survey equipment is unlikely to result in injury given the estimated short horizontal impact distances (Table 3.5.6-13) and given that sound levels diminish rapidly with distance from the survey equipment (BOEM 2018); therefore, no Level A exposures are anticipated for this activity. Based on the reported calculations, during the construction phase, as much as 1,166 common dolphins may be exposed to sound levels leading to behavioral effects. Over the 3-year operations phase, up to 2,334 common dolphins may be exposed to sound levels leading to behavioral effects. These effects are considered to be short term and intermittent because survey activities are only expected to last between 35 and 63 days in the Lease Area and along the ECC per year.

Table 3.5.6-14. Estimated Level B exposures [a] for marine mammals from HRG surveys during construction (Year 1 and Year 2)

Species	Density-Based Exposures by Survey Area						PSO Data-Based Exposure Estimate	Mean Group Size	Total Level B Exposure (Construction Phase)	
	Year 1			Year 2						
	Lease Area	ECC	Annual Total	Lease Area	ECC	Annual Total			Year 1	Year 2
Mysticetes										
Blue whale [b]	0	0	0	0	0	0	–	1.0	1	1
Fin whale [b]	1.8	0.8	2.6	1.8	0.8	2.6	5.3	1.8	6	6
Humpback whale	1.3	0.7	1.9	1.3	0.7	2	51.4	2	52	52
Minke whale	4.5	2.9	7.4	4.6	2.9	7.6	10.2	1.4	11	11
NARW [b]	2.1	2.3	4.4	2.2	2.4	4.5	–	2.4	5	5
Sei whale [b]	0.5	0.3	0.8	0.5	0.3	0.8	1.4	1.6	2	2
Odontocetes										
Atlantic spotted dolphin	1	0	1.1	1	0	1.1	–	29	29	29
Atlantic white-sided dolphin	18.3	4.9	23.3	18.8	5.1	23.9	–	27.9	28	28
Bottlenose dolphin	9.2	2.3	11.5	9.5	2.4	11.9	133.4	12.3	134	134

Species	Density-Based Exposures by Survey Area						PSO Data-Based Exposure Estimate	Mean Group Size	Total Level B Exposure (Construction Phase)	
	Year 1			Year 2						
	Lease Area	ECC	Annual Total	Lease Area	ECC	Annual Total			Year 1	Year 2
Common dolphin	119	21.6	140.6	122.3	22.2	144.5	1,165.5	34.9	1,166	1,166
Harbor porpoise	44.1	26.5	70.6	45.4	27.2	72.6	0.2	2.7	71	73
Pilot whale	2.3	0.2	2.5	2.4	0.2	2.6	5.9	10.3	11	11
Risso’s dolphin	1.1	0.1	1.2	1.1	0.2	1.2	–	5.4	6	6
Sperm whale [b]	0.4	0.1	0.5	0.4	0.1	0.5	0.4	2	2	2
Pinnipeds										
Gray seal	68.9	180.7	249.6	70.8	185.7	256.5	3.1	1.4	250	257
Harbor seal	4.5	11.7	16.2	4.6	12.1	16.7	48.3	1.4	49	49

ECC = export cable corridor; PSO = protected species observer

[a] Exposure estimates are presented here with a single decimal place for readability. Due to rounding, the total yearly density-based exposures may not equal the sum of the LA and ECC exposures.

[b] Denotes species listed under the Endangered Species Act.

Source: LGL 2024b: Table 40.

Table 3.5.6-15. Estimated Level B exposures [a] for marine mammals from HRG surveys during operations (Years 3–5)

Species	Annual Operations Phase Exposure by Survey Area (Years 3–5)		Annual Total Density-Based Exposure Estimate	Annual PSO Data-Based Exposure Estimate	Mean Group Size	Highest Annual Level B Exposure	3-Year Level B Exposure (Operations Phase)
	Lease Area	ECC					
Mysticetes							
Blue whale [b]	0	0	0	–	1	1	3
Fin whale [b]	2.5	1	3.5	3.6	1.8	4	12
Humpback whale	1.8	0.9	2.6	34.3	2	35	105
Minke whale	6.4	3.7	10.1	6.8	1.4	11	33
NARW [b]	3	3	6	–	2.4	7	21
Sei whale [b]	0.7	0.4	1	0.9	1.6	2	6
Odontocetes							
Atlantic spotted dolphin	1.4	0.1	1.5	–	29	29	87
Atlantic white-sided dolphin	26	6.4	32.4	–	27.9	33	99
Bottlenose dolphin	13.1	3	16.1	88.9	12.3	89	267

Species	Annual Operations Phase Exposure by Survey Area (Years 3–5)		Annual Total Density-Based Exposure Estimate	Annual PSO Data-Based Exposure Estimate	Mean Group Size	Highest Annual Level B Exposure	3-Year Level B Exposure (Operations Phase)
	Lease Area	ECC					
Common dolphin	168.9	28	196.9	777	34.9	778	2,334
Harbor porpoise	62.6	34.3	97	0.1	2.7	97	291
Pilot whale	3.3	0.2	3.5	3.9	10.3	11	33
Risso's dolphin	1.5	0.2	1.7	–	5.4	6	18
Sperm whale [b]	0.5	0.1	0.7	0.3	2	2	6
Pinnipeds							
Gray seal	97.8	234.5	332.3	2.1	1.4	333	999
Harbor seal	6.3	15.2	21.6	32.2	1.4	33	99

ECC = export cable corridor; PSO = protected species observer
[a] Exposure estimates are presented here with a single decimal place for readability. Due to rounding, the total yearly density-based exposures may not equal the sum of the LA and ECC exposures.
[b] Denotes species listed under the Endangered Species Act.
Source: LGL 2024b: Table 41.

To mitigate any potential impacts, SouthCoast Wind will implement several mitigation measures specific to HRG survey activities when operating equipment that produces sound within marine mammals' hearing range (i.e., less than 180 kHz) (Appendix G, *Mitigation and Monitoring*). During HRG surveys, 1,640-foot (500-meter) monitoring zones for baleen whales, and 328-foot (100-meter) monitoring zones for other marine mammals would be used 30 minutes prior to noise-producing survey activities. Any marine mammals observed in these zones would pause the 30-minute observation period, which would resume only after confirmation from the observer that the animal has left the area. If the animal dives or visual contact is lost, the 30-minute observation period is reset (BOEM 2021c). During survey activities, 656-foot (200-meter) shutdown zones for baleen whales and 328-foot (100-meter) shutdown zones for all other marine mammals would be established. Observed animals occurring within these ranges would prompt a shutdown of boomers or sparkers until the animal leaves the area (BOEM 2021d). These measures require the use of PSOs to monitor and enforce clearance and shut down zones around HRG survey activities and use of ramp-up procedures prior to commencement of survey activities, further reducing the likelihood of marine mammal injury. Any behavioral impacts on individual marine mammals associated with G&G surveys for the Proposed Action would be temporary and are not expected to result in stock or population-level effects.

Exposure from HRG surveys leading to PTS, serious injury or mortality are not expected for mysticetes (including NARW), odontocetes, and pinnipeds, and are therefore negligible. However, based on the modeling analysis, noise exposure from HRG surveys leading to behavioral disturbance (Level B) is possible. However, due to the small ensonified area from HRG survey equipment (656 feet [200 meters] or less depending on equipment) wherein sound exposure would be brief and temporary, along with the implementation of monitoring and shutdown zones (328–1,640 feet [100–500 meters]) that would more than cover the behavioral disturbance area, the potential for exposure of these marine mammals to noise levels leading to behavioral disturbance would be reduced to the level of the individual animal and would not be expected to have population level effects. Therefore, the effects of noise exposure from HRG surveys leading to behavioral disturbance and masking on mysticetes (including NARW), odontocetes, and pinnipeds are considered minor**.**

Noise - turbine operation: As discussed in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals,* WTGs operating during O&M of the Proposed Action would generate non-impulsive, underwater noise that is audible to marine mammals. This type of sound is considered to be continuous and radiate omnidirectionally from the pile. Available monitoring data for WTGs (Tougaard et al. 2020) is limited to sizes currently in operation (i.e., up to approximately 6 MW) and may underestimate source levels generated by WTGs considered under the Proposed Action. WTGs associated with the Proposed Action are expected to be larger than previously reported on currently operating WTGs, with an anticipated maximum sound power level (LWA) in the range of 115 to 120 dB (IEC 61400-11; IEC 2012). A recent compilation (Tougaard et al. 2020) 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 to near ambient sound levels within approximately 0.62 mile (1 kilometer) from the source), and the combined noise levels from multiple turbines is lower or comparable to that generated by a small cargo ship. Tougaard et al. (2020) developed a formula predicting a 13.6 dB increase for every tenfold increase in WTG power rating. This means that operational noise could be expected to increase by 13.6 dB when increasing in size from a 0.5 MW turbine to a 5 MW one, or from 1 MW to 10 MW. The least squares fit of that dataset would predict that the SPL measured feet 328 feet (100 meters) from a hypothetical 15 MW turbine in operation in 10 m/s (19 knots or 22 mph) wind would be 125 dB re 1 µPa. However, all of the 46 data points in that dataset, with the exception of the two from BIWF, were from WTGs operated with gear boxes of various designs rather than the newer use of direct drive technology, which is expected to lower underwater noise levels significantly. Stöber and Thomsen (2021) make predictions for source levels of 10 MW turbines based on a linear extrapolation of maximum received levels from WTGs with ratings up to 6.15 MW. The linear fit is likely inappropriate, and the resulting predictions may be exaggerated. Tougaard et al. (2020) point out that received level differences among different pile types could be confounded by differences in water depth and turbine size. A recent study (Bellmann et al. 2023) measured 27 operational turbines with nominal power ranging from 2.3–8.4 MW and observed that, on average, larger turbines (>5 MW) produced lower (119 dB) underwater noise levels compared to smaller turbines (≤5 MW at 122.5 dB). This trend may be attributed to the shift from gearbox to direct drive systems, as well as the increasing size and weight of the rotor drive system and foundation structures, which could reduce the emitted vibrations due to the turbines larger masses and more efficient, low-maintenance systems. Another 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). In any case, additional data is needed to fully understand the effects of size, foundation type properties (e.g., structural rigidity and strength), and drive type on the amount of sound produced during turbine operation.

Based on current available data and the estimated ranges to marine mammal acoustic thresholds for these predicted source levels, 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. Masking of the low-frequency calls emitted from LFCs and phocid pinnipeds in-water would be more likely to occur. Mid-frequency cetaceans, such as dolphins, may experience partial masking as they vocalize in low to mid-frequencies. However, these species are also known to shift vocalization frequencies to adapt to natural and anthropogenic conditions (David 2006; Quintana-Rizzo et al. 2006). Overall, it is expected that these effects would be highly localized and would reach ambient underwater noise levels within relatively short distances of the foundations (Miller and Potty 2017; Tougaard et al. 2009b, 2020).

As the Project area is near Nantucket Shoals, noise exposure from WTG operations may affect migratory and foraging behavior in marine mammals in this area. Timing of migrations includes a northward migration during March and April and a southward migration during November to December between summer feeding and winter calving grounds. During this migration period, adults may be accompanied by calves and periodically feed and rest along their migration route. Behavioral disturbance from WTG operations is not expected to impede the migration of NARWs as animals would be able to travel beyond the disturbance area around the Lease Area and the amount of deflection from the migratory path is anticipated to be minimal. Decreased foraging efficiency, especially if individuals move away from Nantucket Shoals, could have short-term impacts on foraging of some animals during noise exposure. However, these effects would be short term, and animals would be expected to resume normal foraging behavior once pile driving stops or the animal moves beyond the Level B disturbance distance. No long-term adverse impacts are expected from temporary disruption of behavior.

Operational noise effects are likely to be of low intensity and highly localized and are anticipated to attenuate to ambient levels within a close range of each foundation (Kraus et al. 2016; Thomsen et al. 2015; Bellmann et al. 2023). While individual marine mammals may be exposed to underwater noise from WTG operations sufficient to cause masking and behavioral effects, those effects are unlikely to result in longer-term consequences to individuals or populations. Based on the low source levels and rapid attenuation of WTG noise, injury and associated behavioral effects are expected to be too small to be meaningfully measured; therefore, impacts of WTG operational noise to mysticetes (including NARW), odontocetes, and pinnipeds are anticipated to be minor.

Noise - UXO detonation: SouthCoast Wind may encounter UXOs on the seabed in the Offshore Project area. The Falmouth ECC does not overlap any UXOs or former defense sites, while Brayton Point ECC intersects one formerly used defense site.[8] The Lease Area does not coincide with any UXOs and the nearest UXO site is 10 miles (16 kilometers) west of the Massachusetts and Rhode Island lease areas

[8] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

(COP Volume 2, Section 14.1.1; SouthCoast Wind 2024). A desktop study by SouthCoast Wind of UXOs in the Offshore Project area concluded that there is a varying low to moderate risk from encountering UXOs on site. The risk is moderate throughout all of the Lease Area, and a relatively equal ratio between low and moderate within the ECCs (COP Appendix E.7; SouthCoast Wind 2024). The exact number and type of UXOs in the Project area are not yet known. As a conservative approach, it is currently assumed that up to five UXOs in the Lease Area and up to five along the ECCs may have to be detonated in place. Several alternative strategies would first be considered prior to detonating a UXO in place. These may include relocating the activity away from the UXO (avoidance), moving the UXO away from the activity (lift and shift), cutting the UXO open to apportion large ammunition or deactivate fused munitions, using shaped charges to reduce the net explosive yield of a UXO (low-order detonation), or using shaped charges to ignite the explosive materials and allow them to burn at a slow rate rather than detonate instantaneously (deflagration). If such alternatives are not possible, UXOs may need to be removed by controlled explosive detonation.

Underwater explosions from UXO detonations generate high pressure levels that could cause disturbance and injury to marine mammals. The physical range at which injury or mortality could occur would vary based on the amount of explosive material in the UXO, size of the animal, and the location of the animal relative to the explosive. Injuries may include physical (non-auditory) injury such as hemorrhages or damage to the lungs, liver, brain, or ears, as well as auditory impairment such as PTS and TTS (Ketten 2004). Smaller animals are generally at a higher risk of blast injuries. The behavioral response of marine mammals to UXO detonations is relatively unknown. For marine mammals that are at a distance but within hearing range of the blast, behaviors could include a short startle response, temporarily displacing LFCs that are migrating or foraging. The response would likely be brief, and the animal would be expected to resume pre-detonation activities.

Modeling of acoustic fields generated by UXO detonations was undertaken by JASCO Applied Sciences using a combination of semi-empirical and physics-based computational models (Hannay and Zykov 2022). The acoustic assessments were subsequently updated in 2024 (Frankel et al. 2024 in LGL 2024b) based on the revised NMFS acoustic technical guidance document (NMFS 2024f), applying the new criteria to produce revised exposure ranges, exposure estimates, and monitoring zones for UXO detonation. Sound propagation away from detonations is affected by acoustic reflections from the sea surface and seabed. Water depth and seabed properties will influence the sound exposure levels and sound pressure levels at distance from detonations. Their influence is complex but can be predicted accurately by acoustic models. Such modeling was conducted at representative sites in the Lease Area and ECC of the SouthCoast Wind Project area. The modeling was carried out in decidecade frequency bands using the marine operation noise model (Marine Operations Noise Model, JASCO Applied Sciences). The propagation modeling was performed using a sound speed profile representative of September, which is slightly downward refracting and, therefore, conservative and also represents the most likely time of year for UXO removal activities.

Potential impacts on marine mammals from underwater explosions were assessed using separate criteria for mortality, non-auditory injury, gastrointestinal injury, auditory injury, and behavioral responses. The largest ranges to the thresholds for the Lease Area and ECC sites were selected for each

UXO size class and marine mammal size class or hearing group. Since the size and type of UXOs that may be detonated are currently unknown, all area calculations were made using the largest charge weight being 1,000 pounds (454 kilograms) (category E12) defined by the U.S. Navy (Table 3.5.6-16).

Table 3.5.6-16. Navy "bins" and corresponding maximum charge weights (equivalent TNT) modeled

Navy Bin Designation	Maximum Equivalent Weight (TNT) in Kilograms	Maximum Equivalent Weight (TNT) in Pounds
E4	2.3	5
E6	9.1	20
E8	45.5	100
E10	227.0	500
E12	454.0	1000

TNT = trinitrotoluene
Source: LGL 2024a: Table 44.

SouthCoast Wind is committed to using a NAS capable of, at minimum, 10 dB attenuation during any UXO detonations, thus, a 10 dB attenuation has been assumed in the estimated distances to thresholds. Since the mitigation and monitoring measures described in Appendix G, *Mitigation and Monitoring,* and discussed below are designed to avoid mortality or non-auditory injuries as well as potential auditory injury for most species, only the auditory injury (PTS) threshold distances are used for the calculation of potential Level A takes. TTS onset serves as the Level B take threshold if only one detonation occurs per day. As was done for the Level A PTS threshold, the largest modeled ranges to the TTS onset threshold assuming 10 dB of attenuation from use of a NAS for each UXO size class was selected from modeling results summarized in Table 3.5.6-17.

The largest modeled distance resulting from a 1,000 pounds (454 kilograms) (E12) UXO charge weight would primarily affect VHFCs. In the Lease Area, PTS onset/auditory injury could occur within 5.86 miles (9.43 kilometers), while TTS/behavioral disturbance could occur within 17.77 miles (28.6 kilometers). When compared to non-auditory injuries, the largest modeled distances to mortality (0.04 mile [64 meters] for porpoises), non-auditory lung injury (0.3 mile [487 meters] for porpoises), and gastrointestinal injury thresholds (0.08 mile [125 meters]) (LGL 2024a: Tables 47–49) were smaller than the distances exceeding auditory injury thresholds (Table 3.5.6-17).

Since detonations would likely occur within a relatively short period of time (e.g., 1 month), using the annual average densities calculated for HRG surveys may underestimate the actual densities of some species during the month that detonations take place. Instead, for the UXO acoustic propagation models, the highest average monthly density for each species from within 9.3 miles (15 kilometers) of the ECCs and Lease Area was used in the estimates of potential exposures. In addition, due to the increased ranges of the TTS thresholds that resulted from the NMFS updated acoustic technical guidance (NMFS 2024f), the month of May during Year 2 is excluded from any UXO detonation activity as an additional mitigation measure. This is aimed at reducing Level B take of NARW, which is higher during Year 2 because of the use of vibratory hammering for foundation installation. Thus, the exposure estimates used the maximum density month during May–November for Year 1 and the maximum density month during June–November for Year 2 (LGL 2024b: Tables 42 and 43).

To calculate the potential exposure from UXO detonations in the Lease Area and ECC, the maximum areas to Level A and Level B thresholds from a single detonation in the Lease Area and the ECC summarized in Table 3.5.6-17 were then multiplied by three (for Year 1) and two (for Year 2) and then multiplied by the estimated marine mammal densities (LGL 2024b: Tables 42 and 43). The division of five total detonations across the 2 years was based on the relative number of foundations to be installed in each year. Based on the calculations, the largest potential Level A exposure from UXO detonations with 10 dB attenuation is 77 harbor porpoises, and similarly, the largest potential Level B exposure is 806 harbor porpoises, both occurring during Year 1 (Table 3.5.6-18).

Table 3.5.6-17. Range (km) to Level A and Level B exposure SEL PTS-onset and SEL TTS-onset thresholds in the Lease Area and ECC for marine mammals hearing groups for five UXO charge sizes assuming 10 dB of noise attenuation, and the maximum area exposed above this threshold

Range per UXO Charge Size	LFC SEL Threshold: Level A - 183 dB re 1 μPa²s Level B - 168 dB re 1 μPa²s				HFC SEL Threshold: Level A - 193 dB re 1 μPa²s Level B - 178 dB re 1 μPa²s				VHFC SEL Threshold: Level A - 159 dB re 1 μPa²s Level B - 144 dB re 1 μPa²s				PPW SEL Threshold Level A - 183 dB re 1 μPa²s Level B - 168 dB re 1 μPa²s			
	Lease Area		ECC		Lease Area		ECC		Lease Area		ECC		Lease Area		ECC	
	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B
E4 R95% Distance (km)	0.35	3.1	0.74	4.2	NC [a]	0.189	NC [a]	0.569	2.08	9.15	2.39	7.79	0.128	2.06	0.424	3.12
E6 R95% Distance (km)	0.823	5.48	1.46	6.12	NC [a]	0.577	0.108	1.07	3.23	13	3.34	15.2	0.322	3.76	0.753	4.52
E8 R95% Distance (km)	1.84	10.2	2.84	8.52	0.072	1.35	0.234	1.98	5.13	18.7	4.77	13.8	0.849	7.1	1.51	6.78
E10 R95% Distance (km)	3.44	17.1	4.11	12.5	0.156	2.52	0.471	3.29	7.88	25	6.74	17.5	1.83	12.1	2.82	9.22
E12 R95% Distance (km)	4.68	23	4.68	14.7	0.256	3.29	0.609	3.98	9.43	28.6	7.88	19.2	2.46	15	3.41	10.9
Single Detonation Maximum Area (km^2)	68.8	1661.9	68.8	678.9	0.2	34.0	1.2	49.8	279.4	2569.7	195.1	1158.1	19.0	706.9	36.5	373.3

[a] NC indicates that the range could not be estimated due to being outside the modeling bounds
dB = decibels; ECC = export cable corridor; km = kilometer; km2 = square kilometer; HFC = high frequency cetaceans; LFC = low frequency cetaceans; VHFC = very high-frequency cetaceans; PPW = phocid pinniped (in-water); PTS = permanent threshold shift; TTS = temporary threshold shift; SEL = frequency-weighted sound exposure level
Source: Frankel et al. 2024 in LGL 2024b: Tables 15–24.

Table 3.5.6-18. Estimated Level A and Level B exposures (# of individuals) from potential UXO detonations for construction Years 1 and 2 assuming 10 dB of attenuation

Species	Year 1				Year 2				Mean Group Size	Year 1 Exposures		Year 2 Exposures	
	Lease Area		ECC		Lease Area		ECC						
	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B		Level A	Level B	Level A	Level B
Mysticetes													
Blue whale [a]	0.002	0.05	0.002	0.02	0.001	0.03	0.001	0.02	1.0	1	1	1	1
Fin whale [a]	0.86	19.35	0.27	9.57	0.57	12.90	0.14	6.38	1.8	2	29	1	20
Humpback whale	0.64	14.29	0.26	7.07	0.42	9.53	0.15	4.71	2.0	1	22	1	15
Minke whale	3.21	72.07	2.21	35.65	2.14	48.05	0.95	23.77	1.4	6	108	4	72
NARW [a]	0.68	15.30	0.46	7.57	0.13	2.94	0.13	1.45	2.4	2	23	1	5
Sei whale [a]	0.36	7.98	0.15	3.95	0.11	2.41	0.07	1.19	1.6	1	12	1	4
Odontocetes													
Atlantic spotted dolphin	0.004	0.69	0.001	1.01	0.003	0.46	0.000	0.67	29.0	1	29	1	29
Atlantic white-sided dolphin	0.02	3.88	0.04	5.68	0.02	2.59	0.02	3.79	27.9	1	28	1	28
Bottlenose dolphin	0.01	2.04	0.02	2.99	0.01	1.36	0.01	1.99	12.3	1	13	1	13
Common dolphin	0.21	34.01	0.12	49.77	0.14	22.67	0.08	33.18	34.9	1	104	1	104
Harbor porpoise	60.34	555.02	16.61	250.14	12.23	112.53	4.05	50.71	2.7	77	806	17	164
Pilot whales	0.002	0.30	0.001	0.44	0.001	0.20	0.000	0.29	10.3	1	11	1	11
Risso's dolphin	0.002	0.36	0.001	0.53	0.001	0.24	0.001	0.35	5.4	1	6	1	6
Sperm whale [a]	0.001	0.17	0.001	0.25	0.001	0.11	0.001	0.17	2.0	1	2	1	2
Pinnipeds													
Gray seal	8.67	322.41	35.12	170.244	2.85	106.00	21.68	55.97	1.4	44	493	25	162
Harbor seal	0.56	20.94	2.28	11.06	0.19	6.88	1.41	3.63	1.4	3	32	2	11

[a] Denotes ESA-listed species.
dB = decibel; ECC = export cable corridor; LA = Lease Area; UXO = unexploded ordnance
Source: LGL 2024b: Table 54.

Should UXOs be encountered in the Project area, non-explosive methods would first be employed to lift and move these UXOs. Only after these alternatives are considered would a decision to detonate the UXO in place be made and no more than a single UXO would be detonated in a 24-hour period. For detonations that cannot be avoided due to safety considerations, a number of mitigation measures will be implemented to reduce the potential for auditory and non-auditory injuries (Appendix G, *Mitigation and Monitoring*). These measures include active visual and acoustic monitoring by PSOs to establish UXO detonation clearance zones shown in Table 3.5.6-19. The pre-start clearance zone size would be dependent on the charge weight of the identified UXO, which would be determined prior to detonation. If the charge weight is determined to be unknown or uncertain, the largest pre-start clearance zone size (charge weight bin E12) would be used throughout the pre-start clearance period.

Table 3.5.6-19. Mitigation and monitoring zones (meters) with In-Situ UXO Detonation of the largest charge weight (E12),[a] with a 10 dB NAS

Hearing Group	Pre-start Clearance Zone [b] (m)	Level B Harassment Zone (m)	PAM Monitoring Zone (km)
Lease Area			
LFC	4,500	20,900	15
HFC	400	3,300	15
VHFC	9,500	28,600	15
PPW	2,500	15,000	15
Export Cable Corridor			
LFC	4,900	14,700	15
HFC	700	4,000	15
VHFC	7,900	19,200	15
PPW	3,500	10,900	15

dB = decibels; NAS = noise abatement system; LFC = low frequency cetacean group; HFC = high-frequency cetacean group; PPW = pinnipeds in water; VHFC = very high-frequency cetaceans; km = kilometers; m = meters

[a] For monitoring zones for charge weights E4 (2.3 kg) to E10 (2.27 kg), please refer to Table 59 of the MMPA ITA (LGL 2024a)

[b] Pre-start clearance zones were calculated by selecting the largest Level A threshold (the larger of either the PK or SEL noise metric). The chosen values were the most conservative per charge weight bin across each of the four modeled sites.

Source: LGL 2024b: Table 59.

A 60-minute pre-start clearance zone would be established prior to detonation. A PAM operator would begin acoustic monitoring 60 minutes prior to detonation. The pre-start clearance zone must be fully visible for 60 minutes and all marine mammals must be confirmed to be out of the pre-start clearance zone for at least 30 minutes before detonation may commence. Sound source verification would allow for adaptive monitoring and the adjustment of clearance zones as needed based on reported measurements. Post-detonation monitoring would occur for 30 minutes. Only one detonation would occur in a 24-hour period and planned UXO detonations would not be conducted during nighttime hours. Further, as an additional measure to minimize impacts on NARWs, planned detonations are prohibited between January and May when NARW density is at its highest.

The injury zones surrounding explosive detonations are of key importance for developing mitigation designed to minimize takes. As the pre-clearance zones were calculated by selecting the largest Level A threshold (the larger of either the PK or SEL noise metric), the potential for auditory and non-auditory injuries would be greatly reduced. Along with the low number of potential UXOs (conservatively up to 10) identified in the Project area and the implementation of mitigation and monitoring measures, potential Level A harassment associated with UXO detonations would be considered extremely unlikely to occur. As the behavioral zones are larger than the PTS zones, behavioral disturbance (Level B) could occur. However, Level B harassment would also be greatly reduced by the mitigation measures outlined previously and would only occur at the level of the individual animal and are not expected to have population-level effects. Therefore, impacts on mysticetes (including NARW), odontocetes, and pinnipeds from UXO detonations under the Proposed Action are expected to be minor with no expected impacts on marine mammal stocks or populations.

Noise - vessels: The Proposed Action includes the use of vessels during construction, O&M, and decommissioning, as described in Section 3.5.6.3, *Impacts of the Alternative A – No Action on Marine Mammals*. Based on the vessel traffic generated by the proposed Project, a daily average of 15–35 vessels depending on construction activities with a maximum peak of 50 vessels could be present in the Lease Area at one time during the construction phase. Vessels generate low-frequency (10 to 100 Hz) (MMS 2007), continuous noise that could affect aquatic species. There are several types of vessels that would be required throughout the life of the Project and are described in COP Volume 1, Section 3.3.14 and Table 3-21 (SouthCoast Wind 2024). Source levels for large vessels range from 177 to 188 dB re 1 µPa SPL_{rms} with frequencies between less than 40 Hz and 100 Hz (McKenna et al. 2012). Smaller support vessels typically produce higher-frequency sound concentrated in the 1,000 Hz to 5,000 Hz range, with source levels ranging from 150 to 180 dB re 1 µPa SPL_{rms} (Kipple 2002; Kipple and Gabriele 2003).

BOEM anticipates that underwater noise generated by larger vessels used for Project activities would overlap 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, LFCs, including fin whales and NARWs, are at the greatest risk of impacts associated with vessel noise. While a review of literature indicates that there is no direct evidence of hearing impairment (either PTS or TTS) occurring in marine mammals as a consequence of exposure to vessel-generated sound, vessel noise could result in a range of behavioral responses (e.g., changes in respiration rates, dive patterns, and swim velocities) and acoustic responses (i.e., alteration of the composition of call types, rate and duration of call production, actual acoustic structure of the calls) (Southall et al. 2021). These responses have, in certain cases, been correlated with numbers of vessels and their proximity, speed, and directional changes. Responses have been shown to vary by gender and by individual.

Vessel activity associated with the Proposed Action is expected to cause repeated, intermittent impacts on marine mammals resulting from short-term, localized behavioral responses. These responses would dissipate once the vessel or individual leaves the area and are expected to be infrequent given the patchy distribution of marine mammals in the Action Area. Any behavioral effects in response to vessel noise are not expected to be biologically significant (U.S. Navy 2018). Therefore, no stock or population-level effects on marine mammal species would be expected.

Mitigation measures such as active visual and acoustic monitoring, vessel separation distances, and vessel speed reduction will also be implemented to reduce the possibility of marine mammals from vessel encounters and vessel noise exposure. Given that peak vessel noise is limited during the construction period and along with mitigation measures to reduce vessel interaction, the potential for exposure of these marine mammal species to noise levels leading to behavioral disturbance or masking would be reduced at the level of the individual animal and would not be expected to have population-level effects. Therefore, potential behavioral impacts on mysticetes (including NARW), odontocetes, and pinnipeds from vessel noise due to the Proposed Action are expected to be short term and minor.

Port utilization: Port expansion is not proposed for SouthCoast Wind, therefore, direct impacts on marine mammals are not expected. Potential impacts from increased vessel traffic are discussed under the *Traffic* IPF.

Presence of structures: The Proposed Action would consist of up to 149 WTG and OSPs in the Lease Area. As described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals,* the presence and operation of these structures over the life of the Project could alter the characteristics of the ocean environment and indirectly affect marine mammals. The various types of impacts on marine mammals that could result from the physical presence of structures and the operation of wind turbines include atmospheric, hydrodynamic, and artificial reef effects that may influence the availability of prey and forage resources, the potential for interaction with active or abandoned fishing gear, and displacement.

As discussed in Section 3.5.6.3, the presence of offshore wind structures could result in avoidance and displacement of marine mammals, which could move marine mammals into areas with lower habitat value or with higher risk of vessel collision or fisheries interactions. However, the installation of 149 WTGs under the Proposed Action would conform to a spacing of a 1.0 nautical mile by 1.0 nautical mile (1.9 kilometer by 1.9 kilometer) between foundations. Based on documented lengths (Wynne and Schwartz 1999), the largest NARW (59 feet [18 meters]), fin whale (79 feet [24 meters]), sei whale (59 feet [18 meters]), and sperm whale (59 feet [18 meters]) would fit end to end between two foundations spaced at 1 nautical mile (1.9 kilometers) 100 times over. This simple assessment of spacing relative to animal size indicates that the physical presence of the monopile foundations is unlikely to pose a barrier to the movement of large marine mammals, and even less likely to impede the movement of smaller marine mammals.

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 interaction with fishing gear, which is a significant threat to some species. Foundations and scour protection could, on the other hand, create an artificial reef effect (Degraer et al. 2020), likely leading to enhanced biological productivity and increased abundance and concentration of fish and invertebrate resources (Raoux et al. 2017;

Bergström et al. 2013; Langhamer 2012; Wilhelmsson et al. 2006). This could alter predator–prey interactions in and around the facility, with uncertain and potentially beneficial or adverse effects on marine mammals. For example, fish predators like seals and porpoises could benefit from increased biological productivity and abundant concentrations of prey generated. This was observed in tagged pinnipeds along the British and Dutch coasts of the North Sea that were found to systematically use the areas around turbine structures to forage (Russell et al. 2014). However, any increase in biomass is anticipated to be small and localized, and it is not expected that reef effect would result in an appreciable increase in the primary prey species of marine mammals such as NARWs, fin whales, or sei whales (NMFS 2021b).

Impacts from Proposed Action structures during operations or as static in-water features on the hydrodynamic patterns in the nearby Nantucket Shoals are an important consideration for marine mammals, especially NARWs, that specialize in prey whose aggregations are entirely driven by hydrodynamics processes. *Calanus*, *Pseudocalanus*, and *Centropages* copepods, which are most abundant in the late fall to early spring, are the primary foraging resource for NARWs. New England waters are an important feeding habitat for NARW after recent shifts in distribution have led to increases in documentation of NARW around Nantucket Shoals and areas east of the Massachusetts WEA (Hayes et al. 2020; Quintana-Rizzo et al. 2021) with foraging primarily occurring between January and April. Zooplankton abundance in the northeast U.S. continental shelf has held at a consistent level over the past 20 years with slight interannual variability (NEFSC 2018) and, more recently, showing increased species diversity of zooplankton with increased krill and gelatinous zooplankton, and periodic shifts between larger copepods such as Calanus finmarchicus and smaller copepods (NEFSC 2022). Aggregations of plankton, which provide a dense food source for NARWs to efficiently feed upon, are concentrated by physical and oceanographic features. Increased mixing from structure-induced turbulent wakes could disperse these plankton aggregations, thereby decreasing efficient foraging opportunities. Water moving around foundations may also form eddies (Chen et al. 2016), which could concentrate aggregations of zooplankton and increase efficient foraging. The exact outcome is currently unknown but would depend heavily on site-specific environmental conditions. For effects to occur, NARW present in this area would have to be foraging on prey that could be affected by changes to oceanographic processes and any changes to those processes would have to be large enough to alter the availability of NARW prey to a biological meaningful extent. In the Southern New England region, only two studies have modeled the hydrodynamic effects of offshore wind development and evaluated the potential impacts on the dispersal and settlement of planktonic larvae (Chen et al. 2021; Johnson et al. 2021a). Both studies found changes in regional larval distribution patterns, which suggests similar impacts may occur with the planktonic prey resources of marine mammals.

The SouthCoast Wind Lease Area is approximately 26 nm (49 kilometers) south of Martha's Vineyard and 20 nm (37 kilometers) south of Nantucket, is oriented in a northeast–southwest direction, and has a gradual deepening from approximately the 40-meter to 60-meter bathymetry contours. Using data collected from SouthCoast Wind's meteorological and oceanographic (metocean) observation buoys deployed in the Lease Area between 2020 and 2022, tidal currents in the area were found to be semidiurnal and rotary in nature with a mean speed of 0.25 m/s. A relatively strong and stable stratification of 10^{o}C also forms in the SouthCoast Wind Lease Area on an annual basis. A tidal mixing front, believed to aggregate patches of zooplankton (Ganju et al. 2011), was predicted to occur on the west side of Nantucket Shoals between the 20-meter and 25-meter depth zones, approximately 10 kilometers from the northeast corner of the Lease Area, based on local bathymetry, tidal current data, and hydrodynamic modeling results which corresponds with previous studies in the area (He and Wilkin 2006; Loder and Greenberg 1986). Southwest winds in warmer months and a rotary tidal current regime in the area of Nantucket Island are other predominant metocean characteristics know to occur in the region (COP Appendix F4; SouthCoast Wind 2024).

While predominant southwest winds are likely to transport impacts to surface waters from the Lease Area toward the northeast and the Nantucket Shoals area, the constantly changing downstream direction and duration of rotary tidal currents may limit the extent of any WTG tower impact on the water column. Observational and modeling data showed that weak stratification with a surface to bottom temperature difference of 0.5°C or less can be strongly affected by WTG impacts, whereas, for stronger stratification with surface to bottom temperature differences of greater than 1.5° C, the impacts are less pronounced and temperature anomalies can be masked by other mixing mechanisms or variability. Greater temperature differences in a strongly stratified water column also decreases the range of influence of WTG impacts downstream. With stratified summer conditions off the coast of southern New England, including Nantucket Shoals, building to greater than 10°C, SouthCoast Wind WTGs are unlikely to break down the thermocline within or downstream of the Lease Area (COP Appendix F4; SouthCoast Wind 2024).

Project-specific wind turbine hub heights (128 meters and 184 meters) and rotor diameters (220 meters and 280 meters) were used to analyze the potential downwind WTG wake effect in the SouthCoast Wind Lease Area. For both WTG sizes modeled, it was found that wind speed deficits were greatest at hub height just behind the WTG after which the wake spreads and diffuses downwind. The width of the wind speed deficit wake stayed within approximately 400 meters of either side of the turbine at both sizes modeled. At the sea surface, the smaller wind turbine had a greater wind speed deficit closest to the WTG of approximate 15 percent compared to 10 percent for the larger turbine. Sea surface wind speed deficits drop to 5% at approximately 6,060 m downwind of the WTG for the smaller wind turbine and at 7,100 meters for the larger wind turbine. These sea surface wind speed deficits correspond with the results of Golbazi et al. (2022) who also found that the wake edge roughly corresponded to the 0.5 m/s deficit for model scenarios of wind farm in the mid-Atlantic Bight. Based on average wind speeds in area, a sea surface wind speed deficit of less than 0.5 m/s would be well within the observed wind speed variability recorded by the SouthCoast Wind's metocean buoys (0.94 m/s). With the low impact of the SouthCoast Wind WTGs on sea surface wind speed, resulting impacts to water column mixing are likely to be within local variability, difficult to detect, and difficult to distinguish from natural variability (COP Appendix F4; SouthCoast Wind 2024).

Laboratory experiments by Miles et al. (2017) demonstrated that the downstream wake generated by the submerged portion of a WTG (pile) extends approximately 11 times the diameter of the pile after which the current speed profile will have recovered. Given the 16-meter diameter monopiles slated for use in the SouthCoast Wind project, the downstream wake generated would extend 176 meters from the WTG. Dorrell et al. (2022) also suggested that the downstream wake may extend up to 50 diameters from a pile, which would be equivalent to 800 meters from a SouthCoast Wind monopile. In either case, the estimated downstream wake would be a fraction of the distance between one monopile to another given the 1 nm (1,852 meters) WTG spacing. Based on this information, cumulative current speed deficit or turbulence impacts from WTG piles were determined to be unlikely to occur (COP Appendix F4; SouthCoast Wind 2024).

The long-term adverse effects from the increased presence of structures on marine mammals and their habitats would likely vary by species. For most species, while the effects could cause localized changes to prey distribution, the presence of structures is not anticipated to cause a significant change in prey availability. For NARW, adverse effects may be greater because their population size is so small that the loss of an individual could have a population-level effect. The impacts of changes on oceanographic conditions caused by the presence of offshore structures on marine mammal prey species and, therefore, marine mammals are difficult to discern and likely to vary seasonally and regionally. While broadscale hydrodynamic impacts could alter zooplankton distribution and abundance (van Berkel et al. 2020), there is considerable uncertainty as to the magnitude and extent of these changes, especially when coupled with broader ecological changes such as climate change. Available empirical evidence of offshore wind farm induced hydrodynamic impacts are from studies on European wind facilities in oceanographic conditions (e.g., stratification, water depth) that differ from the U.S. Atlantic OCS (Hogan et al. 2023). As such, more region-specific research would be necessary to better understand the hydrodynamic impacts on marine mammals and their prey.

A recent report by NASEM (2024) evaluated the potential of offshore wind farms to alter the hydrodynamic processes that affect prey abundance and availability in the Nantucket Shoals region. The report highlighted the dramatic effects of climate change already observed over Nantucket Shoals and the surrounding region. The study concluded that impacts of offshore wind projects on NARW and the availability of their prey will likely be difficult to distinguish from the significant impacts of climate change and other influences on the ecosystem, and suggested the need for further research and monitoring to better understand the regional effects offshore wind development may have on oceanography and ecology. Further monitoring studies would be needed to have the spatial and temporal coverage to adequately understand the impact of future wind farms and BOEM would continue to coordinate with partners to develop regional monitoring strategies to obtain scientific information on the potential hydrodynamic effects of WTGs.

In summary, long-term impacts resulting from presence of structures under the Proposed Action could result in both minor beneficial and minor adverse effects on mysticetes (including NARW), odontocetes, and pinnipeds. Adverse effects due to disruption in hydrodynamics from the Proposed Action could result in minor impacts on mysticetes (including NARW) that forage on plankton and forage fish. Structures associated with the Project would be expected to provide some level of reef effect and may result in long-term, minor beneficial impacts on pinniped and small odontocete foraging and sheltering. However, these beneficial impacts could be offset and result in long-term, minor, adverse impacts due to increased interaction with active or abandoned fishing gear.

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, *Impacts of Alternative A – No Action on Marine Mammals,* vessel strikes are a significant concern for marine mammals and could result in injury or death. Vessel collision risk is expected to be highest during construction when traffic volumes would be greatest and when vessels are transiting to and from the Lease Area. During construction, vessels actively engaged in construction (i.e., jack-up vessels) are expected to be largely stationary and would travel at slow speeds when transiting between locations in the Lease Area. SouthCoast Wind expects a daily average of 15–35 vessels (with a maximum peak of 50 vessels) to be used during construction and installation of the Project, with an average projection of 1 to 15 trips daily over the entire Project lifetime. During O&M, SouthCoast Wind generally expects one to three vessels to operate at a given time. While the increase in traffic associated with the Proposed Action would only be a small incremental increase in overall traffic in the geographic analysis area, SouthCoast Wind has committed to a range of mitigation measures (Appendix G, Table G-1) to avoid vessel collisions with marine mammals, especially in the Project area. Specific mitigation measures pertaining to vessel traffic include maintaining separation distances for marine mammals; reporting as part of the Mandatory Ship Reporting System for NARWs; checking for active Dynamic Management Areas or Slow Zones daily; reporting NARW sightings to the North Atlantic Right Whale Sighting Advisory System; implementing crew member training on vessel strike avoidance measures; and using a dedicated trained visual observer or NMFS-approved PSO on duty at all times to monitor for marine mammals. Visual observers must be equipped with alternative monitoring technology during periods of low visibility (e.g., darkness, rain, and fog). Observers would monitor the NMFS NARW reporting system from November 1–April 30 and whenever a dynamic management area (DMA) is established in the operational area. The Project-specific Letter of Authorization would also include mitigation measures to minimize vessel strike risk for marine mammals. The measures proposed for the Letter of Authorization include minimum separation distances and a 10-knot vessel speed restriction. All vessels, regardless of size, would be required to comply with NMFS regulations and speed restrictions (≤10 knots) in NARW management areas including seasonal management areas (SMA) and active DMAs during migratory and calving periods from November 1–April 30. All vessels would reduce speed to ≤10 knots when mother/calf pairs, pods, or large assemblages of marine mammals are observed. A PAM system would be developed consisting of near real-time monitoring such that NARW or other large whale calls made in or near the transit corridor can be detected and transmitted to the transiting vessel. The detections would be used to determine areas along the transit corridor where vessels would be allowed to travel at > 10 knots when no other speed restrictions are in place (e.g., 10-knot speed restriction in SMAs and DMAs). Separation distances would be required between the vessel and sighted NARWs or unidentified large marine mammals, including the actions taken by the vessel when a marine mammal is in the vicinity. These actions include active avoidance of spotted NARWs at 10 knots or less, shifting engines to neutral in the event a NARW approaches the vessel, and reporting protocols for dead and/or injured marine mammals.

Vessel strikes are not anticipated when mitigation measures are effectively implemented; thus, the potential for vessel strikes to marine mammals is extremely unlikely. Given the small incremental increase in vessel traffic compared to existing traffic, along with the implementation of mitigation measures designed to minimize the risk of vessel strikes, the increased collision risk to pinnipeds, odontocetes, and mysticetes (including NARWs) associated with the incremental increase in vessel traffic would not be expected to have measurable impacts on marine mammal species and is, therefore, considered negligible.

Conceptual decommissioning: An approved decommissioning plan would dictate the removal of Project components and is planned to essentially reverse the construction and installation process, with the exception of the utility-owned POIs and transmission lines as these components would be integrated into the regional transmission system. The decommission plan (as described in detail in COP Volume 2, Section 3.3; SouthCoast Wind 2024) comprises the following steps.

- Dismantle and remove WTGs.
- Cut and remove foundations. Mayflower Wind will assess the removal of scour protection depending on which strategy minimizes environmental impacts.
- Remove OSPs.
- Retire in place or remove offshore cable system including offshore export and interarray cables.
- Retire in place or remove onshore export cables, in coordination with the Massachusetts Energy Facilities Siting Board and Rhode Island Energy Facilities Siting Board.

Similar vessels are anticipated to be used for decommissioning as would be used for construction and installation, and it is anticipated that vessel numbers and types and frequency of transits would be similar or less than those required to support construction of the Project. As the decommissioning phase of the Project is anticipated to be around 35 years after construction is completed, there may be significant technology advancements, which would be taken into account when creating the Project decommissioning plan. Unless otherwise authorized by BOEM, SouthCoast Wind would conduct a site clearance survey after decommissioning is complete to ensure that all Project components are removed, and that no unauthorized debris remains on the seabed. Details of the site clearance survey would be provided in the decommissioning plan. Reusing or recycling the Project components for scrap metal or other materials would be the preferred method of disposal. Generally, decommissioning activities would have similar environmental impacts on construction and installation.

Impacts of Alternative B on ESA-Listed Species

Impacts of Alternative B on ESA-listed species would be the same as the IPFs discussed previously. The ESA-listed species common in the area are NARW (peak abundance in late fall through spring), fin whale (late spring through summer) and sei whale (peak abundance spring through summer). The blue whale and sperm whale are rare and uncommon respectively in the Offshore Project area. The three common ESA-listed whales are also the most susceptible to vessel collisions in the region, and it is known that high traffic areas alter marine mammal distribution and behavior (COP Volume 2, Section 6.8.2.2, Table 6-67; SouthCoast Wind 2024).

BOEM is in the process of assessing the impacts of the Proposed Action on ESA-listed marine mammals and marine mammal critical habitat. Based on this preliminary assessment, BOEM determined that the

Proposed Action likely would not adversely affect blue whale, sperm whale, or West Indian manatee given that their rarity means effects on these species would be extremely unlikely to occur. Fin whales, sei whales, and NARWs, on the other hand, are likely to occur in the Project area and would be subject to effects associated with the Proposed Action, including effects of noise, vessel traffic, habitat disturbance/modifications, repair and maintenance activities, and unexpected/unanticipated events and other effects. Noise associated with the Proposed Action has the potential to result in injury or behavioral effects in these species. While mitigation measures reduce the risk of auditory injury to discountable levels for baleen whales (and sperm whales had no exposures), exposure to noise from pile driving exceeding behavioral thresholds may occur and cause adverse effects. All other sources of noise leading to PTS or behavioral disturbance (G&G surveys, cable laying, dredging, UXO detonation) were found to be discountable, insignificant, or have no effect on fin whales, sei whales, NARWs, or sperm whales. Project vessel traffic could increase vessel strike risk for ESA-listed marine mammals; however, vessel strikes would be unlikely to occur given the measures in place to avoid or minimize vessel strikes, including speed restrictions, minimum separation distances, and vessel strike avoidance procedures. BOEM also concluded that vessel transits through NARW critical habitat would not affect any essential physical and biological features and that vessels transiting along the Atlantic coast between North Carolina and Florida could use routes offshore of the designated critical habitat. Therefore, the Proposed Action is expected to have no effect on designated critical habitat for NARW. Habitat disturbance or modification could result in increased entanglement risk in recreational fishing gear, turbidity effects, species avoidance or displacement, behavioral disruption, or EMF effects. However, such effects are expected to be insignificant or discountable as they would be short-term, localized, and unlikely to occur, or would not be measurable or measurably change risk. Other effects (i.e., shifts or displacement of other ocean users) could result in displacement of fishing activity outside the Lease Area and may result in increased entanglement risk for ESA-listed marine mammals if shifts to fixed gear from mobile gear were to occur. However, such a gear shift is not expected, and effects of displacement would be insignificant.

Cumulative Impacts of the 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 and offshore wind activities. Planned non-offshore wind activities in the geographic analysis area that contribute to impacts on marine mammals include tidal energy projects, oil and gas activities, dredging and port improvement, marine minerals extraction, military use (i.e., sonar), marine transportation, and NMFS research initiatives.

The contribution of the Proposed Action to impacts of vessel traffic and accidental releases from ongoing and planned activities on marine mammals would likely be negligible given the large volume of vessel traffic in the geographic analysis area. BOEM assumes all vessels would comply with laws and regulations to properly dispose of marine debris and minimize releases of fuels/fluids/hazardous materials. Additionally, large-scale releases are unlikely, and impacts from small-scale releases would be localized and short term.

Planned offshore wind activities would generate comparable types of noise impacts to those of the Proposed Action. The most significant sources of noise are expected to be pile driving followed by vessels. The 149 structures for the Proposed Action represent only 5 percent of the 3,094 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms, including the Proposed Action, although some foundations from other wind farms may be installed without pile driving. Project vessels would represent only a small fraction of the large volume of existing traffic in the geographic analysis area. On balance, any operational noise effects from the offshore wind activities are likely to be of low intensity and highly localized. In context of reasonably foreseeable environmental trends, the cumulative noise impacts of the Proposed Action with other ongoing and planned activities on marine mammals would be moderate.

Export and interarray cables from the Proposed Action and planned offshore wind development would add an estimated 11,646 miles (18,742 kilometers) of buried cable to the geographic analysis area of which the Proposed Action represents 14 percent. In context of ongoing and planned activities, the cumulative impacts of the Proposed Action in combination with other ongoing and planned activities from cable emplacement would be minor, while the cumulative impacts from EMFs and heat would be negligible, given the small area that would be affected by the projects compared to the remaining area of open ocean in the geographic analysis area.

The 149 structures for the Proposed Action represent only 5 percent of the 3,094 offshore wind structures that would add to the presence of offshore structures and sources of lighting on the OCS from existing and planned offshore wind farms. In context of reasonably foreseeable environmental trends, the Proposed Action would incrementally contribute to cumulative lighting impacts from ongoing and planned activities, which would be negligible as offshore lighting is anticipated to have minimal effect on marine mammals. The cumulative impacts from the presence of structures from other offshore wind activities would likely be minor, mostly associated with the increased potential for fishing gear entanglement, with some minor beneficial effects from the potential for increased prey aggregation around the structures.

Conclusions

Direct and Indirect Impacts of Alternative B – Proposed Action. The direct and indirect impacts of Alternative B when compared to the No Action Alternative are summarized here. The analysis considered direct and indirect impacts of the Proposed Action as impacts occurring because of the Proposed Action alone, without addition of baseline or other ongoing offshore wind and non-offshore wind activities. The direct and indirect impacts of the Proposed Action when compared to the No Action Alternative would range from negligible to moderate across individual IPFs for mysticetes, odontocetes, and pinnipeds. Project construction would result in noise that would disturb marine mammals and potentially result in auditory impacts (i.e., PTS and TTS). With implementation of mitigation and monitoring measures described in Appendix G, *Mitigation and Monitoring*, only a few marine mammals of select species are anticipated to incur PTS incidental to pile driving (e.g., fin whale, humpback whale, minke whale, sei whale, Atlantic white-sided dolphin, Risso's dolphin, harbor porpoise, gray seal, and harbor seal); any TTS and the severity of any behavioral responses would be minimized; and, more severe impacts on marine mammals such as mortality or serious injury from vessel strikes, UXO detonation, and entanglement are not anticipated to occur. The direct and indirect impacts of the Proposed Action when compared to the No Action Alternative would be **moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds. The moderate impact level for marine mammals other than NARW is primarily driven by the potential for auditory impacts, which could be permanent (i.e., PTS). It is expected that mitigation measures would minimize noise exposure such that any PTS of NARWs would be avoided. However, moderate adverse impacts on NARWs could result from the Proposed Action due to the potential exposure of several individuals to temporary behavioral disturbance in potentially important seasonal foraging habitats along with other IPFs such as the presence of structures, as described above. Impacts on individual marine mammals or their habitat are not anticipated to lead to population-level effects.

Direct and Indirect Impacts of Alternative B – Proposed Action with Existing Baseline. 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, *Impacts of Alternative A – No Action on Marine Mammals* (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 adverse**. 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 adverse**. 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.

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. Considering all of the IPFs together, cumulative impacts on marine mammals would range from negligible to moderate and could include **minor beneficial** impacts. BOEM anticipates that the overall impacts from the Proposed Action when combined with ongoing and planned activities would be **moderate adverse** on marine mammals in the geographic analysis area, with the exception of NARW, on which impacts could be **major adverse**. Impacts are magnified in severity for NARW due to low population numbers and the potential to compromise the viability of the species from the loss of a single individual. Although a measurable impact is anticipated, most other marine mammals would likely recover completely when IPF stressors are removed, or remedial or mitigating actions are taken.

3.5.6.6 Impacts of Alternative C and Alternative F on Marine Mammals

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.

Offshore Activities and Facilities

Impacts of Alternatives C and F. Under Alternative C, the Brayton Point offshore export cable would be routed onshore to avoid potential impacts on fisheries, Essential Fish Habitat (EFH), and Habitat Areas of Particular Concern (HAPCs) in the Sakonnet River. Alternatives C-1 and C-2 would reduce the offshore portion of the Brayton Point ECC by 9 miles and 12 miles (14 and 19 kilometers), respectively.

Generally, marine mammal sightings in Narragansett Bay and nearshore Rhode Island are rare, but gray seal, harp seal, hooded seal, NARW, minke whale, dwarf sperm whale, long-finned pilot whale, Risso's dolphin, Atlantic white-side dolphin, bottlenose dolphin, striped dolphin, harbor porpoise, and West Indian manatee have all been observed in the Sakonnet River. Harbor seals are routinely sighted through the fall and spring at several haul out locations around Narragansett Bay. While the presence of most marine mammals in the Sakonnet River is uncommon and habitat use is not largely influenced by complex fisheries habitat, impacts associated with cable installation outside of the river would still occur. Impacts would be similar to those described under the Proposed Action, which include PTS and behavioral disturbance from noise-producing activities such as cable laying, dredging, and UXO detonations. Impacts from vessel interactions and entanglement could also result in mortality, injury, or behavioral disturbance. However, these potential impacts would be avoided or minimized through the implementation of mitigation and monitoring measures similar to those under the Proposed Action. Thus, BOEM anticipates that impacts from Alternative C would be reduced but not meaningfully different from the Proposed Action.

Under Alternative F, to minimize seabed disturbance in the Muskeget Channel, the Falmouth offshore export cable route would use up to three ±525kV HVDC cables connected to one HVDC converter offshore substation platform, instead of up to five HVAC cables connected to one or more HVAC offshore substation platforms as proposed under the Proposed Action. The additional HVDC converter OSP associated with Falmouth would be located in deeper waters in the southern portion of the Lease Area at a further distance from Nantucket Shoals. During operation, there would be increased intake and discharge from the additional HVDC converter offshore substation platform, which could result in increased entrainment of marine mammal prey compared to the Proposed Action. However, impacts would remain localized near the offshore substation platform locations, and the overall impact magnitude would be the same. Impacts from the additional HVDC converter OSP would be similar to the impacts described under the Proposed Action (the Proposed Action also includes the potential for multiple HVDC converter OSPs).

Additionally, the reduction in the number of cables in the Falmouth offshore export cable route from five HVAC cables, under the proposed action, to three HVDC cables under Alternative F would reduce total seafloor disturbance by approximately 700 acres (2.8 square kilometers). Though fewer DC cables would be installed under Alternative F, the amplitude of EMF generated by DC cables can be up to three times greater than that of AC cables (Hutchison et al. 2020). However, AC and DC EMFs differ in the way they interact with organisms and direct comparisons cannot be made (CSA Ocean Sciences, Inc. and Exponent 2019). Measures to reduce EMF into the surrounding area, including cable burial and shielding where sufficient burial is not possible, are expected to reduce the EMF of DC cables to levels where impacts from EMFs are localized to the immediate area of the cable (CSA Ocean Sciences, Inc. and Exponent 2019). Less installation activity from fewer cable emplacements may also reduce impacts on marine mammal activity along the cable corridor, such as minimizing impacts on harbor seal pupping on Muskeget Island. Offshore impacts on marine mammal prey from cable emplacement and anchoring may be reduced under Alternative F due to the lesser number of cables installed. Because impacts associated with cable installation, O&M, and decommissioning would still occur in the same corridor and there would be no change in impacts from other offshore components (e.g., WTGs), the associated impacts on marine mammals under Alternative F would be reduced but not materially different than those described for the Proposed Action.

Cumulative Impacts of Alternatives C and F. In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives C and F would be similar to those described under the Proposed Action.

Impacts of Alternative C and F on ESA-Listed Species

Impacts of Alternatives C and F on ESA-listed species resulting from individual IPFs associated with the construction and installation, O&M, and decommissioning of the Project would be similar to those described under the Proposed Action for all marine mammals.

Conclusions

Direct and Indirect Impacts of Alternatives C and F. The analysis considered the direct and indirect impacts alone as a result of Alternatives C and F, without the addition of baseline or other ongoing offshore wind and non-offshore wind activities. By minimizing impacts on complex habitats and reducing seabed disturbance, BOEM expects small reductions in underwater noise from cable emplacement, vessel traffic, and bottom habitat disturbance affecting marine mammal prey under Alternatives C and F. However, as impacts associated with cable installation and maintenance would still occur in proximity to the cable corridor, impacts under Alternatives C and F would not be sufficiently reduced from the impacts of the Proposed Action to warrant a lower impact determination. Therefore, direct and indirect impacts from construction, O&M, and decommissioning under Alternatives C and F would be **moderate adverse** for mysticetes (including NARW), odontocetes and pinnipeds primarily due to noise exposure. Adverse effects from all other IPFs are expected to be negligible for mysticetes (including NARWs), odontocetes and pinnipeds.

Direct and Indirect Impacts of Alternatives C and F with Existing Baseline. When including the baseline status of marine mammals into the impact findings, BOEM anticipates that impacts of Alternatives C and F would range from negligible to major across individual IPFs for NARW (primarily due to baseline conditions), resulting in an overall determination of **major adverse**, and negligible to moderate across individual IPFs for mysticetes other than NARW, odontocetes, and pinnipeds, resulting in an overall determination of **moderate adverse**.

Cumulative Impacts of Alternatives C and F. In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternatives C and F would be similar to the Proposed Action and result in **moderate adverse** impacts on marine mammals in the geographic analysis area, with the exception of NARW, on which impacts could be **major adverse**. BOEM made this determination because the anticipated impact would be detectable and measurable but would not compromise the 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 strike).

3.5.6.7 Impacts of Alternative D (Preferred Alternative) on Marine Mammals

Onshore Activities and Facilities

Impacts associated with onshore activities and facilities for Alternative D would be identical to the impacts of onshore activities and facilities associated with the Proposed Action.

Offshore Activities and Facilities

Impacts of Alternative D. Alternative D would eliminate six WTGs in the northeastern portion of the Lease Area to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals (Figure 3.5.6-). Nantucket Shoals is relatively shallow (less than 164 feet [50 meters]) and an area of high biological productivity (Townsend et al. 2006). This broad area extends south, southeast, and east of Nantucket and contains complex, dunelike topography, which reflects the strong tidal currents (PCCS 2005). The shoals are known to be consistently colder than surrounding waters, as proven by satellite images of sea surface temperature, and are tidally well mixed (Townsend et al. 2006). A trend of higher near-surface chlorophyll is greater inshore than offshore (refer to Chapter 2, *Alternatives,* Figure 2-7; Townsend et al. 2006). The year-round productivity of Nantucket Shoals is known to attract primarily NARWs, seals, humpback whales, fin whales, and Atlantic white-sided dolphins, which may use the area for congregation, feeding, or passing through (PCCS 2005). The removal of six WTGs in this area may lessen the impacts on marine mammals by providing more area of open ocean nearest to Nantucket Shoals foraging habitat.

Noise: The removal of six WTGs in the northeastern edge of the Lease Area would reduce potential noise disturbance in turbine positions closest to Nantucket Shoals, thus, decreasing associated risks to marine mammals, especially NARW, that are known to use this area. The roughly 4 percent reduction in the number of WTGs for Alternative D would also reduce the overall number of impact or vibratory pile-driving hours required for monopile and piled jacket installation from 588–882 hours to 564–846 hours. Overall, the number of pile-driving hours under Alternative D would be reduced by 24–36 hours compared to the Proposed Action. The specific effects are likely to remain the same for marine mammals including masking, disturbance, TTS, and PTS. However, by limiting the duration of the effect, the number of marine mammals exposed to underwater sound in excess of acoustic thresholds could be reduced. This could be important for species who are sensitive to impact pile-driving activities including the harbor porpoise, or baleen whales and seals, which are low-frequency specialists with known sensitivity to the low frequencies of pile-driving noise. For other marine mammal species that are more commonly observed in deeper waters along the shelf edge and slope (e.g., blue whales), or other species that have larger home ranges (e.g., most species of dolphins listed in Appendix B, *Supplemental Information and Additional Figures and Tables*), this action alternative is unlikely to result in a change to the impact determinations for the Proposed Action.

A reduction of WTGs under Alternative D would result in a reduction in the number of construction vessels or the duration of vessels transiting to the northeastern edge of the Lease Area, which is in proximity to Nantucket Shoals. The magnitude of the effects from Project vessel-related impacts during construction would remain the same, but the extent and duration of the effects would be reduced in areas closest to Nantucket Shoals. Conceptual decommissioning effects would be similar in magnitude but reduced in extent and duration relative to the Proposed Action due to the exclusion of this area and the reduction in number of piles required to be decommissioned.

The reduction in WTGs under Alternative D would additionally result in a reduced behavioral disturbance footprint around each monopile during O&M in portions of the Lease Area that are in proximity to Nantucket Shoals. The specific level of noise generated by the proposed WTGs is not known, but a reduction in the number of WTGs would reduce the underwater noise footprint and limit the extent of the disturbance of marine mammals within the northeastern edge of the Lease Area.

EMFs: Under Alternative D, a reduction in WTGs would result in a reduction of interarray cable, which would limit the footprint of potential EMF exposure, especially for odontocetes and other marine mammals that forage on benthic prey species near the cable. A roughly 4 percent reduction in WTGs under Alternative D would result in approximately 20 miles (32 kilometers) less interarray cable length within the Lease Area.

Presence of structures: The removal of six WTGs near Nantucket Shoals may lessen the operational impacts on marine mammals by providing more area of open ocean nearest to Nantucket Shoals foraging habitat. Conversely, the removal of WTGs may reduce reef and hydrodynamic effects in this area, thereby reducing foraging opportunities for some marine mammal species compared to the Proposed Action. As described in Section 3.5.6.3, *Impacts of Alternative A – No Action on Marine Mammals,* the presence of vertical structures in the water column may influence productivity and the distribution and abundance of invertebrate and fish community structures within and near Project footprints. Pinnipeds and small odontocetes may benefit from the artificial reef effect, but these beneficial effects may be offset by the potential risks associated with gear entanglement from fishing gear. Modeling of the full build-out of the entire southern New England lease areas indicate that only minor, local changes to the physical hydrodynamic features may occur on the western side of Nantucket Shoals adjacent to the Massachusetts and Rhode Island Lease Areas (Johnson et al. 2021a). Other modeling indicates that large scale wind farms may produce detectable changes to atmospheric forces, which in turn, affect surface mixing. However, the influence of these impacts on biological productivity likely would be minor (Daewel et al. 2022) and may not be distinguishable from natural variability

(Christiansen et al. 2022; Floeter et al. 2022). There is a lack of conclusive evidence that removal of WTGs in the northern portion of the Lease Area would measurably lessen impacts on the hydrodynamic features associated with Nantucket Shoals.

Cable emplacement and maintenance: A reduction in WTGs would result in less interarray cable within the Project area footprint and a reduction in area over which the emplacement disturbance and resulting impacts could occur. This would additionally limit the amount of time waters in the Project area experience short-term elevated turbidity, reducing the number of marine mammals exposed to potentially adverse effects.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Impacts of Alternative D on ESA-Listed Species

Impacts of Alternative D on ESA-listed species resulting from individual IPFs associated with the construction and installation, O&M, and decommissioning of the Project would be similar to those described under the Proposed Action for all marine mammals. Restrictions on development and construction activity in the northeast portion of the Lease Area near Nantucket Shoals under Alternative D would reduce impacts on NARW. As stated previously, Nantucket Shoals exhibits high biological productivity. Tidal pumping driven by the tidal dissipation in Nantucket Shoals is the primary driver of high phytoplankton biomass throughout the year in Nantucket Shoals (Saba et al. 2015). The year-round productivity attracts NARWs presumably to feed on zooplankton (Quintana-Rizzo et al. 2021). Nantucket Shoals attracts a relatively high abundance of NARWs and provides high foraging value at different times of the year (Figure 3.5.6-). Although certain impacts may be minimally decreased in duration and geographic extent, the differences between Alternative D and the Proposed Action do not have the potential to significantly reduce or increase impacts on ESA-listed marine mammals from the analyzed IPFs. BOEM does not anticipate impacts to be measurably different from those described under the Proposed Action.

Conclusions

Direct and Indirect Impacts of Alternative D. The impacts of Alternative D alone would not be sufficiently reduced from the impacts of the Proposed Action alone to warrant a lower impact determination. Therefore, the direct and indirect impacts of construction, installation, O&M, and decommissioning of Alternative D would be **moderate adverse** for mysticetes (including NARW), odontocetes, and pinnipeds.

Direct and Indirect Impacts of Alternative D with Existing Baseline. When including the baseline status of marine mammals into the impact findings, BOEM anticipates that impacts of Alternative D would range from negligible to major across individual IPFs for NARW (primarily due to baseline conditions), resulting in an overall determination of **major adverse**, and negligible to moderate across individual IPFs for mysticetes other than NARW, odontocetes, and pinnipeds, resulting in an overall determination of **moderate adverse**, and could include **minor beneficial** impacts on odontocetes and pinnipeds due to the presence of structures.

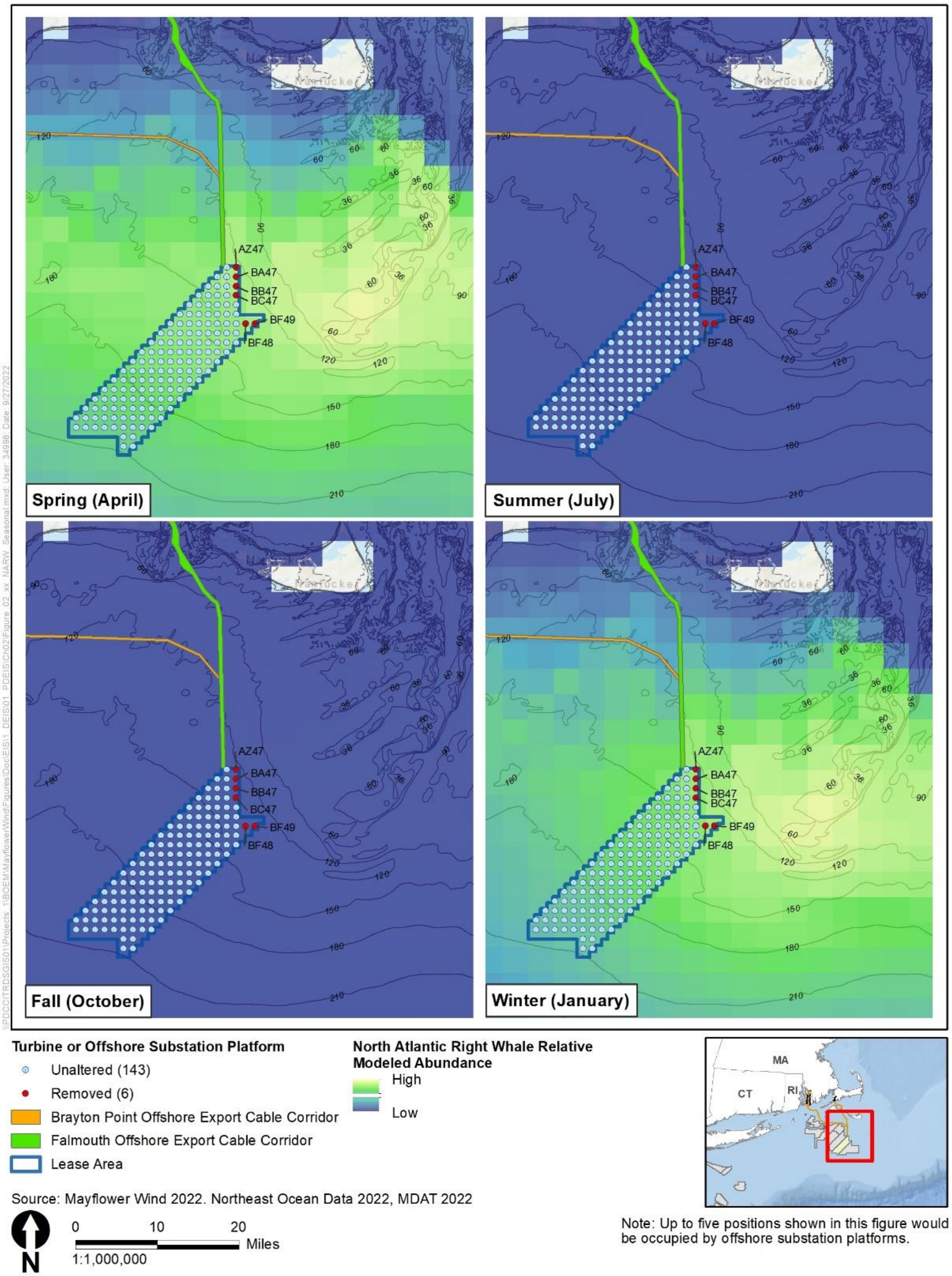


Figure 3.5.6-3. Alternative D and North Atlantic right whale modeled abundance

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative D would be similar to the Proposed Action and range from negligible to moderate and could also include **minor beneficial** impacts. Considering all IPFs together, BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including Alternative D, would result in **moderate adverse** impacts on marine mammals in the geographic analysis area (except for NARW). Although a measurable impact is anticipated, marine mammals would likely recover completely when IPF stressors are removed or remedial or mitigating actions are taken, with the exception of NARWs, on which impacts could be **major adverse**. Impacts are magnified in severity for NARWs due to low population numbers and the potential to compromise the viability of the species from the loss of a single individual.

3.5.6.8 Impacts of Alternative E on Marine Mammals

Onshore Activities and Facilities

Impacts associated with onshore activities and facilities for Alternative E would be identical to the impacts of onshore activities and facilities associated with the Proposed Action.

Offshore Activities and Facilities

Impacts of Alternative E: Alternative E includes the use of all piled (Alternative E-1), all suction bucket (Alternative E-2), or all GBS (Alternative E-3) foundations for WTGs and offshore substation platforms. Installation activities would not differ between the Proposed Action and Alternative E-1, which assumes pile driving would be used for all foundations with corresponding noise impacts. Under Alternatives E-2 and E-3, no pile driving would occur; therefore, there would be no underwater noise impacts on marine mammals due to pile driving. The avoidance of pile-driving noise impacts would reduce overall construction and installation impacts on marine mammals under Alternatives E-2 and E-3 compared to the Proposed Action. Offshore impacts under Alternatives E-1 and E-2 may be reduced compared to Alternative E-3 due to reductions in habitat conversion. Gravity-based foundations, under Alternative E-3, would result in the greatest area of habitat conversion due to foundation footprint and scour protection. Alternative E-1 would result in at least a 77 percent reduction in footprint and scour protection, and Alternative E-2 would result in at least a 58 percent reduction in footprint and scour protection, compared to Alternative E-3. 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 E-1. Given that Alternatives E-1, E-2, and E-3 would result in reductions in both adverse and beneficial impacts, O&M impacts on marine mammals under these alternatives are not expected to be measurably different from those anticipated under the Proposed Action.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative E would be similar to those described under the Proposed Action.

Impacts of Alternative E on ESA-Listed Species

Impacts of Alternative E on ESA-listed species would be the same as the IPFs discussed above.

Conclusions

Direct and Indirect Impacts of Alternative E. Impacts of Alternative E alone would not be sufficiently reduced from the impacts of the Proposed Action alone to warrant a lower impact determination. The installation of all-piled foundations under Alternative E-1 would reduce seabed disturbance that may affect marine mammal prey; however, underwater noise impacts from pile driving would still occur and these impacts would not be measurably different than the impacts of the Proposed Action. Alternatives E-2 and E-3 would use non-piled foundations (suction bucket and GBS, respectively) and would reduce short-term impacts from pile-driving noise. However, these foundation types would increase long-term impacts from larger foundation footprints, consequently, increasing the risks of entanglement, gear interaction, and vessel strike. Therefore, direct and indirect impacts from construction, O&M, and decommissioning under Alternative E would be **moderate adverse** for mysticetes (including NARW), odontocetes and pinnipeds primarily due to the risk of PTS from construction noise (Alternative E-1), entanglement and vessel strike (Alternatives E-2 and E-3). Adverse effects from all other IPFs are expected to be negligible for mysticetes (including NARWs), odontocetes, and pinnipeds.

Direct and Indirect Impacts of Alternative E with Existing Baseline. When including the baseline status of marine mammals into the impact findings, BOEM anticipates that impacts of Alternative E would range from negligible to major across individual IPFs for NARW (primarily due to baseline conditions), resulting in an overall determination of **major adverse**, and negligible moderate across individual IPFs for mysticetes other than NARW, odontocetes, and pinnipeds, resulting in an overall determination of **moderate adverse**, and could include minor beneficial impacts on odontocetes and pinnipeds due to the presence of structures.

Cumulative Impacts of Alternative E. In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative E would result in **moderate adverse** impacts on marine mammals in the geographic analysis area. Although a measurable impact is anticipated, marine mammals would likely recover completely when IPF stressors are removed or remedial or mitigating actions are taken, with the exception of the NARW, on which impacts could be **major adverse**. Impacts are magnified in severity for the NARW due to low population numbers and the potential to compromise the viability of the species from the loss of a single individual.

3.5.6.9 Comparison of Alternatives

Construction, O&M, and decommissioning of Alternatives C, D, E, and F would have the same overall negligible to moderate adverse impacts and minor beneficial impacts on marine mammals compared to the Proposed Action (Alternative B). Comparisons of each alternative to the Proposed Action are briefly described below:

Alternative C intends to reduce impacts on sensitive habitats in the Sakonnet River by diverting cable installation through an onshore alternative route. Similarly, Alternative F intends to reduce impacts on complex habitats and seabed disturbance in Muskeget Channel by using up to three ±525kV HVDC cables connected to one HVDC converter OSP in the Falmouth offshore export cable route instead of up to five HVAC cables connected to one or more HVAC OSPs under the Proposed Action. However, the addition of an HVDC OSP would require more withdrawal and discharge of cooling water and, thus, increase the possibility of entrainment of marine mammal prey items as well as potential adverse effects associated with DC cable EMFs. Impacts related to cable installation and maintenance would still occur along the same export corridors; therefore, the overall impacts from Alternatives C and F on marine mammals would not be materially different than those described under the Proposed Action.

Alternative D intends to address potential impacts on foraging habitat and potential displacement of protected species in the eastern edge of the Lease Area near Nantucket Shoals by eliminating six WTG foundations. The reduction of WTG foundations is expected to lessen the impacts on marine mammals, especially on NARWs and fin whales, by minimizing disturbance to important prey habitats. While small reductions in the presence of structures is expected under Alternative D, impacts from the remaining 143 WTG/OSPs would still occur and would not change the overall impact magnitude of the Project under the Proposed Action.

Alternative E considers the maximum use of each of the three foundation options, which is intended to minimize the benthic area of disturbance and construction noise related to foundation installation. However, installation activities would not differ between Alternative E-1 and the Proposed Action, which assumes pile driving would be used for all foundations. Under Alternatives E-2 and E-3, no pile driving would occur; therefore, there would be no underwater noise impacts from pile driving on marine mammals. The absence of pile driving would reduce construction and installation noise impacts under Alternatives E-2 and E-3 compared to the Proposed Action. Overall, impacts of Alternative E would be similar to impacts of the Proposed Action with the most notable difference being the reduction of short-term impacts from avoidance of pile-driving noise and the increase in long-term impacts from larger foundation footprints.

3.5.6.10 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 3.5.6-21. 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. After publication of the Draft EIS, BOEM conducted ESA consultation with NMFS, which resulted in NMFS issuing Reasonable and Prudent Measures and Terms and Conditions, which are analyzed collectively in Table 3.5.5-20.

Table 3.5.6-20. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): marine mammals

Measure	Description	Effect
Incorporate LOA requirements	The measures required by the final MMPA LOA for Incidental Take Regulations would be incorporated into COP approval and Record of Decision conditions, and BOEM and/or BSEE will monitor compliance with these measures. BOEM will require the applicant to comply with all the BOEM 2021 BMPs and with all future BOEM BMPs and PDCs that are published and applicable to the activities when not superseded by LOA, COP, or ROD conditions.	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 because analysis of the Proposed Action already includes analysis of the mitigation measures included in SouthCoast Wind's LOA Application as outlined in Table G-1.
Draft NMFS Biological Opinion Reasonable and Prudent Measures	The lessee must comply with measures in the Biological Opinion and conduct sound field verification to ensure distances to thresholds for ESA-listed marine mammals are not exceeded during impact pile driving. SouthCoast must also report any effects to ESA-listed marine mammals or incidental take of these species.	Reasonable and Prudent Measures and Terms and Conditions from the NMFS Biological Opinion would minimize impacts on marine 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.

Table 3.5.6-21. Additional Mitigation and Monitoring Measures (also identified in Appendix G, Table G-3): marine mammals

Measure	Description	Effect
HVDC open-loop cooling system avoidance area	To minimize potential impacts on zooplankton from impingement and entrainment in offshore wind HVDC converter station open-loop cooling systems, no open-loop cooling systems would be permitted in the enhanced mitigation area of the Lease Area. No geographic restrictions on the offshore export cable corridor, nor the installation of an HVAC OSP are included in this mitigation measure.	With the incorporation of an open-loop cooling system in the HVDC converter station especially in areas with dense aggregations of zooplankton, mortality to prey species for higher trophic level animals would be minimized. While the implementation of this mitigation measure under the Proposed Action would reduce the risk of entrainment of prey items in HVDC converter stations, it would not alter the impact determination of minor for intakes and discharges related to cooling offshore wind HVDC converter offshore substation platforms
Vessel-strike avoidance	A real-time detection and reporting PAM system must be implemented during the construction period. The PAM system must operate in the enhanced mitigation area 24 hours per day. The system must be capable of detection of NARW	The implementation of a real-time PAM system to detect the presence of marine mammals, including the NARW, followed by a mandatory speed restriction upon confirmed

Measure	Description	Effect
	vocalizations, report the detections to a PAM operator in near-real time, and share all detections with NMFS. Upon a confirmed detection of a NARW, all project construction and crew transfer vessels of all sizes must travel at 10 knots or less in a 10-square-kilometer area around the location of the detection. Speed restriction must remain in place until there are no PAM detections within 48 hours of implementation of the speed restrictions, or daily aerial surveys result in no NARW sightings within 48 hours of implementation of the speed restrictions.	detection during the construction phase of the Proposed Action would reduce the potential of any interactions between vessels and marine mammals. While the implementation of this mitigation measure would reduce the risk to marine mammals from vessel strikes, it would not alter the impact determination of negligible for vessel traffic under the Proposed Action.
Pile-driving time of year restriction in enhanced mitigation area	Pile driving within the enhanced mitigation area will occur only between June 1 and October 31 when NARW presence is at its lowest.	The time-of-year restriction in the enhanced mitigation area would ensure that NARWs would not be exposed to injurious levels of noise from pile driving activities, especially in combination of other measures such as PSO monitoring and acoustic attenuation devices. While the implementation of this measure would minimize the risk to NARW from this construction activity under the Proposed Action, it would not change the impact determination for impact pile-driving noise.
Pile-driving shut down provisions in enhanced mitigation area	SouthCoast Wind will be required to implement a real-time monitoring system. PAM will be used to detect and localize the direction of NARW calls and aerial imagery will be used to identify NARWs in the enhanced mitigation area (Figure G-1). If directly measured or modeled Level A or Level B received sound levels from offshore pile driving occur within the enhanced mitigation area when NARWs are detected, subsequent pile driving shall be suspended until NARWs are confirmed through acoustic monitoring or visual surveillance to be clear of the enhanced mitigation area for 48 hours.	Implementing a real-time PAM along with aerial surveys to detect the presence of NARWs followed by shutdown provisions upon detection would minimize the potential for Level A or Level B exposures during impact pile driving. While the implementation of this mitigation measure would decrease the risk to NARW during impact pile driving under the Proposed Action, it would not change the impact determination of moderate for impact pile-driving noise.
Long-term passive acoustic monitoring	a. The lessee must conduct long-term monitoring of ambient noise, marine mammal and commercially-important fish vocalizations in the Lease Area before, during, and following construction. The lessee must conduct continuous recording at least 1 year before construction, during construction, initial operation, and for at least 3 but no more than 10 full calendar years of operation to monitor for potential noise impacts. The lessee must meet	The implementation of long-term PAM to record ambient noise and document the presence of marine mammals before, during, and after construction would improve accountability of the impact evaluations. While the adoption of this mitigation measure would improve accountability under the Proposed Action, it would not alter

Measure	Description	Effect
	with BOEM and BSEE at least 60 days prior to conclusion of the third full calendar year of operation monitoring (and at least 60 days prior to the conclusion of each subsequent year until monitoring is concluded) to discuss 1) monitoring conducted to-date, 2) the need for continued monitoring, and 3) if monitoring is continued, whether adjustments to the monitoring are warranted. The instrument(s) must be configured to ensure that the specific locations of vocalizing NARW anywhere within the lease area could be identified, based on the assumption of a 10 km detection range for their calls. The lessee may execute the implementation of this condition through Option 1 or Option 2, as below. The timing requirement (i.e., monitoring for at least 3 but no more than 10 full calendar years of operation) will be reevaluated by BOEM and BSEE at the end of the third year and each year subsequently thereafter at the request of the lessee (at a maximum frequency of requests of once per year). i. Option 1 - Lessee Conducts Long-term Passive Acoustic Monitoring. The lessee must conduct PAM, including data processing and archiving following the Regional Wildlife Science Collaborative (RWSC) best practices to ensure data comparability and transparency. PAM instrumentation must be deployed to allow for identification of any NARW that vocalize anywhere within the lease area. The sampling rate (minimum 10 kHz) of the recorders must prioritize baleen whale detections but must also have a minimum capability to record noise from vessels, pile-driving, and WTG operation in the lease area. The system must be configured for continuous recording over the entire year. If temporal gaps in recording are expected, the lessee must ensure that additional recorders can be deployed to fill gaps. The lessee must use trawl-resistant moorings to ensure that instruments are not lost and must replace any lost instruments as soon as possible. The lessee must also notify BOEM if this occurs.	the impact determination of minor for impact pile-driving noise.

Measure	Description	Effect
	The lessee must follow the best practices outlined in the RWSC best practices document, unless otherwise required through conditions of COP approval. The best practices include engaging with the RWSC, calibrating the instruments, running QA/QC on the raw data, following the templates for reporting species vocalizations, and preparing the data for archiving at National Centers for Ecological Information (NCEI). Although section III of the RWSC best practices document specifies steps for Section 106 compliance, the lessee must instead follow the conditions outlined in Section 7.13 of the RWSC document and the Section 106 Memorandum of Agreement. In terms of data processing, the lessee must document the occurrence of whale vocalizations (calls of NARW, humpback, sei, fin, and minke whales, as well as odontocete clicks, as available based on sample rate) using automatic or manual detection methods. In addition, data must be processed with either manual or automatic detection software to detect vocalizations of spawning cod. The lessee must submit a log of these detections as well as the detection methodology to BOEM (at renewable_reporting@boem.gov), BSEE (at protectedspecies@bsee.gov) and NMFS (at nmfs.pacmdata@noaa.gov) within 120 days following each recorder retrieval. All raw data must be sent to the NCEI Passive Acoustic Data archive on an annual basis and the lessee must follow NCEI guidance for packaging the data and pay the fee. Long-term PAM Plan. The lessee must prepare and implement a Long-term PAM Plan under this option. No later than 120 days prior to instrument deployment and before any construction begins, the lessee must submit to BOEM and BSEE (renewable_reporting@boem.gov and OSWsubmittals@bsee.gov) the Long-term PAM Plan that describes all proposed equipment (including number and configuration of instruments), deployment locations, mooring design, detection review methodology, and other procedures and protocols related to the required use of PAM. As the lessee prepares the Long-term PAM	

Measure	Description	Effect
	Plan, it must coordinate with the RWSC. BOEM and BSEE will review the Long-term PAM Plan and provide comments, if any, on the plan within 45 days of its submittal. The lessee may be required to submit a modified Long-term PAM Plan based on feedback from BOEM and BSEE. The lessee must address all outstanding comments to BOEM's and BSEE's satisfaction and will need to receive written concurrence from BOEM and BSEE. If BOEM or BSEE do not provide comments on the Long-term PAM Plan within 45 days of its submittal, the lessee may conclusively presume BOEM's and BSEE's 's concurrence with the Long-term PAM Plan. b. Option 2 – Economic and Other Contributions to BOEM's Environmental Studies Program. As an alternative to conducting long-term PAM in the Lease Area, the lessee may opt to make an economic contribution to BOEM's Environmental Studies Partnership for an Offshore Wind Energy Regional Observation Network (POWERON) initiative on an annual basis and cooperate with the POWERON team to allow access to the Lease Area for deployment, regular servicing, and retrieval of instruments. The lessee's economic contribution will provide for all activities necessary to conduct PAM within the Lease Area, such as vessel and staff time for regular servicing of instruments, QA/QC on data, data processing to obtain vocalizations of sound-producing species and ambient noise metrics, as well as long-term archiving of data at NCEI. At the lessee's request, the amount of the economic contribution will be estimated by BOEM's Environmental Studies Program. The lessee will also be invited to contribute to discussions about the scientific approach of the POWERON initiative via the RWSC. The lessee may request temporary withholding of the public release (placement into the NCEI public data archive) of raw acoustic data collected within the Lease Area for up to 180 days after it is collected. During this temporary hold, the lessee may be provided a copy of the raw PAM data that were collected in the Lease Area or ROW after it has been cleared for any national security concerns under the RWSC best practices document.	

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits or proposed by BOEM listed in Table 3.5.6-20 and Appendix G, Tables G-2, G-3, and G-4 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, *Impacts of Alternative B – Proposed Action on Marine Mammals*.

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.

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.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.1 Commercial Fisheries and For-Hire Recreational Fishing

This section discusses potential impacts on commercial fisheries and for-hire recreational fishing from the proposed Project, alternatives, and ongoing and planned activities in the commercial fisheries and for-hire recreational fishing geographic analysis area. The commercial fisheries and for-hire recreational fishing geographic analysis area, as shown in Figure 3.6.1-1, spans more than 200 million acres and includes waters in the Greater Atlantic Region, managed by the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC) for federal fisheries in the U.S. Exclusive Economic Zone (from 3–200 nm [5.6–370.4 kilometers] from the coastline, plus the state waters in the Greater Atlantic Region—out to 3 nm [5.6 kilometers]—from the coastline) from Maine to North Carolina. 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 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

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

Commercial Fisheries

The primary source for regional fisheries data (Mid-Atlantic and New England regions) was Vessel Trip Report (VTR) data provided by NMFS (2021a). The summary VTR data included catch estimates by fishing location combined with NMFS estimates of revenue using ex-vessel price data drawn from commercial fisheries data dealer reports. The primary source of fisheries data in the Lease Area and ECCs was NMFS's Socioeconomic Impacts of Atlantic Offshore Wind Development website (NMFS 2022b, 2022c, 2022d, 2022e, 2024), which summarizes commercial fisheries data for each proposed wind lease area along the U.S. Atlantic coast. In addition, figures developed by BOEM based on NMFS Vessel Monitoring System (VMS) data provided by NMFS (2019) are included and provide additional information about fishing activities in the Lease Area.

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

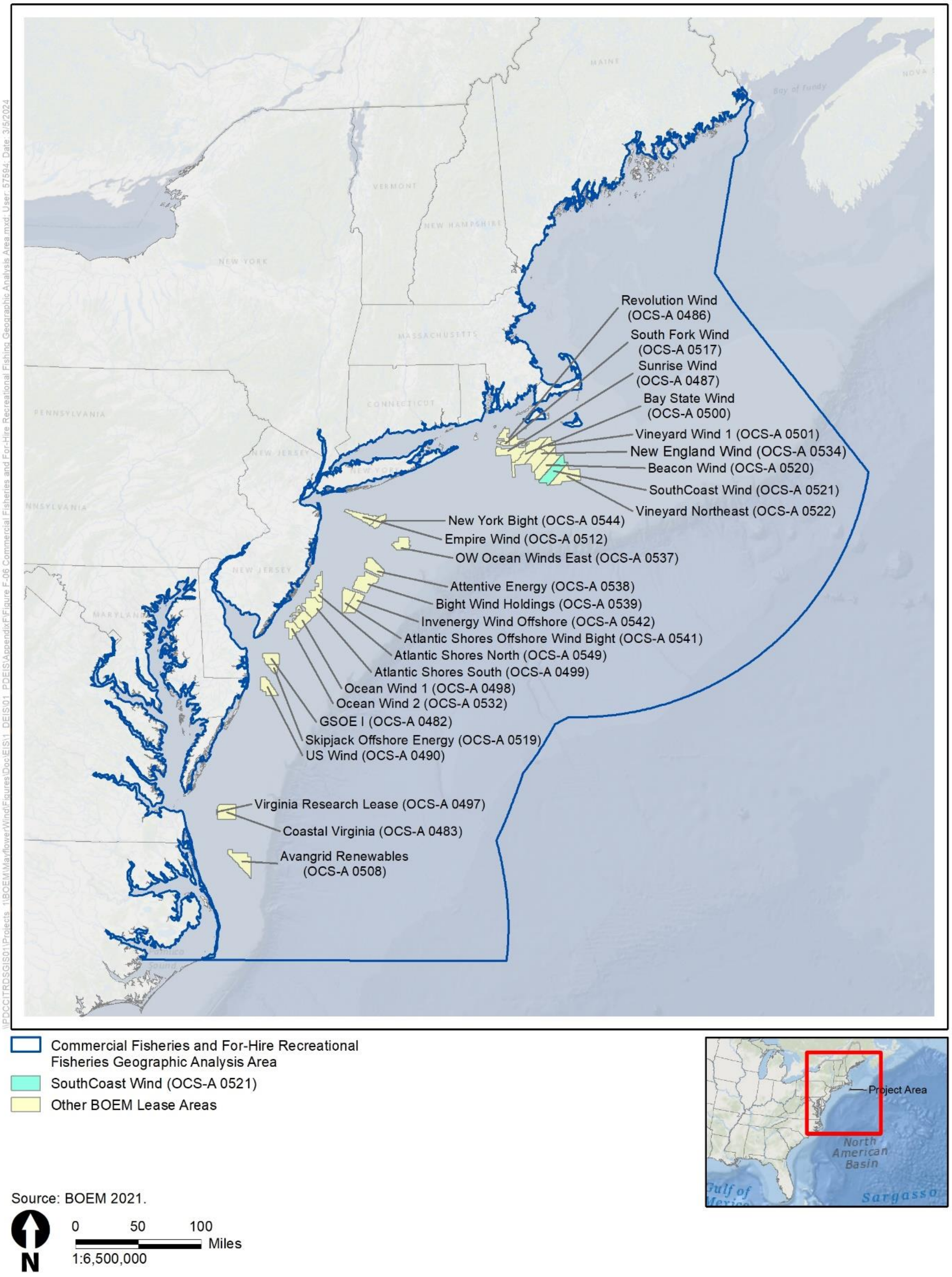


Figure 3.6.1-1. Commercial fisheries and for-hire recreational fishing geographic analysis area

Within Massachusetts and Rhode Island state waters of the Offshore 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 (NEFMC) and by the 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 Massachusetts and Rhode Island, the Massachusetts Division of Marine Fisheries and the Rhode Island Department of Environmental Management administers all laws relating to marine fisheries and are responsible for the development and enforcement of state and federal regulations pertaining to marine fish and fisheries in their respective state waters, including the management of diadromous species (e.g., American eel, striped bass, river herring, sturgeon).

Regional Setting

Commercial fisheries operating in federal waters off the Mid-Atlantic and New England regions are known for large catches of a variety of species, including Atlantic herring (*Clupea harengus*), clams (Atlantic surfclam [*Spisula solidissima*] and ocean quahog [*Arctica islandica*]), squid (*Decapodiformes*), Atlantic sea scallops (*Placopecten magellanicus*), skates (Rajidae), summer flounder (*Paralichthys dentatus*), groundfish, monkfish (*Lophius americanus*), American lobster (*Homarus americanus*), and Jonah crab (*Cancer borealis*). These fishery resources are harvested with a broad assortment of fishing gear, specifically mobile gear (e.g., bottom trawl, dredge, midwater trawl) and fixed gear (e.g., gillnet, pot, bottom longline, seine, hand line). The fishery resources are managed under several FMPs: the Northeast Multispecies (large-mesh and small-mesh) FMP, Sea Scallop FMP, Monkfish FMP, Atlantic Herring FMP, Skate FMP, and Red Crab FMP under NEFMC (NEFMC 2021); the Summer Flounder/Scup/Black Sea Bass FMP, Spiny Dogfish FMP, Mackerel/Squid/Butterfish FMP, Bluefish FMP, Surfclam/Ocean Quahog FMP, and Golden and Blueline Tilefish FMP under MAFMC (MAFMC 2021); the Highly Migratory Species FMP under NMFS (NMFS 2021e); and the Shad and River Herring FMP, Lobster FMP, and Jonah Crab FMP under the ASMFC (ASMFC 2021). These FMP fisheries are referred to throughout this section; therefore, the author-date citations are provided only here. Commercial fisheries species managed in state waters include the American eel (*Anguilla rostrata*), Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*), American shad (*Alosa sapidissima*) and river herring (Alosa), red drum (*Sciaenops ocellatus*), horseshoe crab (*Limulus polyphemus*), northern shrimp (*Pandalus borealis*), striped bass (*Morone saxatillis*), bluefish (*Pomatomus saltatrix*), tautog (*Tautoga onitis)*, and weakfish (*Cynoscion regalis*) among others (ASMFC 2021). The American lobster, as well as Jonah crab, is managed under the authority of the Atlantic Coastal Fisheries Cooperative Management Act and is cooperatively managed by the states under the framework of ASMFC and NMFS in federal waters. There are also smaller fisheries that are not managed under FMPs with importance in the region.

Economic Value and Landings

The predominant commercial fish and shellfish species in the geographic analysis area based on ex-vessel revenue and landed weight are summarized by species for the years 2008 through 2021 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 surf clam. The most valuable species over 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 surf clam, longfin and northern shortfin squid, summer flounder, and monkfish. 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. On average, commercial fishing activity in New England and the Mid-Atlantic generated approximately $1.7 billion in annual ex-vessel revenue from 2008 through 2021. Table 3.6.1-3 depicts the average annual revenue of commercial fisheries in the geographic analysis area by gear type for the 2008–2019 period. The most valuable gear type was scallop dredges, which generated $489.4 million in annual revenue, followed by bottom trawls ($187.2 million), pot-other gear ($115.1 million), and clam dredges ($61.3 million). Table 3.6.1-4 shows the average annual revenue by port of landing from 2008 through 2021 for ports in the geographic analysis area. Landings in New Bedford, Massachusetts represented approximately 32 percent of the average annual commercial fishing revenue in the geographic analysis area. The ports with the next highest revenues—Cape May, New Jersey and Reedville, Virginia—represented 7 percent and 6 percent, respectively.

The current trends for fisheries in the New England region are driven by the reliance on fewer species. The lowest species diversity to date occurred in 2020 (NEFSC 2022a). A decline in revenue for a number of species including monkfish, lobster, and scallops and price declines for monkfish, lobster, scallops and groundfish (NEFSC 2022a) was also observed in 2020 as compared to 2015–2019, attributed to disruptions from the Covid-19 pandemic. Over the past 30 years, total landings coming from the New England region have been on a downward trend. Commercial fleet diversity indicates a shift toward a reliance on American lobster in the Gulf of Maine and scallops on Georges Bank. These two species are the primary drivers behind the current profits realized by the commercial fishing industry (NEFSC 2022a). Conversely, recreational fish species diversity is increasing due to increases in southerly species and lower catch limits on traditional regional species. In the Mid-Atlantic, revenue was down across many federally managed species due to a mix of lower prices for summer flounder, scup, black sea bass, squids, and monkfish and landings from surfclam, ocean quahogs, and monkfish. The Mid-Atlantic has been subject to frequent and intense marine heatwaves over the past decade and the observed cold pool is becoming warmer, smaller, and shorter in duration, which has affected the habitat for federally managed species (NEFSC 2022b). Similar to the New England region, commercial fishing revenue is on a downward trend, and recreational fishing effort is increasing, although recreational fleet diversity is decreasing (NEFSC 2022b).

Table 3.6.1-1. Commercial fishing revenue of the top 20 most valuable species in the geographic analysis area (2008–2021)

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

Source: NMFS 2021f.
[a] Species are sorted by average annual revenue in descending order.
[b] Farmed.
[c] Includes 252 species and taxonomic groups (e.g., drums, skates) for which there were recorded landings.

Table 3.6.1-2. Commercial fishing landings of the top 20 species by landed weight (pounds) in the geographic analysis area (2008–2021)

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

Source: NMFS 2021f.

[a] Species are sorted by average annual landings in descending order.

[b] Includes 252 species and taxonomic groups (e.g., drums, skates) for which there were recorded landings.

Table 3.6.1-3 shows the average annual revenue by gear type for the 2008–2019 period. Scallop dredge gear accounted for 51 percent ($489.4 million) of the revenue generated by all gear in the Mid-Atlantic and New England regions, while bottom trawl gear and pot-other gear (including pot gear used in the Lobster FMP fishery) each generated over $115 million in average annual revenue. Dredge-clam gear accounted for approximately 6 percent ($61.3 million) of the total average annual revenue generated.

Table 3.6.1-3. Commercial fishing revenue by gear type in the geographic analysis area (2008–2019)

Gear Type [a]	Peak Annual Revenue (millions of dollars)	Average Annual Revenue (millions of dollars)	Percentage of Revenue in Geographic Area
Dredge-scallop	$615.2	$489.4	51.3%
Trawl-bottom	$229.2	$187.2	19.6%
Pot-other	$146.2	$115.1	12.1%
Dredge-clam	$65.8	$61.3	6.4%
Gillnet-sink	$44.6	$30.0	3.1%
Trawl-midwater	$26.6	$19.0	2.0%
Handline	$6.2	$4.8	0.5%
All other gear [b]	$62.4	$47.3	5.0%
All gear types	**$1,196.20**	**$954.1**	--

Source: NMFS 2021f.

[a] Gear types are sorted by revenue in descending order.

[b] Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear.

Commercial fishing fleets are important to coastal communities in the Mid-Atlantic and New England regions. These fleets not only generate direct employment and income for vessel owners and crew, but also contribute indirectly to the employment and revenue generated through products and services necessary to maintain and operate fishing vessels, seafood processors, wholesalers/distributors, and retailers. In 2019, total species landings in the Mid-Atlantic and New England regions were valued at $2.02 billion, including landings from non-federally permitted vessels. The Mid-Atlantic region contributed $498 million and the New England region $1.52 billion to the total landings (NMFS 2021f). The region is also home to aquaculture production and research that provides employment and business opportunities for coastal communities. The seafood industry generated $3.8 billion in personal and proprietor income in the Mid-Atlantic region and $5.6 billion in New England (NOAA Fisheries Office of Science and Technology 2019). Table 3.6.1-4 shows the average annual revenue by port of landing in the Mid-Atlantic and New England regions for the period from 2008 through 2021. This data includes revenue only from those vessels issued federal fishing permits by the NMFS Greater Atlantic Region, and therefore does not include all sources of commercial fishing revenue. New Bedford, Massachusetts had the highest revenue of the regional landings, accounting for approximately 36 percent of the total commercial fishing revenue in the Mid-Atlantic and New England regions. Cape May, New Jersey comparatively accounted for approximately 8 percent of the total average annual revenue.

Table 3.6.1-4. Commercial fishing landings and revenue for the Top 20 highest revenue ports in the geographic analysis area (2008–2021)

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

Source: NMFS 2021f.

[a] Ports are sorted by average annual revenue in descending order.

[b] Includes 58 ports in the New England and Mid-Atlantic region.

Commercial Fisheries in the Regional Fisheries Area

The Regional Fisheries Area (RFA) for the Offshore Project area includes Greater Atlantic Region Statistical Areas 537, 538, 539, 611 and 613 (Figure 3.6.1-2). The RFA provides a condensed region, relative to the geographic analysis area, to better analyze impacts at a more relevant scale for the fisheries that operate in the Offshore Project area. For instance, in 2019, 125.8 million pounds of lobster, valued at $628.7 million were landed, of these, 100.8 million pounds valued at $458.9 million were landed in Maine, commensurate with a 38-year trend of Maine as the leading producer (NOAA 2021). Massachusetts, the second leading producer, had landings of 16.7 million pounds valued at $93.1 million in 2019 (NOAA 2021). Together these two states comprised 93 percent of total national landings. Over half of these total landings in 2019, 76.18 million pounds, were harvested within 3 miles of shore in state waters, primarily the state waters of Maine. The remainder of landings were harvested in waters 3–200 miles (4.8–321.8 kilometers) offshore, primarily in Georges Bank (NOAA 2021). In 2019, 9.4 million pounds of the 16.7 million pounds, landed in Massachusetts, were harvested in state waters (MADMF 2021a). Therefore, American lobsters primarily harvested in the RFA, where the Offshore Project area is located, occur in Massachusetts state waters and account for much less landings and revenue compared to the state waters of Maine, and even fewer lobster are harvested from the Lease Area (Table 3.6.1-9). Further, the Gulf of Maine and Georges Bank stock of American lobster is at record high abundance, and the southern New England stock of American lobster is at record low abundance (NOAA 2022a).

Table 3.6.1-5 shows the average annual revenue in the RFA by FMP fishery from 2008 through 2019. On average, federally permitted commercial fishing activity in the RFA annually generated $143.9 million in revenue, with the Sea Scallop FMP fisheries accounting for 35 percent of the total; the Mackerel, Squid, and Butterfish FMP fishery accounting for 11 percent; and the Summer Flounder, Scup, Black Sea Bass FMP, “Other FMPs, non-disclosed species, and non-FMP fisheries” accounting for 23 percent of the average annual revenue for all FMP and non-FMP Fisheries. Table 3.6.1-5 also shows the percentage of each FMP fishery’s total revenue in the Mid-Atlantic and New England regions that came from the RFA from 2008 through 2019. The RFA accounted for a large share of the total revenue of the Jonah crab FMP fishery (61 percent), Skate FMP fishery (48 percent), Bluefish FMP fishery (46 percent), and Monkfish FMP fishery (36 percent). Across all FMP and non-FMP fisheries, the RFA accounted for approximately 15 percent of the total revenue in the geographic analysis area.

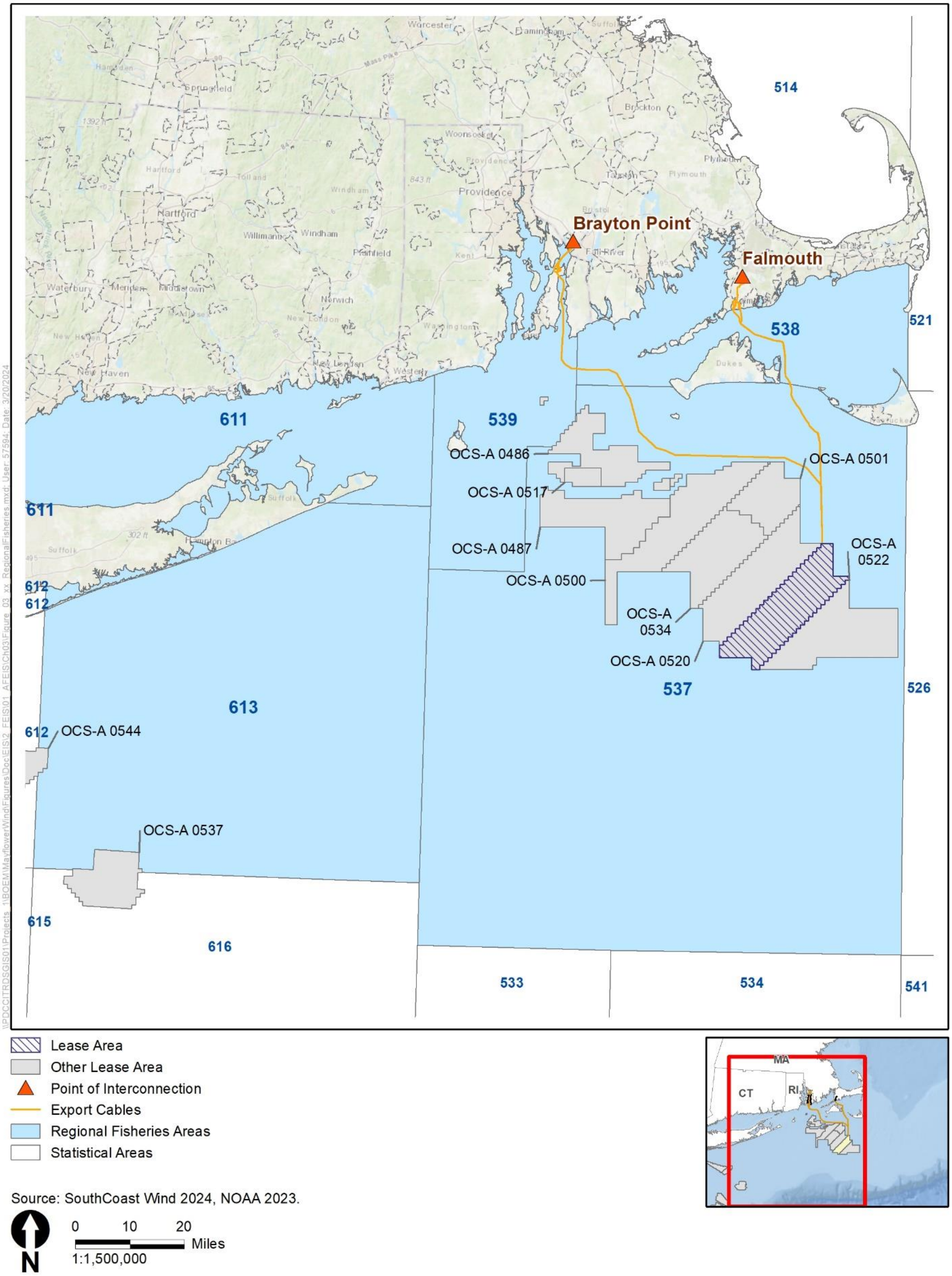


Figure 3.6.1-2. Regional Fisheries Area (blue) relevant to Offshore Project area

Table 3.6.1-5. Commercial fishing revenue of federally permitted vessels in the RFA by fishery management plan (2008–2019)

FMP Fishery	Peak Annual Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Average Annual Revenue in the RFA as a Percentage of Total Revenue in the Geographic Analysis Area
American lobster	$11,498.0	$7,799.0	8.4%
Atlantic herring	$6,853.8	$2,994.1	11.5%
Bluefish	$816.3	$582.6	45.7%
Highly migratory species	$315.5	$219.7	9.9%
Jonah crab	$11,244.6	$5,871.9	61.1%
Mackerel, squid, and butterfish	$29,544.7	$15,424.7	29.7%
Monkfish	$11,610.7	$7,520.2	36.5%
Northeast multispecies (large-mesh)	$4,616.6	$2,389.4	3.3%
Northeast multispecies (small-mesh)	$3,928.6	$2,823.6	25.1%
Sea scallop	$107,023.3	$49,741.2	9.6%
Skates	$5,671.1	$3,579.6	48.1%
Spiny dogfish	$546.8	$244.0	8.2%
Summer flounder, scup, black sea bass	$14,327.2	$10,999.8	27.6%
Other FMPs, non-disclosed species, and non-FMP fisheries [a]	$42,517.3	$33,757.3	35.9%
All FMP and non-FMP fisheries	$213,098.9	$143,947.2	15.1%

Source: Developed using NMFS 2021g, 2022a.

Notes: Revenue is adjusted for inflation to 2019 dollars. Peak annual revenue is calculated independently for all rows including the total row.

[a] Other FMPs, non-disclosed species, and non-FMP fisheries includes revenue from three FMP fisheries: surfclam/ocean quahog, red crab, and river herring. In addition, it includes revenue from species in FMP fisheries for which data could not be disclosed due to confidentiality restrictions, and revenue earned by federally permitted vessels operating in fisheries that are not federally managed.

Table 3.6.1-6 shows the average annual landings by individual species from 2008 through 2019. The top three species were Atlantic herring, skates, and Loligo squid accounting for 27 percent, 16 percent, and 12 percent of the total landings, respectively. Table 3.6.1-6 also shows the percentage of each species' total landings in the Mid-Atlantic and New England regions that came from the RFA from 2008 through 2019. The RFA accounted for a large share of the total landings of rock crab (71 percent), skates (65 percent), scup (65 percent), Jonah crab (54 percent), red hake (48 percent), monkfish (44 percent), Loligo squid (41 percent), butterfish (38 percent), and summer flounder (37 percent).

Table 3.6.1-6. Commercial fishing landings of federally permitted vessels in the RFA by species (2008–2019)

Species	FMP Fishery	Peak Annual Landings (pounds)	Average Annual Landings (pounds)	Average Annual Landings in the RFA as a Percentage of the Total Landings in the Geographic Analysis Area
Atlantic herring	Atlantic herring	49,580,526	23,065,828	14.8%
Skates	Skates	15,472,505	13,964,696	65.50%
Loligo squid	Mackerel, squid, and butterfish	21,451,952	10,224,109	41.50%
Scup	Summer flounder, scup, black sea bass	9,912,424	7,105,610	65.40%
Jonah crab	Jonah crab	10,396,456	6,372,109	53.70%
Sea scallops	Sea scallops	11,529,926	4,685,271	9.40%
Monkfish	Monkfish	4,975,969	4,302,449	44.20%
Silver hake	Northeast multispecies (small-mesh)	5,527,656	3,557,841	25.30%
Summer flounder	Summer flounder, scup, black sea bass	5,161,839	3,425,527	36.90%
Atlantic mackerel	Mackerel, squid, and butterfish	16,142,814	2,803,012	14.90%
American lobster	American lobster	1,930,635	1,334,642	6.90%
Butterfish	Mackerel, squid, and butterfish	2,761,688	1,230,067	37.90%
Spiny dogfish	Spiny dogfish	2,168,519	1,061,854	7.90%
Bluefish	Bluefish	1,000,463	730,175	40.00%
Rock crab	Other FMPs, non-disclosed species and non-FMP fisheries	3,042,399	667,393	70.70%
Red hake	Northeast multispecies (small-mesh)	1,030,911	658,114	48.50%
Black sea bass	Summer flounder, scup, black sea bass	944,309	422,898	23.40%
Yellowtail flounder	Northeast Multispecies (large-mesh)	1,032,864	409,308	18.80%
Winter flounder	Northeast multispecies (large-mesh)	947,933	357,060	9.80%
Cod	Northeast Multispecies (large-mesh)	386,358	201,932	2.70%

Source: Developed using data from NMFS (2021a, 2022a).
Notes: The table shows landings of the top 20 species landed (by pounds) in descending order in the RFA.

Table 3.6.1-7 shows the average annual revenue in the RFA by gear type during the period from 2008 through 2019. Scallop dredge gear accounted for 34 percent of the revenue generated by all gear types, bottom trawl gear accounted for 30 percent, and clam dredge gear accounted for 14 percent. Table 3.6.1-7 also shows the percentage of each gear type's total revenue in the Mid-Atlantic and New England regions that came from the RFA from 2008 through 2019. The RFA accounted for a large share of the total revenue for clam dredge (34 percent), sink gillnet (32 percent), handline (29 percent), and bottom trawl (23 percent).

Table 3.6.1-7. Commercial fishing revenue of federally permitted vessels in the RFA by gear type (2008–2019)

Gear Type	Peak Annual Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Average Annual Revenue in the RFA as a Percentage of Total Revenue in the Geographic Analysis Area
Dredge-clam [a]	$25,562.9	$20,831.9	34.0%
Dredge-scallop	$105,678.5	$48,458.7	9.9%
Gillnet-sink	$13,149.3	$9,615.9	32.0%
Handline	$1,673.2	$1,369.0	28.8%
Pot-other	$19,272.8	$16,089.3	14.0%
Trawl-bottom	$60,400.9	$43,039.0	23.0%
Trawl-midwater	$5,373.1	$2,348.8	12.4%
All other gear [b]	$4,601.1	$2,665.0	5.6%
All gear types	$213,098.9	$144,417.7	15.1%

Source: Developed using data from NMFS (2021a, 2022a).

Notes: Revenue is adjusted for inflation to 2019 dollars. Peak annual revenue is calculated independently for all rows including the total row.

[a] Fewer than 12 years but more than 5 years of data were used to calculate the estimates.

[b] Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear, as well as listed gear for years when they were not disclosed.

Table 3.6.1-8 shows the ports at which fish and shellfish caught in the RFA from 2008 through 2019 were landed. New Bedford and Point Judith together accounted for 53 percent of the peak annual revenue generated by commercial fishing activity in the RFA. Table 3.6.1-8 also shows the percentage of each port's total revenue in the Mid-Atlantic and New England regions that came from the RFA from 2008 through 2019. The RFA accounted for a large share of the total revenue in the geographic analysis area for Little Compton (97 percent), Westport (90 percent), Chilmark/Menemsha (89 percent), Montauk (64 percent), Point Judith (60 percent), and Tiverton (57 percent).

Table 3.6.1-8. Commercial fishing revenue of federally permitted vessels in the RFA by port (2008–2019)

Port and State	Peak Annual Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Average Annual Revenue in the RFA as a Percentage of Total Revenue in the Geographic Analysis Area
Port Judith, RI	$37,052.6	$27,546.5	59.8%
New Bedford, MA	$90,794.6	$48,503.9	12.8%
Little Compton, RI	$2,936.8	$1,940.2	97.4%
Westport, MA	$1,562.6	$1,169.0	89.6%
Newport, RI	$5,302.2	$2,880.8	32.4%
Chilmark/Menemsha, MA	$573.4	$419.6	89.1%
Fairhaven, MA	$4,142.1	$1,439.0	12.8%
Montauk, NY	$16,563.0	$11,859.8	64.1%
Fall River, MA [a]	$649.8	$445.9	39.3%
Tiverton, RI [a]	$880.0	$651.1	56.7%
Other Ports, MA	$8,655.1	$4,875.2	4.7%
Point Pleasant, NJ	$15,019.8	$8,593.3	27.7%
Newport News, VA	$3,587.3	$1,698.9	5.5%
Beaufort, NC [a]	$2,031.2	$862.9	32.5%
Hampton, VA [a]	$3,478.3	$1,562.6	10.9%
Other New England/Mid-Atlantic ports [b]	$48,508.3	$29,943.3	10.0%
All New England/Mid-Atlantic Ports	$213,098.9	$144,391.8	15.1%

Source: Developed using data from NMFS (2021, 2022a).

Notes: Revenue is adjusted for inflation to 2019 dollars. Peak annual revenue is calculated independently for all rows, including the total row.

[a] Fewer than 12 years but more than 5 years of data were used to calculate the estimates.

[b] Includes ports with not applicable (NA) in the table and other unlisted ports that had landings from federally permitted vessels fishing in the RFA from 2008 through 2019.

In 2010, during the first stage of the public process for BOEM's call for information and nominations to establish the Rhode Island and Massachusetts Wind Energy Area, all of Cox Ledge was included in the area considered for leasing (i.e., call area). However, BOEM held a lengthy stakeholder and scientific review process that identified "high-value" fishing grounds and excluded those areas from the Rhode Island and Massachusetts Wind Energy Area (BOEM 2012; Schumann et al. 2016). From 2008 through 2019, the excluded area accounted for approximately 22 percent of the revenue generated by all fisheries in the call area. It accounted for 32 percent of the Sea Scallop FMP fishery revenue and 25 percent of the Monkfish FMP fishery revenue in the call area (NMFS 2021a). For the Sea Scallop and Monkfish FMP fisheries combined, the revenue per square mile in the excluded area was approximately 50 percent higher than that in the Rhode Island and Massachusetts Wind Energy Area in 2007 to 2018 (BOEM 2021c).

Commercial Fisheries in the Offshore Project Area

The commercial fisheries active in the Offshore Project area, inclusive of the Brayton Point and Falmouth ECCs and Lease Area,[1] encompass a wide range of FMP fisheries, gears, and landing ports, although VTR data indicate that most FMP fisheries in the Lease Area do not have a high level of fishing effort compared to surrounding areas (COP Volume 2, Section 11, Figures 11-7 to 11-13, Tables 11-10 to 11-12; SouthCoast Wind 2024). Table 3.6.1-9 and Table 3.6.1-10 provide data on revenue and landings for 2008 through 2022 for commercial fisheries in the Lease Area for vessels that were issued federal fishing permits by the NMFS Greater Atlantic Region. The top FMPs by revenue in the Lease Area were the ASMFC FMP (driven by Jonah crab) (Table 3.6.1-9); Summer Flounder, Scup, Black Sea Bass; Mackerel, Squid, and Butterfish; Small-Mesh Multispecies; and Skates. The top FMP fisheries accounted for approximately 76 percent of total revenue generated commercially in the Lease Area from 2008 through 2022 and approximately 74 percent of all landings from affected FMPs (Table 3.6.1-10). The Atlantic Herring FMP fishery landed over one million pounds in 2010 (Table 3.6.1-10), making it the fourth largest FMP fishery in pounds landed over the 15-year period; however, in other years, no pounds were landed, and a low amount of trips were expected to occur for the Atlantic Herring FMP.

Table 3.6.1-9. Commercial fishing revenue of federally permitted vessels in the Lease Area by FMP (2008–2022) [a]

FMP Fishery	Average Annual Revenue (Lease Area)	Total Revenue (Lease Area)	Average Annual Expected Vessels in the Lease Area [f]	Average Annual Expected Vessel Trips in the Lease Area [f]
Top Five FMPs				
ASMFC FMP [b]	$116,933	$1,754,000	9	9
Summer Flounder, Scup, Black Sea Bass	$112,666	$1,690,000	16	18
Mackerel, Squid, and Butterfish	$111,866	$1,678,000	14	15
Small-Mesh Multispecies	$45,466	$682,000	11	12
Skates	$44,066	$661,000	13	18
Total Top Five FMPs	**$430,997**	**$6,465,000**	**63**	**72**
Other Affected FMPs				
Monkfish	$40,733	$611,000	18	24
Tilefish	$37,133	$557,000	2	2
Sea Scallop	$29,200	$438,000	1	1
Atlantic Herring	$7,866	$118,000	1	1
Surfclam, Ocean Quahog	$4,000	$60,000	1	1

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

FMP Fishery	Average Annual Revenue (Lease Area)	Total Revenue (Lease Area)	Average Annual Expected Vessels in the Lease Area [f]	Average Annual Expected Vessel Trips in the Lease Area [f]
Northeast Multispecies	$3,866	$58,000	2	3
All Others [d]	$3,800	$57,000	NA	NA
No Federal FMP [c]	$3,733	$56,000	5	5
Spiny Dogfish	$1,200	$18,000	3	5
Bluefish	$1,000	$15,000	10	10
Highly Migratory Species	$466	$7,000	2	2
SERO FMP [e]	$133	$2,000	1	1
Other Affected FMPS	**$133,200**	**$1,998,000**	**46**	**55**
All FMP Fisheries	**$564,200**	**$8,463,000**	**109**	**127**

Source: NMFS 2024

[a] Data are for vessels issued federal fishing permits by NMFS Greater Atlantic Region. Numbers are in 2021 dollars and Total Revenue is rounded to nearest $1,000. NA indicates data not available to perform calculations. Federal lobster vessels, with only lobster permits, do not have a VTR requirement. Many Atlantic HMS-permitted vessels also do not have a VTR requirement. Trips with no VTR are not reflected in this summary. Further there exists other fisheries in state waters that may not be reflected in data from federal sources (e.g. whelk, bluefish, and menhaden).

[b] ASMFC FMP includes American lobster, cobia, Atlantic croaker, black drum, red drum, menhaden, NK sea bass, NK seatrout, spot, striped bass, tautog, Jonah crab, and pandalid shrimp.

[c] No federal FMP contains a variety of species that are managed under an FMP but are not federally regulated, such as spotted seatrout (*Cynoscion nebulosus*), whelk (*Buccinidae*) and weakfish (*Cynoscion regali*).

[d] All others refers to FMP Fisheries with fewer than three permits or dealers affected to protect data confidentiality.

[e] SERO FMP includes the following species: Amber jack, brown shrimp, dolphinfish, greater amberjack, grouper, grunts, hogfish, king mackerel, long tail grouper, NK porgy, penaeid shrimp, red grouper, red hind, red porgy, red snapper, rock hind, sand tilefish, scamp grouper, snapper, snow grouper, spadefish, Spanish mackerel, speckled hind, spiny American lobster, triggerfish, vermillion snapper, wahoo, wreckfish, yellowedge grouper.

[f] Vessel and trip numbers are weighted by the probability of overlap with the Lease Area to generate a more precise expected count of trips and vessels in the Lease Area from 2008 to 2022.

Table 3.6.1-10. Commercial fishing landings (pounds) of federally permitted vessels in the Lease Area by FMP (2008–2022) [a]

FMP Fishery	Average Annual Landings (pounds)	Total Landings (pounds)
Top Five FMP Fisheries		
ASMFC FMP [b]	92,066	1,381,000
Mackerel, Squid, and Butterfish	81,600	1,224,000
Summer Flounder, Scup, Black Sea Bass	80,933	1,214,000
Skates	68,933	1,034,000
Small-Mesh Multispecies	62,133	932,000
Total Top Five FMPs	**385,666**	**5,785,000**
Other Affected FMPs		
Atlantic Herring	73,933	1,109,000
Monkfish	23,066	346,000
Tilefish	8,066	121,000
No Federal FMP [c]	6,133	92,000
Spiny Dogfish	6,000	90,000
All Others [d]	4,933	74,000
Surfclam, Ocean Quahog	3,333	50,000
Sea Scallop	2,666	40,000
Northeast Multispecies	2,200	33,000
Bluefish	1,066	16,000
Highly Migratory Species	533	8,000
SERO FMP [e]	66	1,000
Other Affected FMPs	**131,995**	**1,981,000**
All FMP Fisheries	**517,661**	**7,766,000**

Source: NMFS 2024.

[a] Data are for vessels issued federal fishing permits by NMFS Greater Atlantic Region. Pounds are reported in landed (dressed) pounds. Federal lobster vessels, with only lobster permits, do not have a VTR requirement. Many Atlantic HMS permitted vessels also do not have a VTR requirement. Trips with no VTR are not reflected in this summary. Further, there exists other fisheries in state waters that may not be reflected in data from federal sources (e.g., whelk, bluefish, and menhaden).

[b] ASMFC FMP includes American lobster, cobia, Atlantic croaker, black drum, red drum, menhaden, NK sea bass, NK seatrout, spot, striped bass, tautog, Jonah crab, and pandalid shrimp.

[c] No federal FMP contains a variety of species that are managed under an FMP but are not federally regulated, such as spotted seatrout (*Cynoscion nebulosus*), whelk (*Buccinidae*) and weakfish (*Cynoscion regali*).

[d] All others refers to FMP Fisheries with fewer than three permits or dealers affected to protect data confidentiality.

[e] SERO FMP includes the following species: Amber jack, brown shrimp, dolphinfish, greater amberjack, grouper, grunts, hogfish, king mackerel, long tail grouper, NK porgy, penaeid shrimp, red grouper, red hind, red porgy, red snapper, rock hind, sand tilefish, scamp grouper, snapper, snow grouper, spadefish, Spanish mackerel, speckled hind, spiny American lobster, triggerfish, vermillion snapper, wahoo, wreckfish, yellowedge grouper.

Table 3.6.1-11 shows the top ten most affected species in the Lease Area (2008–2022), whereas Table 3.6.1-12 shows the average revenue, landings, and effort (Days-At-Sea [DAS]) as percentages of the total revenue, landings, and effort across the entire geographic analysis area for the top ten species deriving the most revenue from the Lease Area by year (2008–2022). The primary difference between the tables is the disproportionate impact that landings of high value species such as lobster and sea scallops can have on the 15-year total. Both American lobster and Atlantic sea scallop had substantially fewer pounds landed than skate, but the 15-year revenue was similar for American lobster, Atlantic sea scallop and skate. American lobster and Atlantic sea scallops did not rank among the top ten affected species by revenue, however skate did, specifically winter skate in 12 of the 15 years analyzed and little skate in 4 of the 15 years analyzed (Table 3.6.1-12). There are limitations in relying on fishery revenue while analyzing the impacts of potential development due to the interrelatedness and reliance of some fisheries on one another for bait such as the skate fishery and the mixed lobster/Jonah crab/rock crab fishery. The skate and Atlantic herring fishery are generally low value high volume fisheries. Table 3.6.1-11 shows that across 15 years the total pounds of skate landed was 694,000 pounds or roughly 46,266 pounds per year. Skate are generally targeted by gillnet vessels; generally passive gear like this would have more ability to fish in the Lease Area post construction. Further, as discussed, the Atlantic herring fishery had fluctuating landings from the Lease Area over the 15-year period, at times contributing no landings of herring. The species consistent across the two tables are Jonah crab, longfin squid, red hake, silver hake, golden tilefish, skate, monkfish, scup and summer flounder. As depicted in these tables, Jonah crab is the most consistently affected species and FMP by revenue and by landings for the Lease Area. The average revenue, landings, and effort associated with the capture of Jonah crabs in the Lease Area, however, contributed 0.8 percent of revenue, 0.8 percent of landings, and 0.3 percent of DAS for Jonah crab annually over the 15 years analyzed (Table 3.6.1-12); peaking in 2016 at 1.4 percent of revenue and 1.3 percent of landings for the entire geographic analysis area (NMFS 2024). Other species, such as scup and golden tilefish, account for less revenue and landings compared to Jonah crab and longfin squid, but in certain years, scup and golden tilefish were more dependent on the Lease Area relative to Jonah crab and longfin squid. For instance, in 2019 Golden tilefish revenue and landings from the Lease Area accounted for 2.36 percent and 2.28 percent of the total revenue and landings for this species across the entire geographic analysis area (NMFS 2024). In 2019 Jonah crab ranked fifth and longfin squid ranked eighth in terms of dependency on the Lease Area. While spot ranked higher on average revenue and landings than red hake, butterfish, longfin squid, and monkfish, it only occurred in 4 of the 15 years analyzed and is driven by relatively high revenue, 1.5 percent and 2.5 percent and landings 1.7 percent and 3.3 percent in 2008 and 2010, respectively (NMFS 2024).

Table 3.6.1-11. Commercial fishing revenue and landings (pounds) of federally permitted vessels in the Lease Area by most affected species (2008–2022) [a]

Most Impacted Species by Revenue	15-Year Revenue [b]	Most Impacted Species by Landings	15-Year Landings (pounds) [c]
Longfin squid	$1,561,000	Jonah crab	1,303,000
Jonah crab	$1,349,000	Longfin squid	1,035,000
Summer flounder	$890,000	Scup	894,000
Scup	$744,000	Silver hake	834,000
Silver hake	$650,000	Skates	694,000
Monkfish	$611,000	Monkfish	346,000
Golden tilefish	$557,000	Summer flounder	305,000
Skates	$481,000	Golden tilefish	121,000
Sea scallop	$438,000	American lobster	77,000
American lobster	$404,000	Sea scallop	40,000
Total	**$1,998,000**	**Total**	**1,981,000**

Source: NMFS 2024

[a] Data are for vessels issued federal fishing permits by NMFS Greater Atlantic Region. Pounds are reported in landed (dressed) pounds. Federal lobster vessels, with only lobster permits, do not have a VTR requirement. Many Atlantic HMS permitted vessels also do not have a VTR requirement. Trips with no VTR are not reflected in this summary. Further, there exists other fisheries in state waters that may not be reflected in data from federal sources (e.g., whelk, bluefish, and menhaden).

[b] Values are reported in real 2021 dollars as calculated using the GDP Implicit Price Deflator.

[c] Pounds are reported in landed (dressed) pounds.

Table 3.6.1-12. Average commercial fishing revenue, landings, and DAS of the Lease Area as percentages of total revenue, landings, and DAS for the entire geographic analysis area for the species deriving the most revenue from the Lease Area by year [a] (2008–2022)

Species	Average Annual Revenue as a Percentage of Total Revenue in the Geographic Analysis Area	Average Annual Landings as a Percentage of the Total Landings in the Geographic Analysis Area	Average Annual DAS as a Percentage of the DAS in the Geographic Analysis Area	Number of Years as One of the Top Ten Species by Revenue
Jonah crab	0.82	0.78	0.31	15
Golden tilefish	0.66	0.59	0.25	14
Longfin squid	0.28	0.26	0.28	14
Red hake	0.36	0.44	0.33	14
Silver hake	0.41	0.45	0.28	14
Winter skate	0.29	0.26	0.20	12
Butterfish	0.31	0.39	0.38	11
Monkfish	0.21	0.29	0.11	11

Species	Average Annual Revenue as a Percentage of Total Revenue in the Geographic Analysis Area	Average Annual Landings as a Percentage of the Total Landings in the Geographic Analysis Area	Average Annual DAS as a Percentage of the DAS in the Geographic Analysis Area	Number of Years as One of the Top Ten Species by Revenue
Scup	0.74	0.70	0.45	11
Summer flounder	0.35	0.36	0.28	8
Atlantic bluefish	0.16	0.15	0.59	4
Little skate	0.21	0.18	0.16	4
Spot	1.34	1.48	1.42	4
Barndoor skate	0.92	0.89	1.01	2
Black sea bass	0.12	0.12	0.47	2
Yellowtail flounder	0.20	0.19	0.06	2
All others [b]	0.32	0.32	0.09	1
American eel	0.13	0.16	0.11	1
Atlantic herring	0.43	0.71	0.20	1
Atlantic mackerel	0.09	0.05	0.18	1
Blueline tilefish	0.23	0.26	0.51	1
Offshore hake	0.68	1.99	1.13	1
Spiny dogfish	0.10	0.09	0.18	1
Weakfish	0.18	0.13	0.07	1

Source: NMFS 2024

[a] More than ten species shown as the top ten most affected species changed annually, averages were calculated for each species using the number of years where landings occurred so as to not dilute rankings, e.g. the average calculation for spot used four years rather than 15 years.

[b] All others refers to FMP Fisheries with fewer than three permits or dealers affected to protect data confidentiality.

Table 3.6.1-13 and Table 3.6.1-14 show the revenue and landings of federally permitted vessels in the Lease Area by gear type. Considering Table 3.6.1-10, Table 3.6.1-11, and Table 3.6.1-12 with Table 3.6.1-13 and Table 3.6.1-14, the majority of lobster pot gear in the Lease Area captured Jonah crabs. Longfin squid, summer flounder, scup, and silver hake are commonly caught with bottom-trawl gear accounting for the most affected gear type across the 15 years analyzed. The Gillnet-Sink fishery would mainly target monkfish and skate. Together, trawl-bottom, pot-lobster, and gillnet-sink accounted for approximately 85 percent of the total revenue generated by commercial fishing activity in the Lease Area. Further these three gear types accounted for 82 percent of landings for the Lease Area. While longfin squid may rank as the first highest species in the Lease Area by revenue and second by landings (Table 3.6.1-11), in the years analyzed it accounted for less than 0.3 percent, respectively, of the revenue, landings, and effort for the entire geographic analysis area with percentages of revenue, landings, and effort of silver hake and scup being more relevant to the geographic analysis area with revenues exceeding 1 percent in some of the years analyzed. Most of the top ten most affected species by year did not exceed 2 percent of the total revenue of the geographic analysis area. Spot exceeded 2 percent in 2010 and golden tile fish in 2019. In most years, spot generated no value relative to the geographic analysis area, and golden tilefish varies from 0 to over 2 percent of total revenue of the geographic analysis area (NMFS 2024).

Table 3.6.1-13. Commercial fishing revenue of federally permitted vessels in the Lease Area by gear type (2008–2022)

Gear Type	Average Annual Revenue	Total Annual Revenue
Trawl-bottom	$283,533	$4,253,000
Pot-lobster	$117,933	$1,769,000
Gillnet-sink	$79,066	$1,186,000
Longline-bottom	$31,133	$467,000
Dredge-scallop	$28,533	$428,000
All others	$10,800	$162,000
Trawl-midwater	$6,666	$100,000
Dredge-clam	$3,800	$57,000
Pot-other	$2,800	$42,000
Handline	<$500	<$500
Total	**$564,266**	**$8,464,000**

Source: NMFS 2024.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Revenue is in 2021 dollars.

Table 3.6.1-14. Commercial fishing landings (pounds) of federally permitted vessels in the Lease Area by gear type (2008–2022)

Gear Type	Average Annual Landings	Total Annual Landings
Trawl-bottom	243,333	3,650,000
Pot-lobster	94,467	1,417,000
Gillnet-sink	86,067	1,291,000
Trawl-midwater	67,933	1,019,000
All others	9,933	149,000
Longline-bottom	7,800	117,000
Dredge-clam	3,133	47,000
Dredge-scallop	2,667	40,000
Pot-other	2,400	36,000
Handline	<500	<500
Total	**517,666**	**7,765,000**

Source: NMFS 2024.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.

Table 3.6.1-15 shows the average number and average expected number of vessel trips and average number and average expected number of vessels fishing in the Lease Area by port from 2008 through 2022. The Lease Area is predominantly used by vessels whose homeports are in New England. Table 3.6.1-16 provides a ranking of the top ten ports by revenue of fishing vessels in the Lease Area from 2008 through 2022, as well as the level of commercial fishing engagement and reliance of the community in which the port is located. These rankings portray the level of dependence of the community on commercial fishing and are compiled by NMFS (NOAA Fisheries Office of Science and Technology 2021). Thirty-one percent of the average expected number of trips of fishing vessels that operate in the Lease Area originate from Point Judith, Rhode Island, and New Bedford, Massachusetts. Both receive the highest value of landings of any ports, from the Lease Area, with respective totals of $2.4 million and $2 million from 2008 through 2022. These ports contribute 60 percent of the total revenue derived from the Lease Area and account for 76 percent and 62 percent of their respective states' revenue derived from the Lease Area (Table 3.6.1-17). As shown in Table 3.6.1-16, the commercial fishing engagement and reliance differ across communities that engage in commercial fishing in the Lease Area. For example, while New Bedford ranks high in commercial fishing engagement and medium in reliance, Chatham, Massachusetts, which ranks fifth in revenue and landings from the Lease Area, ranks high in fishing engagement and high in fishing reliance, given its relative isolation, size, and relative lack of other industries to engage the coastal community. Information regarding the ranking determinations for each community is provided in the community profiles available from NMFS (NMFS 2021b). These profiles present the most recent data available for these key indicators of New England and Mid-Atlantic fishing communities related to dependence on fisheries and other economic and demographic characteristics. Selected socioeconomic characteristics of communities with fishing ports that could be affected by the Project are also presented in Section 3.6.3, *Demographics, Employment, and Economics,* and Section 3.6.4, *Environmental Justice*. Additionally, the percentage of regional revenue and landings for the ten most dependent ports (by maximum percent of annual regional revenue) are listed below. Percent of revenue and landings is derived by taking the annual revenue and landings in the Lease Area and dividing it by the total annual fishing revenue and landings in that port during 2008–2022 (Table 3.6.1-18). The ports that are most dependent on the Lease Area are smaller ports such as Westport, Massachusetts and Little Compton, Rhode Island. These ports, however, derive less than 1 percent of their revenue and landings from the Lease Area (Table 3.6.1-18).

Table 3.6.1-15. Average number of total and expected commercial fishing trips and vessels in the Lease Area by port (2008–2022)

Port and State	Average Number of Vessels [a]	Average Number of Trips [a]	Average Expected Number of Vessels [b]	Average Expected Number of Trips [b]
Point Judith, RI	62	548	11	13
New Bedford, MA	71	347	6	8
Montauk, NY	14	79	3	3
Westport, MA	6	62	2	2
Harwichport, MA	3	61	2	2
Provincetown, MA	3	60	1	1

Port and State	Average Number of Vessels [a]	Average Number of Trips [a]	Average Expected Number of Vessels [b]	Average Expected Number of Trips [b]
Newport, RI	6	59	2	2
Fairhaven, MA	5	54	3	5
Little Compton, RI	5	51	2	2
Chatham, MA	8	48	3	6
Hyannis, MA	7	40	1	1
Beaufort, NC	21	35	1	1
Fall River, MA	3	30	1	1
Tiverton, RI	3	28	1	1
New London, CT	4	25	1	1
Stonington, CT	7	25	1	1
Hampton, VA	14	23	1	1
Boston, MA	7	22	1	1
Newport News, VA	12	19	1	1
Chincoteague, VA	10	16	1	1
North Kingstown, RI	3	16	1	1
Barnstable, MA	4	15	1	1
Point Pleasant, NJ	6	13	1	1
Davisville, RI	3	13	1	1
Hampton Bay, NY	3	12	1	1
Cape May, NJ	5	8	1	1
Gloucester, MA	6	8	1	1
Harwich Port, MA	4	7	1	1
Chilmark, MA	5	7	1	1
Hobucken, NC	4	6	1	1
Shinnecock, NY	4	5	1	1
Wanchese, NC	5	5	1	1
Total	**331**	**1,756**	**60**	**68**

Source: NMFS 2024f

Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.

[a] Number of Trips and Number of Vessels represent, "An upper bound on the counts as it does not take into account the probability of these trips actually overlapping the area of interest and identifies all the individuals who could be displaced by wind energy development."

[b] Expected Trips and Expected Vessels represent, "A count of trips and vessels weighted by probability of overlap with the area of interest, to generate a more precise expected count of trips and vessels fishing within the area."

Table 3.6.1-16. Commercial fishing revenue of federally permitted vessels in the Lease Area by the ten most affected ports (2008–2022) and commercial fishing engagement and reliance (2018)

Port and State	15-Year Revenue	15-Year Landings	Commercial Fishing Engagement Categorical Ranking [a]	Commercial Fishing Reliance Categorical Ranking [b]
Point Judith, RI	$2,409,000	2,113,000	High	Medium
New Bedford, MA	$2,062,000	2,385,000	High	Medium
Montauk, NY	$997,000	575,000	High	Medium
Newport, RI	$499,000	436,000	NA	NA
Chatham, MA	$473,000	506,000	High	High
Fairhaven, MA	$398,000	381,000	High	Low
Beaufort, NC	$212,000	74,000	High	Low
Newport New, VA	$138,000	63,000	High	Medium
Little Compton, RI	$135,000	148,000	Medium-High	Low
Westport, MA	$122,000	90,000	Medium	Medium
Total	**$7,445,000**	**6,771,000**		

Source: NMFS 2024; NOAA Fisheries Office of Science and Technology 2021.
[a] Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. A high rank indicates more engagement. Rankings are for 2018.
[b] Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity. A high rank indicates more reliance. Rankings are for 2018.
Notes: Data is for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Revenue is in 2021 dollars with total revenue rounded to nearest thousand.

Table 3.6.1-17. Total revenue and total landed pounds by state in the Lease Area (2008–2022)

State	15-Year Revenue	15-Year Landings
Massachusetts	$3,304,000	3,837,000
Rhode Island	$3,169,000	2,899,000
New York	$1,053,000	599,000
North Carolina	$306,000	106,000
Virginia	$286,000	127,000
New Jersey	$151,000	54,000
Connecticut	$148,000	122,000
Maryland	$33,000	11,000
New Hampshire	$6,000	3,000
Maine	$1,000	2,000

Source: NMFS 2024.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.

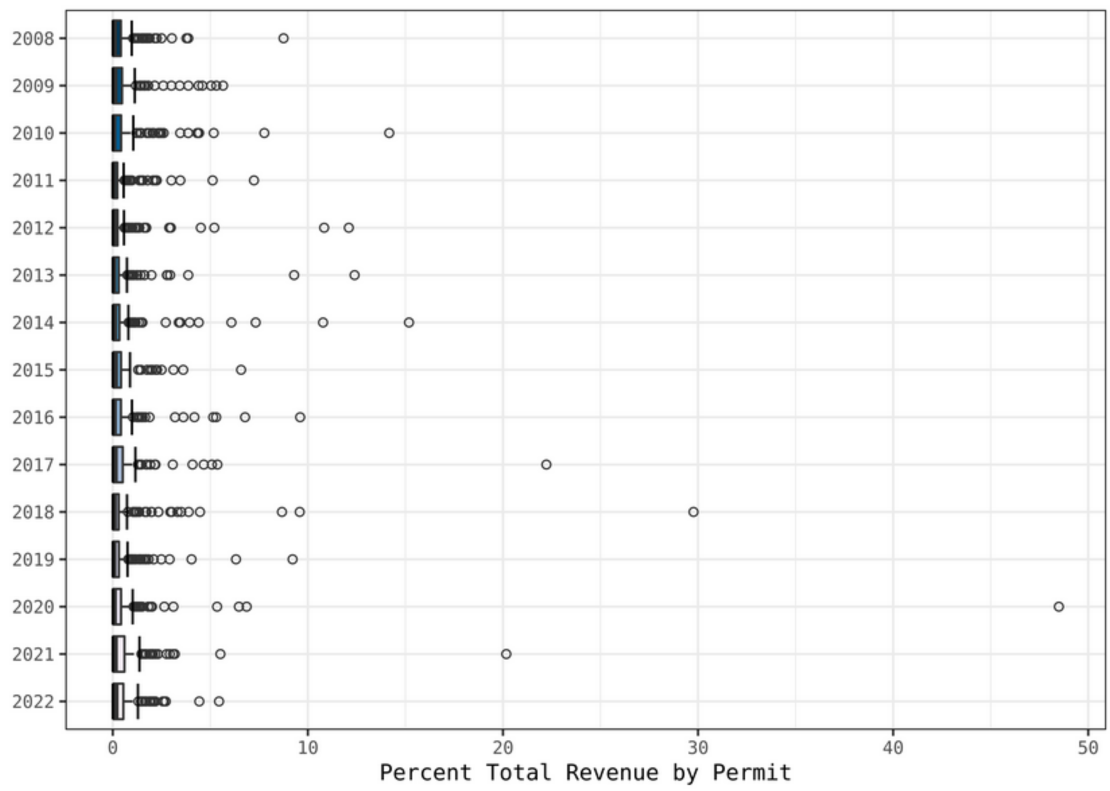
Table 3.6.1-18. Fifteen-year maximum percent annual regional fishing revenue from the most dependent ports in the Lease Area

Port	State	Percent of Revenue	Percent of Landings
Westport	Massachusetts	0.60%	0.49%
Manasquan	New Jersey	0.41%	0.14%
Little Compton	Rhode Island	0.37%	0.27%
Newport	Rhode Island	0.36%	0.36%
Montauk	New York	0.33%	0.29%
Beaufort	North Carolina	0.29%	0.23%
Point Judith	Rhode Island	0.29%	0.26%
Chatham	Massachusetts	0.25%	0.18%
Fairhaven	Massachusetts	0.24%	0.16%
Fall River	Massachusetts	0.22%	0.14%

Source: NMFS 2024.

To analyze differences in the economic importance of fishing grounds in the Lease Area across the commercial fishing fleet, NMFS analyzed the percentage of each permit's total commercial fishing revenue attributed to catch in the Lease Area during 2008 through 2022 (NMFS 2024).The vessel-level annual revenue percentages were divided into quartiles, which were created by ordering the data from lowest to highest percentage value and then dividing the data into four groups of equal size. The first quartile represents the lowest 25 percent of ranked percentages, while the fourth quartile represents the highest 25 percent.

The distributions of the vessel-level annual revenue percentages for the Lease Area that NMFS presented are provided in Figure 3.6.1-3. The boxplot begins at the first quartile, or the value beneath which 25 percent of all vessel-level revenue percentages fall. A thick line in the box identifies the median, the observation that 50 percent of vessel-level revenue percentages are above or beneath. The box ends at the third quartile, or the vessel-level revenue percentage beneath which 75 percent of observations fall. This analysis was conducted in the statistical software R, using the ggplot2 package (Wickham 2016). The upper whisker extends from the hinge to the largest value no further than 1.5 * IQR from the hinge (where IQR is the inter-quartile range, or distance between the first and third quartiles). The lower whisker extends from the hinge to the smallest value at most 1.5 * IQR of the hinge. Data beyond the end of the whiskers are called "outlying" points and are plotted individually. Nonparametric estimates of the minimum and maximum values are also indicated by the "whiskers" (dashed line terminating in a vertical line) that jut out from each side of the box. Any points outside of these whiskers are vessel-level revenue percentages that are considered outliers. In the context of this analysis, an outlier is a vessel that derived an exceptionally high proportion of its annual revenue from the Lease Area in comparison to other vessels that fished in the area. Outliers typically lie an abnormal distance from other values in a sample.



Source: NMFS 2024.

Figure 3.6.1-3. Annual permit revenue percentage boxplots for the Lease Area

Table 3.6.1-19 presents the minimum, first quartile, median, third quartile, and maximum revenue values for each portion of the Lease Area as delineated by NMFS from 2008 through 2022. Table 3.6.1-20 shows the number of revenue outliers by year from 2008 through 2022. A total of 75 percent of the permit revenue from the Lease Area derived less than 0.38 percent of their total annual revenue from the Lease Area (Table 3.6.1-19). The highest percentage of total annual revenue attributed to catch is 48 percent (Table 3.6.1-19). Although outliers derived a high proportion of their annual revenue from the Lease Area in comparison to other vessels that fished in the area, Figure 3.6.1-3 and Table 3.6.1-20 show that, in any given year, the revenue percentage for the majority of vessels was less than 0.38 percent and the majority of outliers derived less than 5 percent of their total revenue from the Lease Area. In 8 of the 15 years, there was one permit holder (two in 2012, and two in 2014) who derived greater than 10 percent of their revenue from the Lease Area. The interannual variation of the extreme outliers varies greatly, with reliance fluctuating from approximately 13 percent to 15 percent, up to 48 percent in 2020, and down to approximately 5 percent in 2022. As such, no permit holder consistently relies on the Lease Area for a majority of their total revenue; given the number of outliers in the data, the median is a better representation of the data versus the mean (the mean would be unduly inflated in a year like 2020), thus, the majority of permit holders derive less than 0.1 percent of their total revenue from the Lease Area. Table 3.6.1-21 and Table 3.6.1-22 show the potential total number of trips and vessels that may have overlapped the Lease Area, thus, identifying all the individuals who could be displaced by wind energy development and the number of trips and vessels weighted by the probability of overlap with the Lease Area, to generate a more precise expected count of trips and vessels in the Lease Area. Of the total number of trips and vessels that occurred in and around the Lease Area, a small proportion of them are calculated to actively fish the Lease Area in any given year.

Table 3.6.1-19. Analysis of 15-year permit revenue percentage boxplots for the Lease Area

Minimum	1st Quartile	Median	3rd Quartile	Maximum
0%	0.02%	0.09%	0.38%	48%

Source: NMFS 2024.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.

Table 3.6.1-20. Total number of federally permitted vessel revenue outliers from the Lease Area (2008–2022)

Year	Number of Revenue Outliers
2008	27
2009	20
2010	24
2011	26
2012	27
2013	22
2014	22
2015	14
2016	18
2017	17
2018	28
2019	27
2020	20
2021	18
2022	20

Source: Developed using data from NMFS 2024.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.

Table 3.6.1-21. Total number of vessels and trips and total expected number of vessels and trips by year in the Lease Area (2008–2022)

Year	Number of Trips [a]	Number of Vessels [a]	Expected Trips [b]	Expected Vessels [b]
2008	1,558	207	41	34
2009	1,422	188	39	31
2010	1,241	188	51	36
2011	1,152	192	30	26
2012	1,573	222	42	30
2013	1,695	228	39	31
2014	1,853	209	37	27
2015	1,719	191	38	29
2016	1,917	225	49	33
2017	1,716	181	60	44
2018	1,310	216	41	33
2019	1,402	253	39	35
2020	1,150	200	37	32
2021	1,201	189	33	28

Source: Developed using data from NMFS 2024.

[a] Number of Trips and Number of Vessels represent, "An upper bound on the counts as it does not take into account the probability of these trips actually overlapping the area of interest and identifies all the individuals who could be displaced by wind energy development."

[b] Expected Trips and Expected Vessels represent, "A count of trips and vessels weighted by probability of overlap with the area of interest, to generate a more precise expected count of trips and vessels fishing within the area."

Table 3.6.1-22 Average number of vessels and trips and average expected number of vessels and trips by FMP in the Lease Area (2008–2022)

FMP	Average Number of Vessels [a]	Average Number of Trips [a]	Average Expected Number of Vessels [b]	Average Expected Number of Trips [b]
Summer Flounder, Scup, Black Sea Bass	114	706	16	18
Monkfish	127	644	18	24
Mackerel, Squid, and Butterfish	92	615	14	15
ASMFC FMP	73	492	9	9
Skates	91	428	13	18
Small-Mesh Multispecies	71	417	11	12

FMP	Average Number of Vessels [a]	Average Number of Trips [a]	Average Expected Number of Vessels [b]	Average Expected Number of Trips [b]
Bluefish	71	364	10	10
No Federal FMP	78	298	5	5
Northeast Multispecies	53	127	2	3
Tilefish	47	124	2	2
Spiny Dogfish	17	48	3	5
Surfclam, Ocean Quahog	9	48	1	1
Highly Migratory Species	15	43	2	2
Sea Scallop	25	36	1	1
SERO FMP	9	14	1	1
Atlantic Herring	6	10	1	1
Total	898	4,414	108	127

Source: NMFS 2024.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.
[a] Number of Trips and Number of Vessels represent, "An upper bound on the counts as it does not take into account the probability of these trips actually overlapping the area of interest and identifies all the individuals who could be displaced by wind energy development."
[b] Expected Trips and Expected Vessels represent, "A count of trips and vessels weighted by probability of overlap with the area of interest, to generate a more precise expected count of trips and vessels fishing within the area."

A business primarily engaged in commercial fishing 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 $11 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 in Table 3.6.1-23. For those businesses with historical fishing in the Lease Area, Table 3.6.1-24 presents the revenue generated inside the Lease Area against the total revenue from those same entities. Revenue values have been deflated to 2022 dollars. Commensurate with the trends already described the Lease Area revenue is a fraction of the revenue derived from the geographic analysis area (Table 3.6-24).

Table 3.6.1-23. Total number of entities engaged in federally managed fishing in the Northeast region

Year	Business Type	Number of Entities	Revenue
2020	Large Business	11	$172,982,000
2020	Small Business	1,042	$394,946,000
2021	Large Business	11	$209,355,000
2021	Small Business	1,087	$530,723,000
2022	Large Business	11	$147,391,000
2022	Small Business	1,119	$376,978,000

Source: NMFS 2024.

Table 3.6.1-24. Revenue in the Lease Area compared to total revenue from all areas for entities active in the Lease Area, by business category

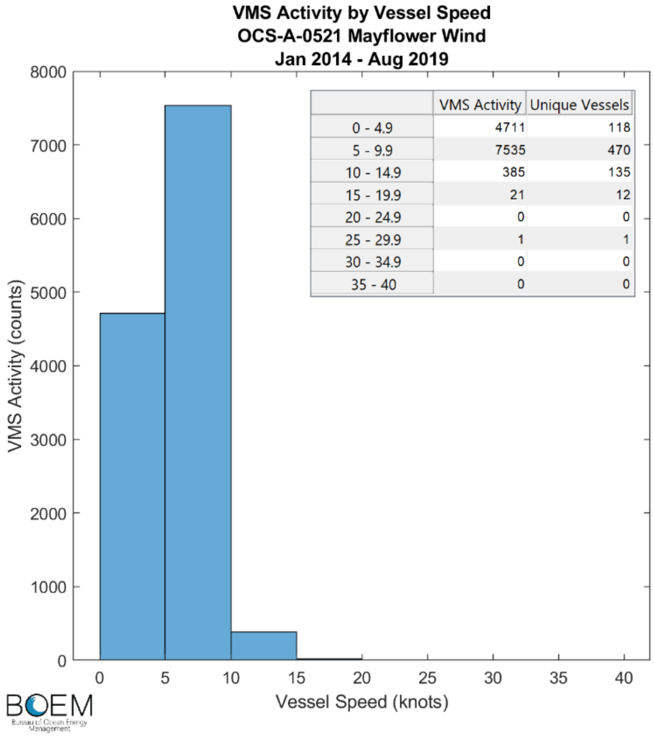
Year	Business Type	Number of Entities	Lease Area Revenue	Revenue
2020	Large Business	9	$52,000	$144,853,000
2020	Small Business	141	$471,000	$93,131,000
2021	Large Business	7	$34,000	$135,983,000
2021	Small Business	138	$612,000	$70,077,000
2022	Large Business	8	$68,000	$99,537,000
2022	Small Business	161	$800,000	$102,527,000

Source: NMFS 2024.

Commercial fishing regulations include requirements for VMS. A VMS is a satellite surveillance system that monitors the location and movement of commercial fishing vessels; therefore, it is a good data source for understanding the spatial distribution of fishing vessels engaged in FMP fisheries in the Northeast region. However, VMS coverage is not universal for all fisheries, with some fisheries (summer flounder, scup, black sea bass, bluefish, American lobster, spiny dogfish, skate, whiting, and tilefish) not covered at all by VMS. In 2018, there were 912 VMS-enabled vessels operating in the Northeast across all fisheries. These 912 vessels represented a substantial portion (71–87 percent) of summer flounder, scup, black sea bass, and skate landings, and greater than 90 percent of landings for scallops, squid, monkfish, herring, mackerel, large mesh multispecies, whiting, surfclams, and ocean quahogs. 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 in all reasonably foreseeable project areas (NMFS 2021a).

Using VMS data conveyed in individual position reports (pings) from January 2014 to August 2019, BOEM compiled information about fishing activities in the Lease Area. From the VMS data, it is interpreted that vessels with speeds less than 5 knots (2.6 m/s) are actively engaged in fishing, although vessels may also be using slower speeds to transit or be engaged in other activities, such as processing at sea. Vessels traveling faster than 5 knots (2.6 m/s) are generally interpreted to be transiting. Figure

3.6.1-4 indicates that only about 16 percent of the 736 unique vessels identified operating in the Lease Area during the above-referenced period were actively fishing. BOEM also developed polar histograms using the VMS data that show the directionality of VMS-enabled vessels operating in the Project area and the targeted FMP fishery (Figure 3.6.1-5 through Figure 3.6.1-9). The larger bars in the polar histograms represent a greater number of position reports showing fishing vessels moving in a certain direction in the Project area. The polar histograms differ with respect to their scales.



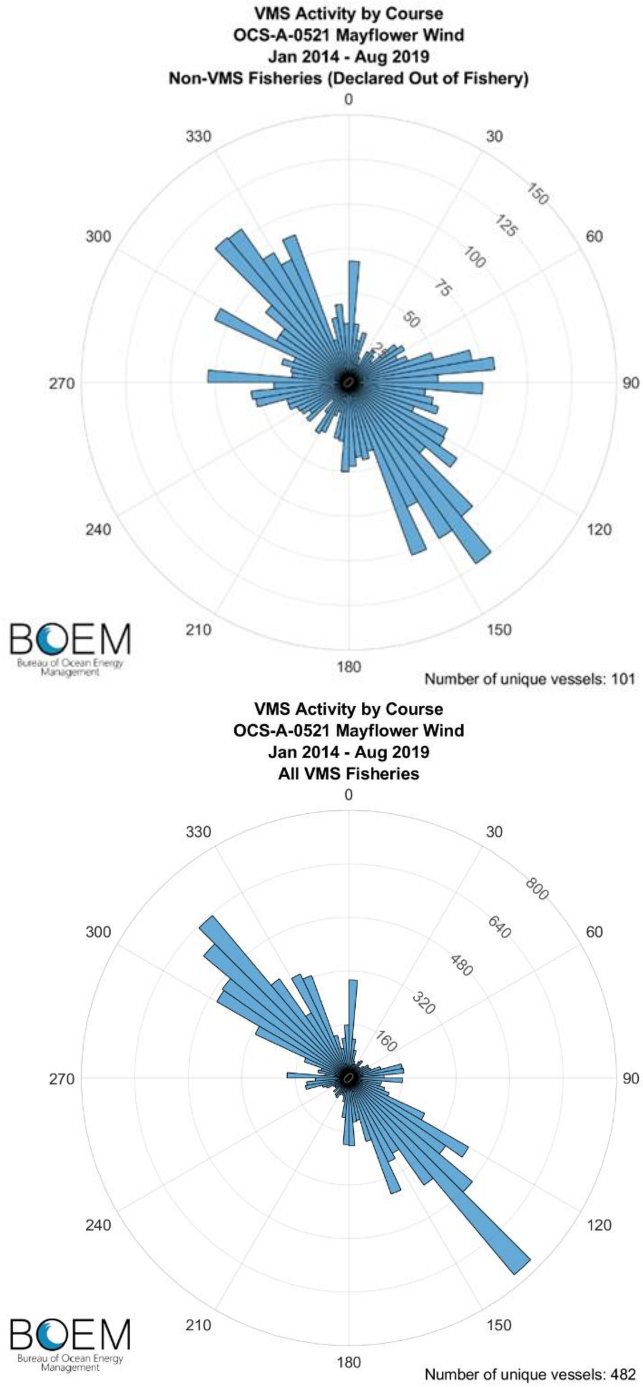
Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.6.1-4. VMS activity and unique vessels operating in the Lease Area, January 2014–August 2019

Figure 3.6.1-5 shows that for all activities (transiting and fishing combined), most of the 482 unique vessels participating in a VMS fishery generally operated in a northwest–southeast pattern with a secondary pattern of north–south. Most of the 201 unique vessels participating in a non-VMS fishery[2] followed the northwest–southeast orientation with a secondary pattern of east–west. Figure 3.6.1-6 shows multiple orientations for VMS fishery vessels fishing in the Lease Area; vessels followed a north-south, east-west, and northwest-southeast pattern. A more pronounced east–west fishing orientation was observed for non-VMS fishery vessels actively fishing in the Lease Area, but generally followed the VMS fishery vessels patterns. Figure 3.6.1-7 shows that VMS and non-VMS fishery vessels transiting the Lease Area followed primarily a northwest–southeast pattern. For individual FMP fisheries, Figure 3.6.1-8 shows that the orientation of vessels transiting the Lease Area generally followed a northwest-

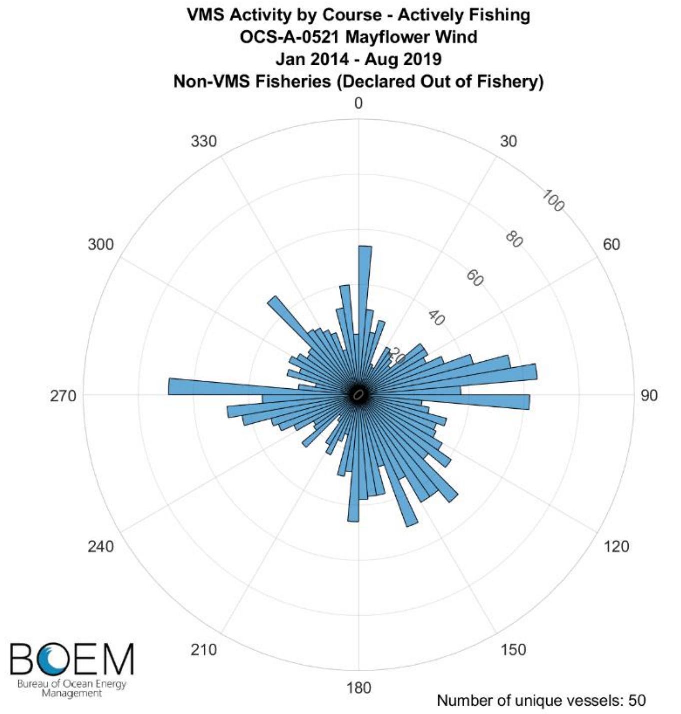
[2] These are fishing vessels that are transmitting VMS data after having declared themselves as participating in a non-VMS fishery (e.g., lobster, river herring).

southeast pattern except for those in the Monkfish FMP fishery, which followed a north-south pattern primarily and northwest-southeast pattern secondarily. Figure 3.6.1-9 shows that the orientation of vessels actively fishing in the Lease Area varied by FMP fishery.

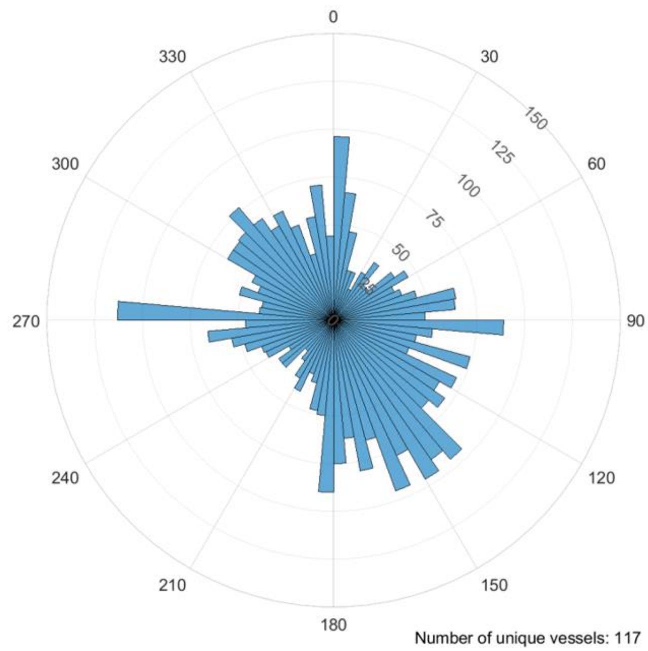


Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.6.1-5. VMS bearings for all activity by VMS and Non-VMS fishery vessels in the Lease Area, January 2014–August 2019

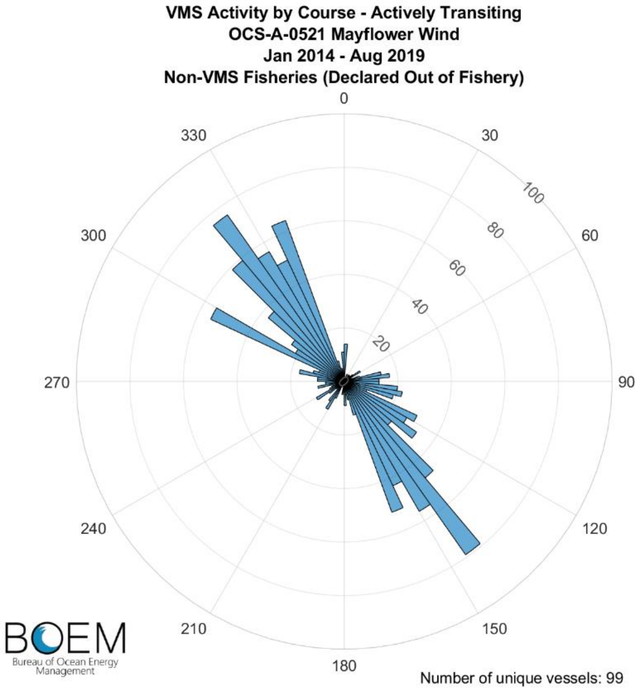


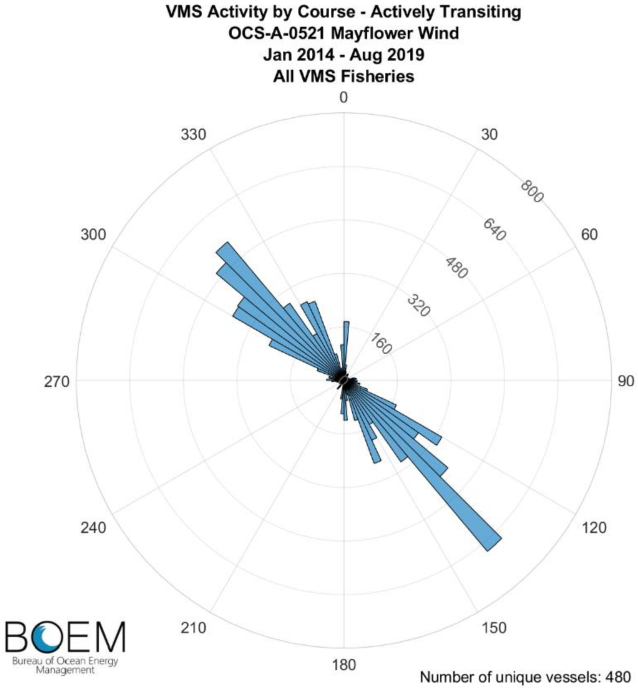
VMS Activity by Course - Actively Fishing OCS-A-0521 Mayflower Jan 2014 - Aug 2019 All VMS Fisheries



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

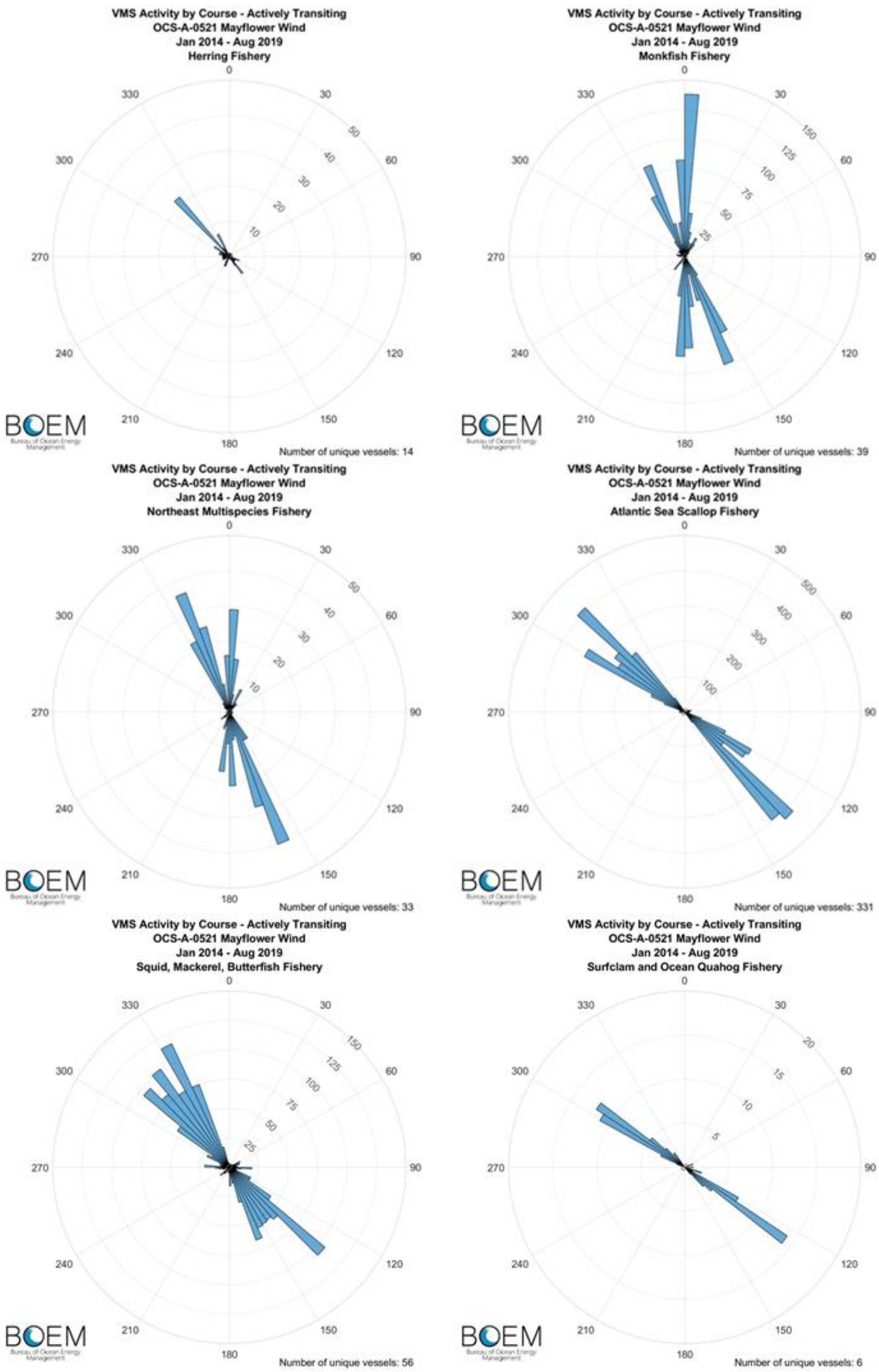
Figure 3.6.1-6. VMS bearings for fishing activity by VMS and Non-VMS fishery vessels in the Lease Area, January 2014–August 2019





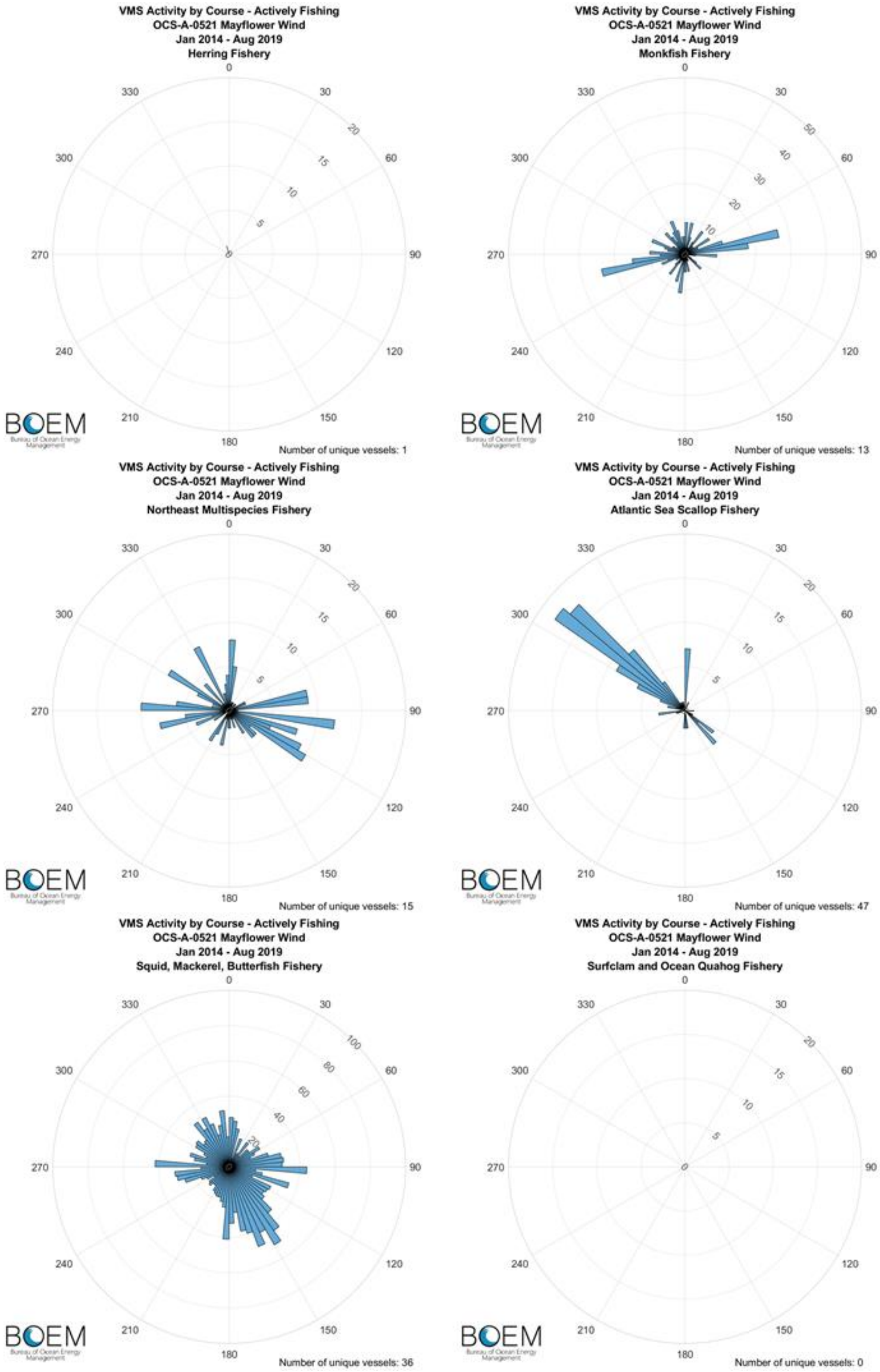
Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.6.1-7. VMS bearings for transiting VMS and non-VMS fishery vessels in the Lease Area, January 2014–August 2019



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

Figure 3.6.1-8. VMS bearings for transiting VMS and non-VMS fishery vessels in the Lease Area, January 2014–August 2019



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

Figure 3.6.1-9. VMS bearings for actively fishing VMS and non-VMS fishery vessels in the Lease Area, January 2014–August 2019

Fishing activity occurs more frequently in the ECCs than in the Lease Area. VMS data for monkfish, large- and small-mesh multispecies, pelagics, scallop, squid, and surfclam/ocean quahog all had VMS activity in the medium to very high range from 2011–2014 (COP Appendix V, Section 2.4, Figures 2-17 and 2-18; SouthCoast Wind 2024). Bottom trawling for squid is the primary fishery that operates in and near the Lease Area. VMS data from 2015–2016 show low to medium-high levels of squid fishing in the northwest corner of the Lease Area, and very high fishing effort north of the Lease Area in both ECCs (COP Appendix V, Section 2.4, Figure 2-18; SouthCoast Wind 2024). Other fisheries with low to medium-low fishing effort in the Lease Area include monkfish, occurring throughout the Lease Area, large- and small-mesh fisheries in the southeast corner, and pelagics co-occurring in the northeast corner with squid.

Further, VTR data shows high fishing activity in both ECCs for bottom trawl, dredge, gillnet, longline and pots and traps for 2006–2010 and 2011–2015 (COP Appendix V, Section 2.4, Figure 2-20; SouthCoast Wind 2024). Generally, fishing activity increases closer to shore, along the ECCs and in Vineyard Sound and outside of Narragansett and Buzzards Bay. General trends were the same between the two analyzed time periods, with variations in fished areas in the Lease Area, for instance less trawl fishing appeared to occur during the 2011–2015 time series and most dredging occurred outside the Lease Area from 2011–2015. Additionally, HMS logbook effort from 2011 to 2020 shows the majority of HMS effort occurs farther offshore near the shelf break (Figure 3.6.1-10).

NMFS calculated the estimates of vessel revenue and landings (2008–2021) from the Brayton Point and Falmouth ECCs, similar to the Lease Area, using a buffered distance of 1 nm on either side of the proposed cable corridor. The maximum Falmouth ECC width is 3,280 feet (1,000 meters) and the maximum Brayton Point ECC width is 2,300 feet (700 meters). SouthCoast Wind intends to maintain these corridors to allow for maneuverability during installation and maintenance. The cable corridors may be locally narrower or wider to accommodate sensitive locations and to provide sufficient area at landfall locations, at crossing locations, or for anchoring. The estimated seabed disturbance, however, around each installed cable, for both ECCs, is estimated at 19.7 feet (6 meters) per cable. Thus, the landings and revenue data calculated by NMFS are likely overestimates of the affected species, given the localized and temporary impacts of cable installation. The NMFS data, however, do not include state-permitted vessels, and only represents vessels issued a federal fishing permit, and is likely an underestimate of the fishery landings and revenue that could be affected along these corridors.

The most affected FMPs for the Falmouth ECC are mackerel, squid, butterfish, summer flounder, scup, black sea bass, small-mesh multispecies, species with no federal FMP, and surfclam/ocean quahog. The most affected species from these FMPs is longfin squid. Other affected species include silver hake, scup, summer flounder, channeled whelk, black sea bass, conchs, American lobster, and sea scallops. Consequently, the most affected gear types fishing in the buffered zone are bottom and midwater trawls (NMFS 2022b).

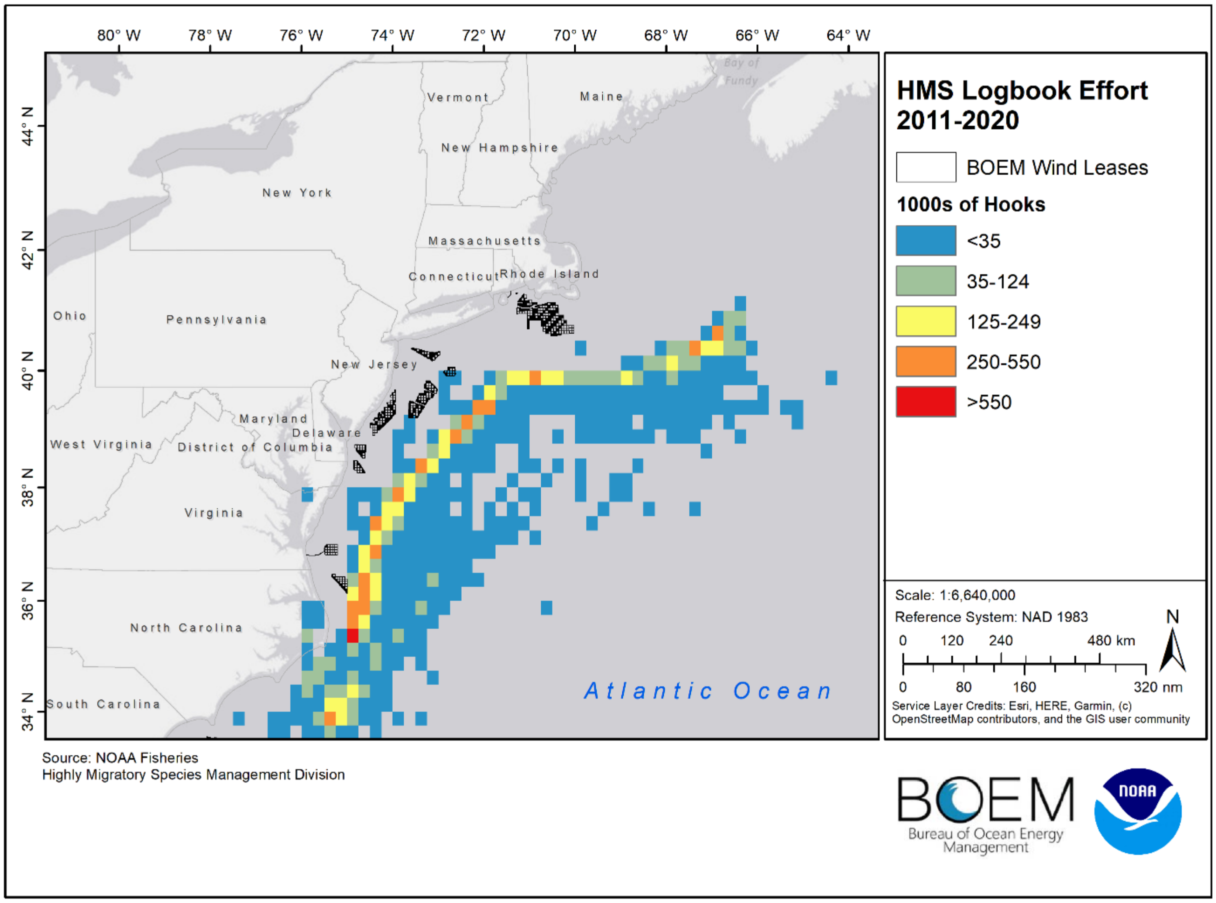


Figure 3.6.1-10. HMS Logbook Effort (2011–2020)

The most affected FMPs for the Brayton Point ECC are mackerel, squid, butterfish, summer flounder, scup, black sea bass, species managed by ASMFC FMPs, surf clam and ocean quahog, and species not managed under a federal FMP. Similar to the Falmouth ECC, the most affected species by revenue is longfin squid; however, exceptionally high landings of Atlantic herring in 2013 put Atlantic herring as the most affected species by landings. Skate was the second-most affected species by landings and eighth-most affected by revenue. Other affected species include American lobster, summer flounder, sea scallop, scup, channeled whelk, and black sea bass. The most affected gear types are bottom and midwater trawl; however, all gear types, derived more revenue from the Brayton Point ECC relative to the Falmouth ECC (NMFS 2022c).

There are currently no ocean-based, commercial-scale finfish aquaculture operations in Massachusetts or Rhode Island state waters. Massachusetts cities and towns manage the shellfish fisheries in all waters within their boundaries that are not closed by the Massachusetts Division of Marine Fisheries for public health or other reasons, except for the commercial harvest of Atlantic surfclams and ocean quahogs which remain under federal control. All shellfish aquaculture requires permits from Massachusetts Division of Marine Fisheries and permits from the nearest municipality. A commercial harvest permit is also required to sell shellfish in Massachusetts.

No aquaculture leases in Falmouth, Massachusetts are located near the proposed Landfall Site. In 2017, the Town of Falmouth developed a Rotational Aquaculture Plan to address estuaries in the area that would be suitable for aquaculture production (Town of Falmouth 2017). Nine of 15 estuaries in Falmouth are conditionally approved for shellfish production and have historically had a productive bottom for wild harvesting in the area. Two of the 15 are currently open for shell fishing. The town proposes a rotational system because it accomplishes the goal of allowing private aquaculture to expand into the two estuaries currently open to shell fishing. Other estuaries that have been identified by the town for the proposed aquaculture program include Megansett Harbor, Rands Canal, Quissett Harbor, Great Pond, Bournes Pond, and Waquoit Bay/Eel Pond. There are no mapped, permitted commercial aquaculture operations in or near Brayton Point in Somerset, Massachusetts.

In 2021, the value of Eastern Oyster aquaculture was $29.6 million for 54.6 million pieces (individual oysters) (MADMF 2021b). The value of Quahog aquaculture was $4.3 million for 4.3 million pieces (individual quahogs) (MADMF 2021b). The value of other cultured shellfish species including bay scallops, softshell clams and surf clams, and kelp does not substantially add to the aquaculture landings value and were not reported for confidentiality (MADMF 2021b).

The CRMC is the regulatory body that manages aquaculture leasing and permitting within Rhode Island state waters. Much of the Rhode Island aquaculture industry, which primarily produces oysters, occurs in the state's several inland salt ponds, but there are some permitted aquaculture site operations in open, nearshore waters in Narragansett Bay (RIDEM 2021). There are active and permitted aquaculture sites, floating fish traps, fixed monitoring sites, and oyster research sites within Rhode Island state waters (RIDEM 2021). Although there are several approved aquaculture areas in the Cove on Aquidneck Island and adjacent to Hog Island, Rhode Island, the Brayton Point ECC is not directly adjacent or collocated with any of these sites. The floating fish trap fishery is unique to Rhode Island and targets wild fish but is permitted and managed through a mechanism similar to aquaculture operations. Although there are permitted and actively fished floating fish traps in the mouth of and in the Sakonnet River, none of these occur in the proposed Brayton Point ECC. Similar to Massachusetts, in Rhode Island, the eastern oyster was the number one aquaculture product with 10.1 million pieces sold for consumption valued at approximately $6.9 million (CRMC 2021).

For-Hire Recreational Fishing in the Offshore Project Area

As with the commercial fishing industry, the for-hire recreational fishing fleets contribute to the economy through direct employment, income, and gross revenues of the for-hire businesses, as well as through spending on products and services to maintain and operate their vessels, triggering further indirect multiplier effects that are dependent upon the initial demands of the for-hire fleet (Steinback and Brinson 2013). 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., whose participants are part of a preformed group of anglers (NMFS 2021c). The recreational fleet in Massachusetts consists of approximately 430 charter and head boats, and Rhode Island's fleet consists of 96 charter and head boats which are docked near all major inlets and bays (COP Appendix V, Section 3; SouthCoast Wind 2024).

SouthCoast Wind has compiled information from recreational fishing trips to identify the areas considered prime fishing areas (Table 3.6.1-25 and COP Volume 2, Section 11.1.3.2, Figure 11-22 and Tables 11-16 through 11-18; SouthCoast Wind 2024). These specific areas are described as those that consistently produce good catches of commonly caught recreational fish species in Massachusetts and Rhode Island, most likely because the physical characteristics of those locations provide optimum fish habitat. Historically productive fishing grounds, for example, often occur around rock piles, shallow ridges, artificial and natural reefs, deep sloughs, and bay inlets.

Table 3.6.1-25. For-Hire recreational fishing locations within or near the Offshore Project area

Name of Fishing Location	Location Fish	Fish Species Targeted [a]
The Dump	Approximately 100 square miles (260 square kilometers) in size; according to NOAA charts located west of the Lease Area	Yellowfin tuna, albacore tuna, and mahi-mahi
The Star	Along the 25-fathom line outside the Offshore Project area	Yellowfin tuna
Gordon's Gully	Along the 25-fathom line outside the Offshore Project area	Bluefin tuna, Mako, and Thresher sharks
The Owl	Along the 20-fathom line outside the Offshore Project area	Bluefin tuna, Mako, and Thresher sharks
Mutton Shoal	Located in Muskeget Channel	Striped bass, bluefish, false albacore, bonito, summer flounder, black sea bass, and scup
Hawes Shoal	North of Muskeget Channel	Striped bass, bluefish, false albacore, bonito, summer flounder, black sea bass, and scup
Eldridge Shoal	In Nantucket Sound	Striped bass, bluefish, false albacore, bonito, summer flounder, black sea bass, and scup
Wreck Shoal	In Nantucket Sound	Striped bass, bluefish, false albacore, bonito, summer flounder, black sea bass, and scup
Colliers Ledge	In Nantucket Sound	Striped bass, bluefish, false albacore, bonito, summer flounder, black sea bass, and scup
The Hooter	Marker for the end of Muskeget Channel Southwest of Martha's Vineyard	Striped bass, bluefish, bonito, and false albacore
Brown's Ledge	Offshore of Sakonnet Point	Scup, black sea bass, striped bass, summer flounder, bluefish
Southwest Shoal	Southwest of Martha's Vineyard	Scup, black sea bass, striped bass, summer flounder, bluefish

Name of Fishing Location	Location Fish	Fish Species Targeted [a]
Beavertail State Park	The opening of West Passage, inshore	Scup, black sea bass, striped bass, summer flounder, bluefish
Brenton Point State Park	The opening of West Passage, inshore	Scup, black sea bass, striped bass, summer flounder, bluefish
Sachuest Point National Wildlife Refuge	The opening of East Passage, inshore	Scup, black sea bass, striped bass, summer flounder, bluefish
Breakwater at Sakonnet	Inshore of the East Passage, Sakonnet River	Scup, black sea bass, striped bass, summer flounder, bluefish

[a] For-hire recreational fishing typically occurs from spring through fall for summer flounder, black sea bass, and scup and in late summer/early fall for yellowfin, bluefin, and albacore tuna, sharks, bonito, and false albacore. Striped bass recreational fishing typically occurs in the spring, summer, and fall.

NMFS works with state and local partners to monitor the recreational fishery catch and effort through the Marine Recreational Information Program (COP Volume 2, Section 11.1.1.3; SouthCoast Wind 2024). The NMFS analyzed the total revenue of party/charter trips by year (Table 3.6.1-26) by multiplying the annual mean combined charter and party for-hire fee of each state by the total number of anglers for each year. Revenue values have been deflated to 2022 dollars. All numbers have been rounded to the nearest thousand. Suppressed years have been set to when the total was calculated.

Table 3.6.1-26. Total party/charter revenue by year for the Lease Area

Year	Annual Revenue
2008	Suppressed
2009	Suppressed
2010	$8,000
2011	Suppressed
2012	$7,000
2013	$6,000
2014	No Trips
2015	No Trips
2016	No Trips
2017	No Trips
2018	No Trips
2019	No Trips
2020	No Trips
2021	Suppressed
2022	Suppressed
Total	$21,000

Source: NMFS 2024

The tables below indicate the total number of vessel trips (Table 3.6.1-27) and angler trips (Table 3.6.1-28) by port. Data for ports that cannot be displayed due to confidentiality protection or because no known port was reported are displayed as “all other ports” for the affiliated landing state. There is a general lack of recreational fishing effort occurring in the Lease Area.

Table 3.6.1-27. Total number of vessel trips by port and year in the Lease Area

Port	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
All Other Ports, MA	1	1	2	0	2	2	0	0	0	0	0	0	0	0	0
All Other Ports, NH	0	0	1	3	1	0	0	0	0	0	0	0	0	2	0
All Other Ports, NY	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
All Other Ports, RI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	1	1	3	3	3	4	0	0	0	0	0	0	0	2	1

Source: NMFS 2024

Table 3.6.1-28. Total number of angler trips by port and year in the Lease Area

Port	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
All Other Ports, MA	6	39	35	0	19	19	0	0	0	0	0	0	0	0	0
All Other Ports, NH	0	0	18	112	30	0	0	0	0	0	0	0	0	52	0
All Other Ports, NY	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0
All Other Ports, RI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Total	6	39	53	112	49	43	0	0	0	0	0	0	0	52	6

Source: NMFS 2024

In 2016, over 150,000 for-hire trips occurred in southern New England, and approximately 4 million shore and private angler fishing trips were reported in southern New England. For-hire fishing generates thousands of jobs (Table 3.6.1-29), and both direct and indirect sales from for-hire and private recreational fishing generated over $1.8 billion in southern New England in 2016 (COP Appendix V, Section 3, and COP Volume 2, Section 11.1.3.1; SouthCoast Wind 2024). A wide variety of species/groups were reported, with the highest numbers and diversity of species in offshore areas. Striped bass (*Morone saxatilis*) is the primary species targeted and caught by recreational anglers, with over 4 million pounds reported in 2019 in Massachusetts and Rhode Island combined (Table 3.6.1-30). Of the ten most commonly caught species in Massachusetts and Rhode Island, (COP Volume 2, Section 11.1.3.2, Tables 11-16 and 11-17; SouthCoast Wind 2024) four (Atlantic mackerel, scup, black sea bass, and bluefish) were reported caught in the Offshore Project area, with most catch associated near the ECCs. In general, the species most likely to be targeted in the Lease Area are highly migratory species. The Lease Area, however, compared to other areas in the geographic analysis area, is not a hotspot of recreational fishing activity for HMS (Figure 3.6.1-11).

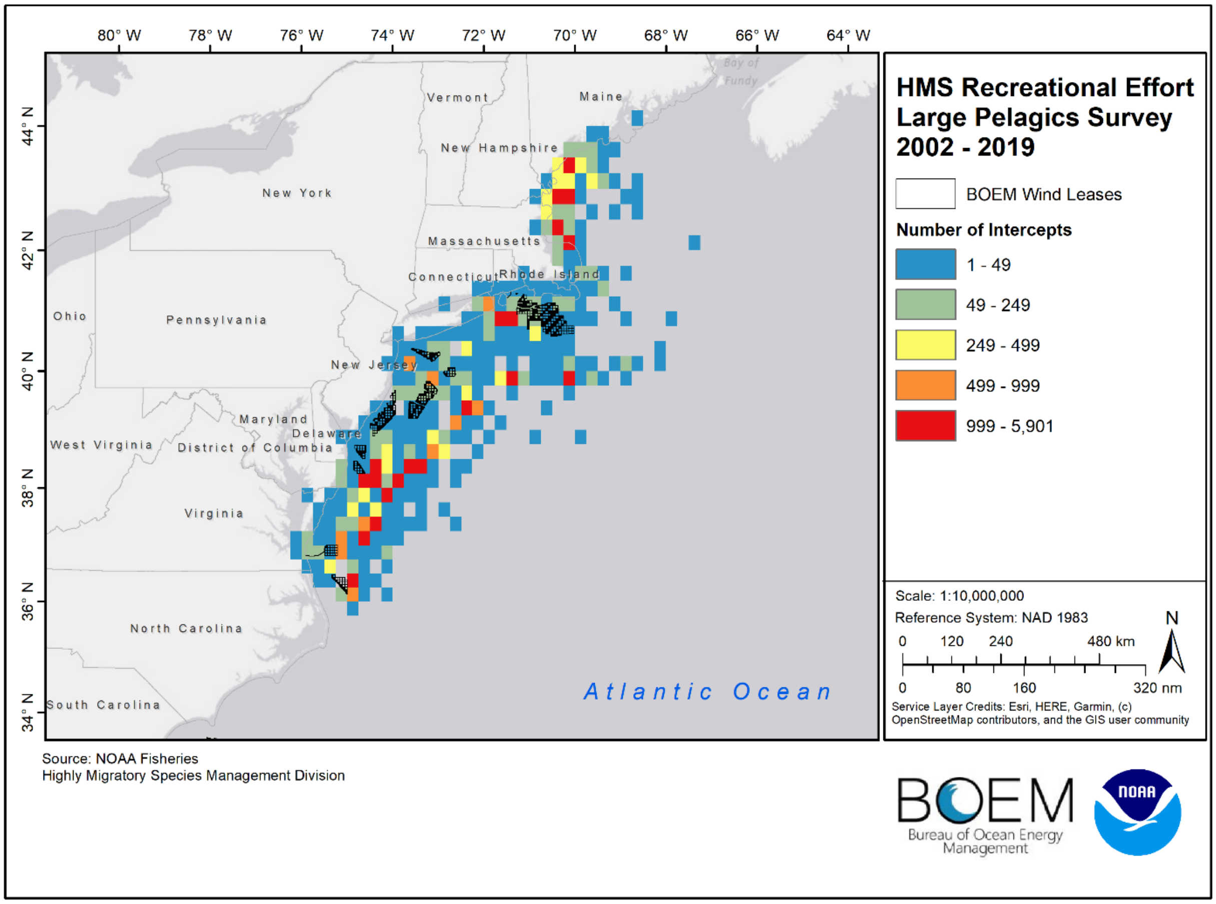


Figure 3.6.1-11. HMS Recreational Effort Large Pelagics Survey 2002–2019

Table 3.6.1-29. Recreational Fishery Trips and Jobs Generated in Southern New England in 2016

State	Trips	Jobs Generated
For-Hire		
Massachusetts	93,000	350
Rhode Island	45,000	113
Connecticut	38,000	63
Shore and Private Anglers		
Massachusetts	2,000,000	1,109
Rhode Island	1,000,000	198
Connecticut	1,000,000	295

Source: COP Volume 2, Appendix V, SouthCoast Wind 2024

Table 3.6.1-30. Commonly Caught Recreational Fish Species in Massachusetts and Rhode Island (2019)

Rank	Species	Pounds (lbs)
Massachusetts		
1	Striped bass	2,697,766
2	Atlantic Mackerel	2,340,416
3	Scup	1,924,223
4	Black sea bass	1,361,124
5	Haddock	1,223,756
6	Atlantic menhaden	846,444
7	Bluefish	719,137
8	Tautog	646,039
9	Acadian redfish	618,604
10	Little tunny	227,636
Rhode Island		
1	Scup	2,856,492
2	Striped bass	2,299,617
3	Tautog	1,483,139
4	Black sea bass	1,225,072
5	Bluefish	932,001
6	Summer flounder	837,116
7	Atlantic cod	143,753
8	Atlantic menhaden	135,763
9	Atlantic Bonito	102,213
10	Striped sea robin	53,819

Source: COP Volume II, Appendix V, SouthCoast Wind 2024

Recreational harvest of shellfish and finfish is likely in the Sakonnet River and in and around the landfall locations for both ECCs where fishers target American lobster, bay scallops, quahogs, whelk, and various crab species.

A total of 0.6 percent of for-hire vessels that fished in the Lease Area derived less than 2 percent of their total annual expenditures from the area (COP Appendix V, Section 3.23, Table 3-13; SouthCoast Wind 2024). Of the states with residents likely to fish in the Lease Area, Massachusetts is the most exposed with 4.4 percent of total expenditures exposed to offshore wind activities (COP Appendix V, Section 3.23, Table 3-12; SouthCoast Wind 2024).

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 in Table 3.6.1-31. There was not enough recreational fishing activity to generate a table showing the value of the Lease Area relative to the wider region.

Table 3.6.1-31. Total number of entities engaged in federally managed fishing in the northeast region, and their total revenue by business category

Year	Business Type	Number of Entities	Revenue
2020	Small Business	322	$66,666,000
2021	Small Business	358	$81,119,000
2022	Small Business	446	$92,285,000

Similar to the calculations for commercial fisheries landing and revenue data, NMFS calculated the estimates of vessel revenue and landings (2008–2021) from the Brayton Point and Falmouth ECCs, using a buffered distance of 1 nm on either side of the proposed cable corridor.

The most affected FMPs for the Falmouth ECC are summer flounder, scup, black sea bass, FMPs with less than three permit holders (i.e. data are confidential), ASMFC interstate, and bluefish. The most affected species are species with less than three permit holders, for which information is confidential. Other affected species include scup, black sea bass, bluefish striped bass, and summer flounder (NMFS 2022d).

The most affected FMPs for the Brayton Point ECC are summer flounder, scup, black sea bass, other federal FMPs, ASMFC interstate, confidential FMPs, no federal FMP, bluefish FMP, and Northeast Multispecies FMP. The most affected species are summer flounder, black sea bass, scup, species with less than three permit holders, skates, tautog, bluefish, cod, sea robins and spiny dogfish (NMFS 2022e).

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

Definitions of impact levels are provided in Table 3.6.1-32.

Table 3.6.1-32. Definitions of impact levels for commercial fisheries and for-hire recreational fishing

Impact Level	Type of Impact	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 on the affected activity or community would not disrupt the normal or routine functions of the affected activity or community. Once the affecting agent is eliminated, the affected activity or community would return to a condition with no measurable effects.
	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 proper remedial action is taken.
	Beneficial	Notable and measurable effects that would result in an economic improvement.
Major	Adverse	The affected activity or community would experience substantial disruptions. 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 for commercial fisheries and for-hire recreational fishing. 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, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for commercial fisheries and for-hire recreational fishing 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 non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on commercial fisheries and for-hire recreational fishing resources are generally associated with activities that limit the aerial extent of where fishing can occur such as tidal energy projects, military use, dredge material disposal, and sand borrowing operations; increased vessel congestion that can pose a risk for collisions or allisions; dredging and port improvements, marine transportation, and oil and gas activities; or activities that pose a risk for gear entanglement such as undersea transmission lines, gas pipelines, and other submarine cables. Existing undersea transmission lines, gas pipelines and other submarine cables are generally indicated on nautical charts and may also cause commercial fishers to avoid the areas to prevent the risk of gear entanglement. Some of these activities may also result in bottom disturbance or habitat conversion that may alter the distribution of fishery-targeted species and increase individual mortality resulting in a less productive fishery or causing some vessel operators to seek alternate fishing grounds, target a different species, and/or switch gear types.

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 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 will also be affected by climate change primarily through ocean acidification, ocean warming, sea level rise, and increases in both the frequency and magnitude of storms, which could lead to altered habitats, altered fish migration patterns, increases in disease frequency, and safety issues for conducting fishing operations. Over the next 35 years, GHG emissions are expected to continue and will gradually warm ocean waters, affecting the distribution and abundance of finfish and invertebrates and their food sources. Ocean acidification driven by climate change is contributing to reduced growth and, in some cases, decline of invertebrate species with calcareous shells. Increased freshwater input into nearshore estuarine habitats can also result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016). Risks to fisheries associated with these events include the ability to safely conduct fishing operations (e.g., because of storms) and climate-related habitat or distribution shifts in targeted species. Fish and shellfish species are expected to exhibit variation in their responses to climate change, with some species benefiting from climate change and others being adversely affected (Hare et al. 2016). To the extent that impacts of climate change on targeted species result in a decrease in catch or increase in fishing costs, the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected. Ongoing activities of NMFS and fishery management councils affect commercial and for-hire recreational fisheries through stock assessments, setting quotas, and implementing FMPs to ensure the continued existence of species at levels that will allow commercial and for-hire recreational fisheries to occur. The economies of communities reliant on marine species that are vulnerable to the effects of climate change would also be affected. Where commercial and for-hire recreational fisheries are located could be affected 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).

The following ongoing offshore wind activities in the geographic analysis area would contribute to impacts on commercial and for-hire recreational fisheries (based on the scenario shown in Appendix D).

- Continued O&M of three offshore wind projects:
  - BIWF Project (5 WTGs) in state waters.
  - SFWF Project (12 WTGs and 1 OSP) in OCS-A 0517.
  - CVOW pilot Project (2 WTGs) in OCS-A 0497.
- Ongoing construction of eight offshore wind projects:
  - Vineyard Wind 1 Project (62 WTGs and 1 OSP) in OCS-A 0501.
  - Revolution Wind Project (65 WTGs and 2 OSPs) in OCS-A 0486.
  - Sunrise Wind Project (94 WTGs and 1 OSP) in OCS-A 0487.
  - New England Wind Project (128 WTGs and 2 OSPs) in OCS-A 0534 and a portion of OCS-A 0501.
  - Empire Wind Project (138 WTGs and 2 OSPs) in OCS-A 0512.
  - Ocean Wind 1 Project (98 WTGs and 3 OSPs) in OCS-A 0498.
  - Atlantic Shores South Project (195 WTGs and 2 OSPs) in OCS-A 0499.
  - CVOW-C Project (176 WTGs and 3 OSPs) in OCS-A 0483.

Ongoing activities would affect commercial fisheries and for-hire recreational fishing 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 that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

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

Planned non-offshore wind activities, described in Appendix D, *Planned Activity Scenario*, that may affect commercial fisheries and for-hire recreational fishing include tidal energy projects, dredge material disposal and sand borrowing operations, increased vessel congestion, dredging and port improvements, marine transportation, and oil and gas activities. Similar to ongoing activities, other planned non-offshore wind activities may result in limiting the areal extent of where fishing can occur, pose a risk for collisions or allisions, pose a risk for gear entanglement, and result in bottom disturbance or habitat conversion that may alter the distribution of fishery-targeted species and increase individual mortality.

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

Anchoring: Excluding the Proposed Action, BOEM estimates that approximately 6,722 acres (2,720 hectares) of seabed would be disturbed by anchoring/spuds associated with other offshore wind activities (Appendix D, Table D2-2). Anchoring vessels used in the construction of offshore wind energy projects would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of an anchored vessel) and temporary (hours to days in duration). Spud cans used to support construction vessels could also affect commercial fishing if holes are left that need to be backfilled, potentially resulting in habitat conversion and gear snags. Although anchoring impacts would occur primarily during construction of other planned offshore wind activities, some impacts could also occur during O&M and conceptual decommissioning. Therefore, the adverse effects of offshore wind energy–related anchoring on commercial fisheries and for-hire recreational fishing are expected to be long term and moderate, though periodic in nature.

Cable emplacement and maintenance: Displacement of fishing vessels and disruption of fishing activities would occur from the installation of 66,451 miles (26,892 hectares) of cables (Appendix D, Table D2-1), though this disruption would not occur all at the same time. Installation of offshore cables for each offshore wind energy facility would require temporary rerouting of all vessels, including commercial and for-hire recreational fishing vessels, away from areas of active construction.

Construction activities related to offshore wind energy development that disturb the seabed, together with activities that reduce water quality, increase underwater noise, or introduce artificial lighting, could result in a behavioral response from some target species. In turn, these responses could decrease catchability for a fishery, due to factors such as fish not biting at hooks or changes in swim height. For any given offshore wind energy project, the impacts of behavioral responses on target species catch in commercial and for-hire recreational fisheries are expected to be confined to a small area, and to end shortly after construction activities end. Benthic species such as sea scallops and ocean quahogs would also be expected to repopulate cable areas once the offshore cables are installed and buried. Cable inspection and repair activities would result in types of impacts similar to those resulting from construction activities, such as temporary displacement or other behavioral responses of target species. The impacts are expected to be moderate and temporary in nature, only occurring during cable placement or maintenance activities. Impacts related to gear entanglement from interactions with cables is discussed under the *Presence of structures* IPF. Details regarding potential impacts from cable seabed preparation activities, sedimentation, as well as lighting and noise impacts that could affect commercial species of finfish and invertebrates are provided in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*.

Noise: Noise impacts caused by offshore construction, including pile driving, trenching for cable placement, O&M activities, G&G investigations, and vessels, could cause indirect impacts on commercial and for-hire recreational fisheries through their direct impacts on species targeted by commercial and for-hire recreational fisheries. Noise impacts would also occur during decommissioning activities. Most impacts would be short term and behavioral in nature, with most finfish species avoiding the noise-affected areas, while invertebrates may exhibit stress and behavioral changes such as discontinuation of feeding activities. With impulse impacts, such as those from pile driving, physiological sound thresholds may be exceeded for some species, resulting in injury or mortality, especially for affected species in the immediate vicinity. Further, impulse impacts could disrupt spawning due to startle responses and masking for some species of finfish and invertebrates. However, most pile-driving activities use ramp-up measures to allow mobile species to leave the area prior to experiencing full-impact pile driving. Once the noise-generating activities cease, most species would be expected to recolonize the affected area. Therefore, impacts on the commercial and for-hire recreational fisheries from noise-generating activities would be moderate and long-term in nature given that construction activities for other offshore wind energy projects are expected to occur over a multi-year period. See Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat,* for a full description of noise impacts on fish and invertebrates.

Port utilization: Construction and decommissioning of offshore wind energy projects would require port facilities for staging and installation/decommissioning vessels, including crew transfer, dredging, cable lay, pile driving, survey vessels, and, potentially, feeder lift barges and heavy lift barges. All these activities would add vessel traffic to port facilities and would require berthing. The additional vessel volume in construction ports could cause vessel traffic congestion, difficulties with navigating, and an increased risk for collisions, together with reduced access to high-demand port services (e.g., fueling and provisioning) by existing port users, including commercial fishing vessels. The impacts would be spread across the entire geographic analysis area throughout the duration of the construction period for offshore wind projects from 2023 to 2030, as well as beyond 2030 when offshore wind farms go through decommissioning. These potential adverse impacts could cause some commercial and for-hire recreational vessel operators to change routes or use an alternative port. Impacts would be moderate to major and long-term, lasting the duration of the construction and decommissioning of the Project.

Presence of structures: The presence of structures can lead to impacts on commercial fisheries and for-hire recreational fishing through allisions, entanglement or gear loss/damage, fish aggregation, and habitat conversion. They can also create navigation hazards (including transmission cable infrastructure) and space use conflicts, which in turn can lead to vessel collisions. These impacts may arise from buoys, meteorological towers, foundations, scour/cable protection, and transmission cable infrastructure. Using the assumptions in Appendix D, offshore wind energy projects would include 3,080 foundations (Appendix D, Table D2-2), up to 4,934 (1,997 hectares) (Appendix D, Table D2-2) of seabed disturbance due to foundation and scour protection, and 2,625 acres (1,062 hectares) of new hard protection atop cables (Appendix D, Table D2-2). BOEM anticipates that structures would be added intermittently over an assumed 10-year period and that they would remain until conceptual decommissioning of each facility is complete.

The presence of the WTG foundations and associated scour protection would convert existing sand or sand with mobile gravel habitat to hard bottom, which, in turn, would reduce the habitat for target species that prefer soft-bottom habitat (e.g., surfclams, sea scallops, squid, summer flounder) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, cod). 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. Where WTG foundations and associated scour protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species (Kirkpatrick et al. 2017). Although species that rely on soft-bottom habitat would experience a reduction in favorable conditions, the impacts from structures are not expected to result in population-level impacts (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). Decommissioning of each wind farm would then have the opposite impact, wherein the species dependent on hard-bottom or reef habitat would experience a reduction in favorable conditions, although some hard-bottom protection measures would remain, while removal of WTGs and their foundations would favor the increase of targeted species that prefer soft-bottom habitat.

USCG has stated that it does not plan to create exclusionary zones around offshore wind facilities during their operation (BOEM 2018). However, because of the height of wind turbines above the ocean surface, they would be visually detectable at a considerable distance during the day and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all structures would have appropriate markings and lighting in accordance with USCG, BOEM, and IALA guidelines, and NOAA would chart wind turbine locations and could include a physical or virtual AIS at each turbine. Some fishing vessels operating in or near offshore wind facilities may experience radar clutter and shadowing. As described in Section 3.6.6, *Navigation and Vessel Traffic*, most instances of interference can be mitigated through the proper use of radar gain control. Impacts on navigation can also be mitigated with AIS and electronic chart systems, which many fishing vessels use, as well as use of additional watchstanders (NASEM 2022).

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

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

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

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

Fishing vessel operators unwilling or unable to travel through areas where offshore wind facilities are located or to deploy fishing gear in those areas may be able to find suitable alternative fishing locations and continue to earn revenue, while others may switch the species they target and/or the gear they use. Seeking alternate fishing grounds could result in increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea), 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. However, if, at times, a fishery resource is only available in the offshore wind lease area, some fishers, primarily those using mobile gear, may lose the revenue from that resource for the time that the resource is inaccessible. Those vessel operators switching species targeted and/or gear typed used may also lose revenue from targeting a less valuable species and increased costs from switching gear type. These impacts could remain until decommissioning of each facility is complete, although the magnitude of the impacts would diminish over time if fishing practices adapt to the presence of structures.

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

The amount of revenue exposed to offshore wind energy development in the geographic analysis area increases as proposed offshore wind energy projects are constructed and come online and would continue beyond 2030 during the continued operational phases of the offshore wind energy projects. The maximum exposed revenue—which is projected to occur in year 2029 when construction on the last of the planned activities could begin—represents a small percentage of the total regional revenue, similar to fisheries operating in the Offshore Project area. In general, fisheries do not have high relative revenue intensity in the offshore wind lease areas compared with nearby waters because offshore wind lease areas were chosen to reduce potential use conflicts between the wind energy industry and the fishing industry.

The cumulative use of ocean space by offshore wind farms would likely result in increased travel time to landing ports, which may cause some fishers 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 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.

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

Traffic: The installation, O&M, and decommissioning of offshore components for offshore wind energy projects and the presence of construction and maintenance vessels could temporarily restrict fishing vessel movement and thus transit and harvesting activities in offshore wind lease areas and along the cable routing areas. To safeguard mariners from the hazards associated with installation, O&M, and decommissioning of these offshore components, it is expected that offshore wind energy projects would request the establishment of safety zones around construction areas. For example, for the Block Island Wind Farm, a 500-yard (457-meter) safety zone around the individual wind turbine locations was implemented during construction (BOEM 2018). When safety zones are in effect, fishing vessels could either forfeit fishing revenue or relocate to other fishing locations and continue to earn revenue. However, vessels that chose to relocate could incur increased operating costs such as increased fuel costs due to longer transit times to and from more distant fishing grounds and additional crew compensation due to more days at sea, among other factors. Commercial and for-hire recreational vessel operators could also experience lower revenue due to fishing potentially less-productive fishing grounds, potentially having to switch to less-valuable species, and potentially encountering more competition for a given resource.

Once offshore wind projects are completed, some commercial fishers may avoid the offshore wind lease areas if large numbers of recreational fishers are drawn to the areas by the prospect of higher catches. WTG foundations and associated scour protection may produce an artificial reef effect, potentially increasing fish and invertebrate abundance within a facility's footprint (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). According to ten Brink and Dalton (2018), the influx of recreational fishers into the Block Island Wind Farm caused some commercial fishers to cease fishing in the area because of vessel congestion and gear conflict concerns. If these concerns cause commercial fishers to shift their fishing effort to areas not routinely fished, conflict with existing users could increase as other areas are encroached. In general, the potential for conflict among commercial fishers due to fishing displacement may be higher for fishers engaged in fisheries that have regulations that constrain where fishers can fish, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishers, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to offshore wind energy facilities by the artificial reef effect, and fishers targeting these species concentrate their fishing effort in offshore wind lease areas as a result. Overall, the adverse impacts from vessel traffic would be long term and moderate.

Regulated fishing effort: Offshore wind development could influence fishery management by affecting fisheries' independent surveys used to inform management measures and by changing patterns of fishing activity. In the short term, widespread adverse impacts are likely to occur from fishery related management measures, but, in the long term, beneficial impacts are anticipated as fisheries achieve maximum sustainable yield from management measures. Fisheries managers, however, may need to revise the sampling design of fisheries surveys to include sampling in the wind farm areas 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. BOEM expects that changes in regulated fishing effort in response to future offshore wind activities will cause long-term, widespread, moderate beneficial impacts on commercial and for-hire recreational fisheries as management adapts to changing fishing patterns, data availability, and management options.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, ongoing activities would have continuous temporary to long-term impacts on commercial fisheries and for-hire recreational fishing, primarily through port use, vessel activity, other offshore development, climate change, and fisheries management. BOEM anticipates that the impacts of ongoing activities would be long term and **moderate** to **major**. The major impact rating for some fisheries and fishing operations is primarily driven by regulated fishing effort, other offshore development, and climate change associated with ongoing activities.

Cumulative Impacts of the No Action Alternative: 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 future marine transportation and fisheries use, would contribute to impacts on commercial fisheries and for-hire recreational fishing. Planned offshore wind activities would affect commercial fisheries and for-hire recreational fishing 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 long-term, **moderate to major adverse** impacts on commercial fisheries and **minor to moderate adverse** impacts on for-hire recreational fishing. These impacts would occur primarily due to the increased presence of offshore structures (cable protection measures and foundations) that could reduce fishing access and increase the risk of fishing gear damage or loss, regulated fishing effort, and climate change. The extent of adverse impacts would vary by fishery and fishing operation due to differences in target species, gear type, and predominant location of fishing activity. The impacts could also include long-term, **moderate beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect. With mitigation measures implemented across all offshore wind projects, including WTG spacing and orientation measures to better accommodate commercial fishing vessels transiting the Lease Areas and typical commercial fishing path orientations, offshore cable burial to minimum depths deeper than trawl gear would penetrate, and financial compensation programs for fishing interests that have lost or entangled gear, the moderate to major impact rating for some commercial fisheries could decrease to moderate.

3.6.1.4 Relevant Design Parameters and Potential Variances in Impacts

This 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 commercial and for-hire recreational fisheries:

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

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

- Number, size, location, and amount of scour protection for WTGs, as the level of hazard related to WTGs is proportional to the number of WTGs installed.
- Season of construction: Certain fisheries have peak times during the year. For-hire recreational fisheries are most active when the weather is more favorable, while commercial fishing is active year-round, with many species harvested throughout the year. However, construction activities can

affect access to fishing areas and availability of fish in the area, thereby reducing catch and fishing revenue.

SouthCoast Wind has committed to measures to minimize impacts on commercial fisheries and for-hire recreational fishing such as developing and implementing a Fisheries Communication Plan (SouthCoast Wind 2024). SouthCoast Wind will work with fishers through a gear loss claim application form to determine if reimbursement is warranted.

3.6.1.5 Impacts of Alternative B – Proposed Action on Commercial Fisheries and For-Hire Recreational Fishing

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

Anchoring: Anchoring involves both anchoring of a vessel involved in the Project and the attachment of a structure to the sea bottom by use of an anchor or mooring. Anchoring vessels and other structures used in construction would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of anchored vessels) and temporary (hours to days in duration). The Proposed Action would contribute up to 441.8 acres (1.8 square miles) of combined anchoring impacts on commercial fisheries and for-hire recreational fishing from planned activities in the Offshore Project area (COP Volume 1, Table 3-38; SouthCoast Wind 2024). Although anchoring impacts would primarily occur during construction, some impacts could also occur during O&M and conceptual decommissioning. Therefore, the adverse effects of offshore wind energy-related anchoring on commercial fisheries and for-hire recreational fishing are expected to be long term, though periodic in nature, and moderate.

Cable emplacement and maintenance: The Proposed Action would entail a maximum of approximately 1,676 miles (2,697 kilometers) of new cable installation, which includes 497 miles (800 kilometers) of interarray cables and 1,179 miles (1,897 kilometers) of offshore export cables. SouthCoast Wind proposes to bury all cables to a target depth of 3.2 to 13.1 feet (1 to 4 meters) (SouthCoast Wind 2024); this is well below the typical depth to which bottom trawls penetrate the ocean floor. In a study of seabed depletion and recovery from bottom trawl disturbance, Hiddink et al. (2017) found that hydraulic dredges penetrated the ocean floor the deepest at 6.3 inches (16.1 centimeters). While it is possible that cables could become uncovered during extreme storm events or other natural processes, burial to the target depth would minimize the risk of exposure and potential damage to fishing gear.

Pre-installation activities and cable laying disturbs the seabed and can reduce water quality through resuspension of sediment, increase underwater noise, or introduce artificial lighting; and can result in a behavioral response from mobile finfish species and injury or death of less-mobile species or benthic infauna such as scallops, surfclams, and ocean quahogs; as well as alter the seabed profile (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). These responses could decrease catchability for a fishery, such as by changing the species composition where seabed profiles are changed or due to behavioral disturbances. Impacts (disturbance, displacement, injury, and mortality) of new cable emplacement and maintenance under the Proposed Action alone are estimated to affect up to 2,480 acres (10.6 square kilometers) of seafloor in the export cable route corridors and 1,408 acres (5.7 square kilometers) in the Lease Area (COP Volume 1, Tables 3-29 and 3-30; SouthCoast Wind 2024). Behavioral responses of target species in commercial and for-hire recreational fisheries are expected to be confined to a small area at any one time, and to end shortly after construction activities end. Benthic species such as sea scallops and ocean quahogs would also be expected to readily repopulate cable areas once the offshore cables are installed and buried. Cable inspection and repair activities would result in types of impacts similar to those of construction activities, with temporary disturbance, displacement, injury, or mortality of target species. Hydrodynamic/sediment transport modeling conducted by SouthCoast Wind has shown minimal impacts from proposed cable laying activities at the distances from which aquaculture lease holders and permitted fish traps exist from proposed cable laying activities. Modeled results indicate that seabed sedimentation thickness would extend from < 32 ft (<10 m) from the ECC for sediment thickness greater than 0.39 in (10 mm) up to 876 ft (267 m) for sediment thicknesses of 0.19 in (0.5 mm) in Mount Hope Bay. For the Sakonnet River, modeled results indicate that seabed sedimentation thickness would extend <10 m for sediment thicknesses greater than 0.39 in (10 mm) and up to 663 ft (202 m) for sediment thicknesses of 0.019 in (0.5 mm). Southcoast Wind outreach for the whelk and mantis shrimp fisheries has also shown that the majority of effort in these fisheries occurs outside of the indicative centerline for the export cable. Any areas of impact would be expected to be minor and the duration of impacts to be temporary.

Cable-laying activities, including seabed preparation involving preparatory boulder and sand wave clearance activities, would directly disrupt commercial and for-hire recreational fishing activities in areas of active construction, although disruption in any given area would be temporary. Existing aquaculture leases would be avoided to the extent practicable. Boulder clearance or relocation will be minimized through micro-routing of cables within each ECC. Any boulders discovered in the pre-installation surveys that cannot be easily avoided by micro-routing could be removed with a grab lift or plow. SouthCoast Wind's preferred method is boulder grab, which is a method that would result in minimal seabed impact. Boulders would be relocated as close as practical to their original location within similar habitat types and would be located in the ECCs. Sand wave clearance may be undertaken by traditional dredging methods such as a trailing suction hopper or water injection dredge, or by a constant flow excavator, with the ultimate method chosen based on the results from the site investigation, surveys, and cable design (COP Volume 1, Table 3-16; SouthCoast Wind 2024). Section 3.5.5, Figure 3.5.5-2 shows the location of temporary seabed disturbance locations in the Falmouth and Brayton Point ECCs from seabed preparation activities which include vessel anchoring, boulder clearance, and sand wave clearance.

Boulder clearance, sand wave clearance, and cable laying disturbs the seabed and can reduce water quality through resuspension of sediment, increase underwater noise, or introduce artificial lighting and can result in a behavioral response from mobile finfish species and injury or death of less-mobile species or benthic infauna such as scallops, surfclams, and ocean quahogs, as well as alter the seabed profile. In turn, these responses could decrease catchability for a fishery, such as by changing the species composition where seabed profiles are changed or due to disturbances causing fish to not bite at hooks or changing swim height. The maximum impact for boulder field clearance and sand wave clearance would be 116.5 acres (0.47 square kilometer). Additionally, grapnel runs along 100 percent of the Brayton Point and Falmouth cable routes and the interarray cable layout would be conducted (COP Volume 1, Section 3.4.1.1.1, Table 3-29 and Table 3-30; SouthCoast Wind 2024). New cable emplacement and maintenance are estimated to affect up to 2,480 acres (10.03 square kilometers) of seafloor in the export cable route. The relocation of boulders would likely not pose any additional risk to gear snags, as the coordinates of the original and relocated locations of boulders will be made available to BOEM and NMFS for charting. Behavioral responses of target species in commercial and for-hire recreational fisheries are expected to be confined to a small area at any one time, and to end shortly after construction activities end. Cable inspection and repair activities would result in types of impacts similar to those of construction activities, with temporary disturbance, displacement, injury, or mortality of target species. Impacts would be moderate and short term.

Noise: Noise impacts associated with offshore construction activities for up to 149 WTGs/OSPs, including pile driving, trenching for cable placement, O&M activities, G&G investigations, and vessels, could cause indirect impacts on commercial and for-hire recreational fisheries in the Wind Farm Area through their direct impacts on species targeted by the commercial and for-hire fisheries. See Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat,* for a full description of noise impacts on finfish and invertebrates. Most noise impacts on species would be short term and behavioral in nature, with most finfish species avoiding the noise-affected areas, while invertebrates may exhibit stress and behavioral changes such as discontinuation of feeding activities. The greatest impact would be from pile driving and the impulse noise impacts it would create, as pile driving is the only human-made, non-blasting sound source that has killed or caused hearing loss in fish in the natural environment (Kirkpatrick et al. 2017). Impulse noise from pile driving may exceed physiological sound thresholds for some species, resulting in injury or mortality, especially for affected species in the immediate vicinity (less than 164 feet [50 meters]), although many studies found no statistically significant change in direct mortality, even at distances of less than 33 feet (10 meters) (Kirkpatrick et al. 2017). To reduce potential impacts from pile driving, SouthCoast Wind has committed to using ramp-up procedures to allow mobile species to leave the area prior to experiencing the full noise impact of pile driving (COP Volume 2, Table 16-1; SouthCoast Wind 2024). High-intensity pile-driving noise may influence fish behavior by causing auditory masking and alteration of foraging patterns, social behavior, and metabolism (McCauley et al. 2000; Wahlberg and Westerberg 2005; Madsen et al. 2006; Slabbekoorn et al. 2010, as cited in 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).

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

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

Throughout construction and installation, vessel traffic associated with the Proposed Action would likely result in behavioral responses from several species, including species targeted by fisheries. However, noise from vessels would be considered low intensity and would not be expected to affect species on a fisheries level; therefore, impacts on commercial and for-hire recreational fisheries would be negligible.

For all of the above noise-generating activities, once the activity ceases, most fish and invertebrate species would be expected to return to or recolonize the affected area. Therefore, impacts from noise-generating activities on commercial and for-hire recreational fisheries would be long-term and moderate.

Noise impacts during decommissioning would be similar to those during the construction and O&M phases, although there would be no pile-driving activities.

Port utilization: Construction would require a range of both construction and support vessels, including vessels for transferring crew, transporting heavy cargo, and conducting heavy lifts, as well as multipurpose vessels and barges. All of these vessels would add traffic to port facilities and would require berthing. SouthCoast Wind is considering multiple ports for construction including New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; Corpus Christi, Texas; as well as some international ports. These ports are locations where WTG/OSP components may be delivered from the manufacturer, may be partially assembled, or may be pre-commissioned and subsequently transferred to the installation site (COP Volume 1, Section 3.3.14.1, Figures 3-39 and 3-40; SouthCoast Wind 2024). Based on information provided by SouthCoast Wind, construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require a daily average of 15–35 vessels depending on construction activities, with an expected peak of 50 vessels in the Lease Area at one time (COP Volume 1, Section 3.3.14.1, Table 3-21; SouthCoast Wind 2024). In total, the Proposed Action would generate approximately 6,600 vessel trips during the construction and installation phase. Typical large construction vessels used in this type of project range from 325 to 350 feet (99 to 107 meters) in length, from 60 to 100 feet (18 to 30 meters) in beam, and draft from 16 to 20 feet (5 to 6 meters) (Denes et al. 2021).

The ports that would be used by SouthCoast Wind are also used by commercial fishing vessels and for-hire recreational fishing vessels. For example, New Bedford ranked in the top ten for commercial fishing revenue attributed to catch from the Lease Area in the years 2008–2019. It ranked number one in average yearly landings (871,931 pounds [395,501 kilograms]) and number two in total revenue ($448,858) (COP Volume 2, Section 11.1.1.1.1, Table 11-6; SouthCoast Wind 2024). The additional vessel volume in the ports associated with operation of the Proposed Action could cause vessel traffic congestion, difficulties with navigating, an increased risk for collisions, and reduced access to high-demand port services (e.g., fueling and provisioning) by existing port users, including commercial and for-hire recreational fishing vessels. However, SouthCoast Wind proposes to employ a Fisheries Liaison Officer to communicate Project-related vessel movements with non-Project-related vessels and implement communication protocols to minimize adverse impacts on other users (COP Volume 2, Table 16-1; SouthCoast Wind 2024). As a result, the adverse impact on commercial fisheries and for-hire recreational fishing would be long-term and moderate during construction. These same impacts would occur during decommissioning, although no data are available for the number of vessels that would be required. During O&M the number of vessels needed to service offshore wind farms would drastically reduce from the construction and installation phase. SouthCoast Wind estimates 1-3 vessel trips between the Lease Area and ports per day will occur during O&M. Additionally, vessels would be dispersed throughout the region, lessening the number of vessels at any one port.

Presence of structures: The presence of structures can lead to impacts on commercial fisheries and for-hire recreational fishing through navigation hazards (including transmission cable infrastructure) and allisions (collisions with stationary objects), entanglement or gear loss/damage, fish aggregation, habitat conversion, and space use conflicts, including potential vessel collisions (Section 3.6.6, *Navigation and Vessel Traffic*).

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

Under the Proposed Action, SouthCoast Wind proposes to install up to 147 WTGs extending up to 1,066.3 feet (325 meters) above MLLW with spacing of 1-by-1 nm (1.9 by 1.9 kilometers) between WTGs (SouthCoast Wind 2024). The proposed design orients the WTG arrays uniformly in both north-south and east-west orientations, commensurate with the rest of the Massachusetts/Rhode Island wind energy lease areas, to create straight-route orientations to maximize safe navigation amongst all lease areas (COP Volume 1, Section 2.1.2.1, Figure 2-1; SouthCoast Wind 2024).

The presence of WTG arrays may restrict fishing vessel maneuverability (including risk of allisions) in the Wind Farm Area. Fishermen have expressed specific concerns about fishing vessels operating trawl gear that may not be able to safely deploy and operate in an offshore wind lease area given the size of the gear, the spacing between the WTGs, and the space required to safely navigate, especially with other vessels present and during poor weather conditions. Trawl and dredge vessel operators have commented that spacing less than 1 nm (1.9 kilometers) 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) state that their operations require a minimum distance of 2 nm (3.7 kilometers) between WTGs, in alignment with the bottom contours, for safe operations (BOEM 2021a; RODA 2021). Additionally, certain fixed and mobile gear fishing patterns established amongst fishers in southern New England waters may be altered. Navigating through the Wind Farm Area would not be as problematic for for-hire recreational fishing vessels, which tend to be smaller than commercial vessels and do not use large external fishing gear (other than hook and line) that makes maneuverability difficult. However, trolling for highly migratory species (e.g., bluefin tuna) may involve deploying many feet of lines and hooks behind the vessel and then following large pelagic fish once they are hooked, which poses additional navigational and maneuverability challenges around WTGs (BOEM 2021a).

SouthCoast Wind's Navigation Safety Risk Assessment (NSRA) (SouthCoast Wind 2024) concluded that the risk (i.e. allision, collision, grounding) of vessels in the area will increase by 0.4 vessel accidents per year; 70 percent of this increase (0.248 vessel accidents/year) is attributed to fishing vessels. The majority of the risk increase is due to the risk of a vessel striking a project structure (i.e., allision). In addition, up to 50 vessels in the Lease Area may be present at one time in the Lease Area supporting construction activities, exacerbating congestion and space use conflict. Additionally, commercial fishing vessels routinely transit through the Lease Area, primarily through the northern portion as a transit route to fishing grounds farther offshore. The study does recognize that, depending on the exact type and length of gear being used, the distances between the WTGs may limit safe fishing patterns in the Lease Area. While SouthCoast Wind's NSRA shows that it is technically feasible to navigate and maneuver fishing vessels and mobile gear through the Lease Area, BOEM is cognizant that maneuverability in the Wind Farm Area may vary depending on many factors, including vessel size, fishing gear or method used, and environmental conditions such as wind, sea state, current, and visibility. In addition, BOEM recognizes that even when it Is feasible to fish in the Lease Area, some fishers might still not consider it safe to do so. Furthermore, operating in the Lease Area with other vessels and gear types present may restrict vessel maneuverability.

Because of the height of WTGs above the ocean surface, they would be visually detectable at a considerable distance during the day and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all WTGs and OSPs would be lit and marked in accordance with USCG and FAA lighting standards and consistent with BOEM best practices, and WTG locations would be charted by NOAA and could include protocols for sound signals, radar beacons, and AIS, which would be finalized with consideration for other such private aids to navigation in the area (i.e., foghorns) in coordination with USCG. Some fishing vessels operating in or near the Wind Farm Area may experience radar clutter and shadowing. Impacts on navigation can be mitigated with AIS and electronic chart systems, which many fishing vessels use, as well as use of additional watchstanders (NASEM 2022). Refer to Section 3.6.6, *Navigation and Vessel Traffic*, for additional discussion regarding impacts marine vessel radar.

Notwithstanding these safety measures, some fishers have commented that, because of safety considerations, they would not enter an offshore wind array during inclement weather, especially during low-visibility events (Kirkpatrick et al. 2017). During interviews with commercial fishers, ten Brink and Dalton (2018) found that fishers had concerns that low visibility, wind, or crew exhaustion could lead to vessels hitting WTGs. Moreover, mechanical problems, such as loss of steerage, could result in an allision with a WTG as the vessel drifts during repair (SouthCoast Wind 2024). Aside from these potential navigational issues, some commercial fishers may avoid the Lease Area if large numbers of recreational fishers are drawn to the area by the prospect of higher catches. According to ten Brink and Dalton (2018), the influx of recreational fishers into the Block Island Wind Farm in Rhode Island caused some commercial fishers to cease fishing in the area because of vessel congestion and gear conflict concerns. In addition, if these concerns cause commercial fishers to shift their fishing effort to areas not routinely fished, conflict with existing users could increase as other areas are encroached. In general, the potential for conflict among commercial fishers due to fishing displacement may be higher for fishers engaged in fisheries that have regulations that constrain where fishers can fish, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishers, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to the Wind Farm Area, and fishers targeting these species concentrate their fishing effort in the Lease Area as a result. As described in Section 3.6.1.3, *Impacts of Alternative A – No Action on Commercial Fisheries and For-Hire Recreational Fishing,* in the context of the No Action Alternative, the presence of gear entanglement hazards and navigational hazards associated with structures in the Lease Area may cause some fishers 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 fishers (O'Farrell et al. 2019). Fishers that are willing to seek alternate fishing grounds may experience increased operating costs or lower revenue. Fishers that switch target species or gear types used may also lose revenue from targeting a less-valuable species and increased costs from switching gear type. Switching species could also cause fishers to land their catch in different ports (Papaioannou et al. 2021), which could increase operational costs depending on where the port is located.

Whether fishers continue to fish in the Lease Area is also determined by cultural and traditional values that go beyond expected profit. For example, it is advantageous for fishers to be able to fish in locations that are known to them and also fished by their peers. In addition, the presence of other boats in the area can contribute to the fishers' sense of safety. Some fishers may choose to not fish in the area due to their perception of risk. Impacts on commercial fisheries may affect the economic health, the cultural identity, and values and, therefore, the wellbeing, of individuals and communities that identify as "fishing" communities. Impacts on cultural and traditional values are not quantifiable but are qualitatively considered when assessing the impacts of the Proposed Action.

Some fishing vessel operators unwilling or unable to travel through or deploy fishing gear in the Lease Area may be able to find suitable alternative fishing locations and continue to earn revenue, although it is difficult to predict the ability of fishing operations displaced by the Proposed Action to locate alternative fishing grounds that would allow them to maintain revenue targets while continuing to minimize costs; some vessel operators may choose not to seek alternate fishing grounds. If a vessel operator chooses to seek alternate fishing locations, the available data suggest the presence of alternative productive fishing grounds in proximity to the Lease Area, especially for the two highest revenue-producing FMP species in the Lease Area: longfin squid and Jonah crab (COP Appendix V, Section 2.4.1, Table 2-79; SouthCoast Wind 2024). The figures in the COP (COP Appendix V, Figures 2-17 through 2-20; SouthCoast Wind 2024) indicate that the fishing level efforts in large expanses of ocean within 30 nm (55.6 kilometers) of the Lease Area are comparable to or higher than those in the Lease Area. While comparable fishing grounds may exist in proximity to the Lease Area, shifting locations could result in increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea), 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. However, if, at times, a fishery resource is only available in the Lease Area, some fishers, primarily those using mobile gear, may lose the revenue from that resource for the time the resource is inaccessible. Not all fishers would seek alternative fishing grounds, though some may switch the species they target. Those vessel operators switching species targeted may also lose revenue from targeting a less valuable species and increased costs from switching gear type. All of these impacts could remain until decommissioning is complete, although the magnitude of the impacts would diminish over time if fishing practices adapt to the presence of structures.

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

The average amounts of commercial fishing revenue and landings currently exposed in the Lease Area are $564,127 and 517,661 pounds respectively (Table 3.6.1-9 and Table 3.6.1-10). The commercial species most consistently affected in the Lease Area by total revenue and by total landings are Jonah crab and longfin squid (Table 3.6.1-11). Proportionally, the revenue and landings for Jonah crab from the

Lease Area equate to 0.48–1.42 percent and 0.49–1.35 percent of the total revenue and landings derived from the entire geographic analysis area over the 15 years analyzed. While the revenue and landings for longfin squid equate to 0.41–0.63 percent and 0.12–0.57 percent of the total revenue and landings derived from the entire geographic analysis area over the 15 years analyzed. When considering proportional impacts relative to the geographic analysis area the species with higher average percentages of total revenue and landings include red hake, silver hake, and golden tilefish. These species had less total revenue and landings compared to Jonah crab and longfin squid but all had higher or the same average percentages of revenue and landings compared to longfin squid (Table 3.6.1-12). While summer flounder was only a top ranked impacted species for 8 of the 15 years analyzed and it derived a low average percentage of revenue and landings from the Lease Area in terms of total revenue and landings from the geographic analysis area; it ranked third in revenue while its landings ranked seventh for the Lease Area (Table 3.6.1-11). This indicates that this species at times is a relatively high value species in the Lease Area. Conversely, skate, a species with relatively high total landings from the Lease Area, ranked fifth in total landings and eighth in total revenue and had less than 1 percent of its revenue and landings from the Lease Area. Another species that ranked higher in total landings vs revenue was scup, and while it ranked in the top ten most impacted species for 11 of the 15 years analyzed, the average annual revenue as a percentage of the total revenue in the geographic analysis area was one of the highest, while also considering the number of years as one of the top ten impacted species by revenue. While New Bedford, Massachusetts, and Point Judith, Rhode Island, are the most valuable ports that operate in the Lease Area (Table 3.6.1-16) smaller ports such as Westport, Manasquan, and Little Compton are most exposed to the Proposed Action with 0.6 percent, 0.41 percent, and 0.37 percent of their maximum revenue and 0.49 percent, 0.14 percent, and 0.27 percent of their maximum landings exposed (Table 3.6.1-18).

As described above, the amount of fishing activity that could be affected in the Lease Area is a small fraction of the amount of fishing activity in the New England and Mid-Atlantic regions as a whole. However, for fishing vessels that choose to avoid the Wind Farm Area, that have historically derived a large percentage of their total revenue from the area, and are unable to find suitable alternative fishing locations, the adverse impacts would be long term and major. While a small number of commercial fishing vessels fish heavily in the Lease Area, the highest percentage of total annual revenue attributed to catch in the Lease Area was 48 percent in 2020. However, three-quarters of the vessels fishing in the area derived less than 0.16 percent of their total revenue from the area in 2008 through 2022 (Section 3.6.1.1, *Description of the Affected Environment*). In short, some vessels depended heavily on the Lease Area, but most vessels derived a relatively small percentage of their total annual revenue from the area. In both cases, the impacts could be long term if the respective vessels choose to avoid the Lease Area, but the level of impact for vessels deriving only a small percentage of their revenue from the area would be substantially less than for vessels that derive a large portion of their revenue from the Lease Area. Considering the low revenue risk across ports, together with the small number of vessels and fishing activity that would be affected by the Proposed Action, the impacts on other fishing industry sectors, including seafood processors and distributors and shoreside support services, would be long term and minor to major, depending on the fishery in question.

Annual exposure of revenue for for-hire recreational fishing specific to the Lease Area is low. Further, BOEM conducted an economic analysis of recreational for-hire boats, as well as for-hire and private-boat angler trips that might be affected by the overall Massachusetts Wind Energy Area, of which the Lease Area is a part (Kirkpatrick et al. 2017). Recreational fishing was considered "exposed" to potential impact if at least part of the trip occurred within 1 nm (1.9 kilometers) of a wind lease area during the study period (2007–2012). Recreational fisheries in Massachusetts, New York, and Rhode Island all fished in the WEA. Massachusetts was the most exposed at 4.4 percent, with a negligible amount from New York and Rhode Island for which approximately 0.5 percent of the revenue was exposed (Kirkpatrick et al. 2017). On average, approximately 3,872 for-hire boat trips and 54,118 for-hire angler trips were made from a home port in Massachusetts annually during this period. Of these annual estimates, approximately 0.6 percent of boat trips and 0.1 percent of for-hire angler trips were estimated to be exposed to the Massachusetts Wind Energy Area (Kirkpatrick et al. 2017). The majority of for-hire recreational fishing in the Wind Energy Area originates from Narragansett, Rhode Island, and Montauk, New York, but only accounted for 0.1 and ~0 percent of angler trips at each port, respectively (Kirkpatrick et al. 2017).

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

In areas where seabed conditions might not allow for cable burial, other methods of cable protection would be employed, such as rock placement, concrete mattress placement, front mattress placement, rock bags, or seabed spacers. Based on G&G surveys already completed, SouthCoast Wind estimates 10 percent of the area along the interarray cables, 10 percent of the Falmouth ECC and 15 percent of the Brayton Point ECC will require cable protection. In addition to cable armoring, the Proposed Action includes installation of up to approximately 578.32 acres (233.4 hectares) of scour protection for the 149 installed foundations. The scour protection would extend out 62 yards (57 meters) from the foundations and have a layered thickness of 8.2 feet (2.5 meters). Similar to cable armoring, scour protection would pose a risk to entanglement and gear loss for commercial fishers, as well as gear loss for for-hire recreational fishers, because hook and line fishing could be more challenging, as the fish (especially large migratory fishes) could use foundations and the scour protection to break free.

Cable, WTG, and OSP locations would be indicated on nautical charts, helping to reduce the potential for fishing gear interactions. Additionally, while SouthCoast Wind does not currently plan to propose for the USCG to establish formal exclusion/safety zones around construction vessels during the laying of cables, USCG may implement safety zones, as described in SouthCoast Wind's Fisheries and Communication and Outreach Plan (COP Appendix X; SouthCoast Wind 2024). SouthCoast Wind plans to employ a Fisheries Liaison to coordinate outreach to the fishing industry and disseminate information regarding anticipated activities such as vessel movements and construction schedule to minimize potential adverse interactions between commercial and for-hire recreational fisheries and operations of the Proposed Action. Additionally, SouthCoast Wind has developed a financial compensation policy to be used when interactions between the fishing industries and Proposed Action activities or infrastructure cause gear loss or damage (COP Volume 2, Table 16-1; SouthCoast Wind 2024). The use of this policy for qualifying gear interactions that may occur during operations and maintenance, is considered part of the Proposed Action and would help reduce adverse impacts for commercial fisheries.

Impacts due to entanglement and gear damage/loss would persist for the duration of Project operations. During decommissioning, all foundations for WTGs and OSP would be removed below the mudline, and BOEM would most likely require that the scour protection be removed in accordance with 30 CFR 285.902(a), eliminating the opportunities for entanglement and gear damage/loss. However, if left in place, the scour protection would continue to pose an indefinite threat for entanglement and gear damage/loss. Offshore cables may be either left in place or removed depending on the regulatory requirements at the time of decommissioning, although it is assumed that all interarray cables would be removed. Any scour protection or materials (e.g., concrete mattresses) that were used to protect exposed cables permitted to be left in-situ would continue to affect bottom trawl fisheries as well as for-hire recreational fishing due to possible entanglement and gear loss.

In addition to posing hazards to fishing gear, 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, summer flounder) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, Atlantic cod). Where WTG foundations, scour, and cable protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species (Kirkpatrick et al. 2017). Although species that rely on soft-bottom habitat would experience a reduction in favorable conditions, the impacts from structures are not expected to result in population-level impacts (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*) and changes to species biomass are not expected to be significant enough to affect total quotas. While habitat conversion may not result in changes to species biomass significant enough to affect total quotas, the presence of structures will likely result in the exclusion of scientific research surveys that inform stock assessments for many of the fisheries affected by the Proposed Action. This will result in increased uncertainty in survey indices and resulting stock assessment conclusions. Existing fishery management council risk policies and harvest control rules dictate that more conservative quotas be set if there is increased uncertainty in stock assessments. Therefore, the presence of structures may affect fishery quotas for species reliant on existing fishery surveys resulting in indirect adverse impacts on associated fisheries.

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

The Proposed Action is expected to add up to 149 foundations and 369 acres (1.5 square kilometers) of hard protection atop cables and 597.9 acres (242 hectares) of foundation scour protection. Foundations and scour/cable protection would remain until decommissioning. This could tend to slow migration. However, water temperature is expected to be a bigger driver of habitat occupation and species movement (Fabrizio et al. 2014; Moser and Shepherd 2009; Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded. Therefore, this impact is anticipated to be negligible and would only last through the operations phase, as the foundations and scour/cable protection would be removed during decommissioning.

Traffic: The Proposed Action's installation of offshore components and the presence of construction vessels (15–35 construction vessels operating at any given time with a maximum peak of 50 vessels in the Lease Area at one time) and O&M vessels (up to 1–3 vessel trips per day) could temporarily restrict fishing vessel movement and thus transit and harvesting activities including along the cable routing areas. It could also lead to traffic congestion and an increased risk for collisions. SouthCoast Wind would implement construction safety zones and coordinate with fishers on courses of action for areas temporarily closed due to construction activities (COP Volume 2, Table 16-1; SouthCoast Wind 2024). SouthCoast Wind would employ a Fisheries Liaison to keep the fishing industry aware of construction vessel movements, construction timelines, and other information to help minimize conflicts and potential vessel collisions. Regardless of safety zones, fishing vessels would likely steer clear of construction vessels to avoid potential collisions and damage to their fishing gear. In doing so, fishing vessels could either forfeit fishing revenue or relocate to other fishing locations and continue to earn revenue. However, vessels that choose to relocate could incur increased operating costs such as increased fuel costs due to longer transit times to and from more distant fishing grounds and additional crew compensation due to more days at sea, among other factors. They could also experience lower revenue due to fishing potentially less-productive fishing grounds, potentially having to switch to less-valuable species, and potentially encountering more competition for a given resource.

After construction is complete, WTG foundations and associated scour protection may produce an artificial reef effect, potentially increasing fish and invertebrate abundance within a facility's footprint (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*), as well as recreational fishing use. Some commercial fishers may avoid the Lease Area if large numbers of recreational fishers are drawn to the area by the prospect of higher catches (ten Brink and Dalton 2018). Outreach by SouthCoast Wind to the local recreational fishing community has shown that this distance (23 miles [37 kilometers] from the closest turbine to shore) will preclude large increases in recreational fishing vessel traffic owing to the time/fuel considerations and the composition of the recreational fishing fleet. SouthCoast Wind's outreach and observations also indicate that a smaller number of larger recreational fishing vessels utilize the Lease Area during the summer months targeting high profile gamefish while a larger number of more diverse recreational fishing vessels utilize the export cable corridors and surrounding area targeting a wider array of species. If these congestion concerns cause commercial fishers to shift their fishing effort to areas outside of the Lease Area to areas not routinely fished, conflict with existing users could increase as other areas are encroached upon. In general, the potential for conflict among commercial fishers due to fishing displacement may be higher for fishers engaged in fisheries that have regulations that constrain where fishers can fish, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishers, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to offshore wind energy facilities by the artificial reef effect, and fishers targeting these species concentrate their fishing effort in the Project area as a result. Overall, the adverse effects of vessel traffic on commercial and for-hire fishing vessels are expected to be moderate and long term. Similar impacts would also occur during decommissioning of the Project. Once fully decommissioned, navigational and fishing hazards (e.g., WTG foundations and interarray cables) would be removed, minimizing space use conflicts and vessel traffic impacts previously caused by the wind farm.

Cumulative Impact of the 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 and offshore wind activities. Ongoing and planned non-offshore wind activities including tidal energy projects, military use, dredge material disposal, and sand borrowing operations; vessel use; dredging and port improvements, marine transportation, oil and gas activities; undersea transmission lines, gas pipelines, and other submarine cables; climate change; and regulated fishing effort. Ongoing and planned offshore wind activities in the geographic analysis area include the construction and installation, O&M, and decommissioning of multiple offshore wind projects.

Anchoring from the Proposed Action and other offshore wind activities would result in localized, short-term, moderate cumulative impacts on commercial fisheries and for-hire recreational fishing, primarily as a result of navigational hazards that are introduced when multiple offshore wind projects overlap in the same area as fishing or transiting fishing vessels. The incremental contributions of the Proposed Action to the combined anchoring effects of ongoing and planned activities would be appreciable given the size of the area that would be affected by the Proposed Action. The 442 acres (178 hectares) of seafloor disturbed by anchoring under the Proposed Action would represent 14 percent of the estimated 3,072 acres (1,243 hectares) of seafloor that would be disturbed from anchoring on the OCS due to existing and planned offshore wind farms, including the Proposed Action.

The 3,888 acres (1,573 hectares) of seabed disturbance from cable emplacement associated with the Proposed Action represents only 2 percent of the 185,710 acres (75,154 hectares) of seabed expected to be disturbed on the OCS due to existing and planned offshore wind farms, including the Proposed Action. In context of reasonably foreseeable environmental trends, the Proposed Action would incrementally contribute to moderate cumulative impacts from new cable emplacement and maintenance, primarily due to fishing vessel displacement during installation.

Planned offshore wind activities would generate comparable types of noise impacts to those of the Proposed Action. The most significant sources of noise are expected to be pile driving (construction) followed by vessels (all project phases). The 149 structures for the Proposed Action represent only 5 percent of the 3,094 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms, including the Proposed Action, although some foundations from the Proposed Action and other wind farms may be installed without pile driving. Project vessels would represent only a small fraction of the large volume of existing traffic in the geographic analysis area. The contribution of the

Proposed Action to the combined noise impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind, would depend on the timing and overlap of disturbance areas and could result in moderate impacts.

Other offshore wind projects would result in similar impacts as the Proposed Action from port utilization, although vessel traffic that would contribute to congestion at ports would be spread out across ports along the Atlantic OCS. The Proposed Action would incrementally contribute to the combined impacts associated with port utilization from ongoing and planned activities, which would likely be moderate to major.

BOEM expects that the presence of structures associated with the Proposed Action would contribute a noticeable increment to the combined presence of structure impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind. The 149 structures for the Proposed Action represent 5 percent of the 3,094 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms. The increased number of structures would increase the risk of highly localized and periodic impacts on commercial fisheries that could be long term and major and impacts on for-hire recreational fishing that could be minor for those trolling for highly migratory species or minor to moderately beneficial due to increased fishing opportunities for other for-hire recreational fisheries.

The Proposed Action in combination with ongoing and planned activities would result in increased vessel traffic during construction and O&M activities, resulting in moderate cumulative impacts on commercial fishing and for-hire recreational fishing. Impacts would be most pronounced during periods of overlapping construction (Appendix D, Table D2-1) that result in increased vessel congestion and the potential for fishing displacement, vessel collisions, and gear conflict.

Conclusions

Impacts of the Proposed Action: Construction and installation, O&M, and conceptual decommissioning could affect port and fishing access, as well as transit and harvesting activities, fishing gear interactions, and target species catch. BOEM anticipates that the adverse impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing would vary by fishery and fishing operation due to differences in target species abundance in the Offshore Project area, gear type, and predominant location of fishing activity. It is conceivable that some of the small number of fishing operations that derive a large percentage of their total revenue from areas where Proposed Action facilities would be located would choose to avoid these areas once the facilities become operational. In the event that these specific fishing operations are unable to find suitable alternative fishing locations, they could experience long-term, major disruptions. However, it is estimated that the majority of vessels that fish in the Lease Area, are not overly reliant on the Lease Area, with the majority of fishers deriving less than 5 percent of their revenue from the Lease Area. Therefore, BOEM expects that the impacts resulting from the Proposed Action would range from **minor to major adverse**, depending on the fishery and fishing operation. In addition, the impacts of the Proposed Action could include long-term, **minor beneficial** impacts for some for-hire recreational fishing operations due to the artificial reef effect. If

BOEM's recommendations related to project siting, design, navigation, access, safety measures, and financial compensation are implemented across all offshore wind energy projects as identified in *Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf* (BOEM 2022), adverse impacts on commercial fisheries could be reduced.

Cumulative Impacts of the Proposed Action: The incremental impacts contributed by the Proposed Action to the cumulative impacts on commercial fisheries and for-hire recreational fishing would be appreciable. BOEM anticipates that the cumulative impacts on commercial fisheries and for-hire recreational fishing associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be **major adverse** because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely, even with implementation of applicant-committed measures. This impact rating is primarily driven by the presence of structures from ongoing and 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 on commercial and for-hire recreational fisheries would be **major adverse** 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 Alternative C on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternative C: Under Alternative C, the Brayton Point offshore export cable would be routed onshore to avoid fisheries impacts in the Sakonnet River. Alternative C-1 and Alternative C-2 would reduce the offshore cable route by 9 and 12 miles (14.5 and 19.3 kilometers), respectively, reducing the disturbances associated with vessel anchoring, increased vessel traffic, cable emplacement and maintenance, and noise associated with underwater construction and maintenance when compared to the Proposed Action and eliminating EMFs in the Sakonnet River.

The primary benefits of Alternatives C-1 and C-2 would be to recreational and commercial fishers that exclusively use the Sakonnet River, in particular, aquaculture lease holders, floating fish trap, whelk, and mantis shrimp fisheries. Both alternatives could help avoid adverse impacts on juvenile cod HAPC in the Sakonnet River, which could have indirect positive impacts on the commercial and for-hire fisheries by improving juvenile recruitment into the fishery and helping the stock rebuild. However, both alternatives, particularly Alternative C-2, would also pass through areas known to have floating fish traps, a fishery unique to Rhode Island (COP Volume 2, Figure 11-21; SouthCoast Wind 2024), which may temporarily affect access to the traps during cable-laying activities. Further, Alternative C-1 has the potential to temporarily interrupt commercial/recreational fishing operations occurring on Elbow Ledge or in Sachuest Bay (TetraTech 2023). While there are aquaculture lease holders and permitted locations for floating fish traps near the Brayton Point ECC under the Proposed Action, the corridor (and especially the much smaller extent of the cable itself) does not directly overlap with these other uses. Floating fish traps may be temporarily displaced by exclusions zones around vessels while cable is routed to land, however these impacts would be temporary and last only as long as the time to complete cable installation activities. Outreach conducted by SouthCoast Wind showed that at least some of the commercial fishing vessels in the Sakonnet River area are trailered as opposed to being docked at local fishing ports. For Alternative C-2, construction of a landfall at the Sakonnet Point Marina at Sakonnet Harbor may temporarily affect trailering activities for fishing vessels, although this impact would only occur during HDD and cable installation activities and would be short-term and minor.

Additionally, the southern New England skate bait fishery has a trawl exemption that extends from southern Massachusetts, Rhode Island, and Connecticut down to the southern shore of Long Island with most of the catch occurring around Block Island and some catch south of the Sakonnet River (NOAA 2022b). In particular, Little Compton, Rhode Island is reliant on skate bait (Ferrio pers comm. 2022). Impacts on the skate bait fishery can cause bait prices to increase, as other species are targeted for bait, and can create bait supply issues in the fisheries (lobster, crab) that rely on bait. During construction, vessels landing skate bait in Little Compton may be displaced by cable-laying activities for Alternative C-2; however, this impact is expected to be temporary and impacts overall would be similar to the Proposed Action.

The primary benefits to commercial and recreational fishing would be a reduction of 52 acres (21 hectares) and 70 acres (28 hectares) of ECC seabed disturbance and permanent cable protection in the Sakonnet River for Alternative C-1 and Alternative C-2, respectively. By relocating the offshore export cable onshore, Alternatives C-1 and C-2 would avoid impacts on recreational harvest of shellfish and finfish that occurs in the Sakonnet River, compared to the Proposed Action. Further, for bottom-tending mobile gear operating during construction activities, the potential for vessel collisions would be reduced. In contrast, there would be increased temporary impacts on fish traps (under both Alternatives C-1 and C-2) and recreational fishing off Elbow Ledge and in Sachuest Bay (under Alternative C-1). Overall, impacts would be similar but slightly reduced under Alternative C compared to the Proposed Action.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be slightly reduced but similar to those under the Proposed Action.

Conclusions

Incremental Impacts of Alternative C: The anticipated impacts associated with Alternatives C-1 and C-2 would not be substantially different from those of the Proposed Action. While these alternatives could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, O&M, and decommissioning impacts would still occur. The only difference would be for recreational and commercial fishers that exclusively use the Sakonnet River, in particular aquaculture lease holders, floating fish trap fishers, whelk, and mantis shrimp fisheries. These individuals would experience negligible to major impacts from offshore wind development. Generally, aquaculture lease holders would benefit from a cable reroute to land; however, floating fish traps may be affected by either Alternative C-1 or Alternative C-2, as the reroute would place the cable in areas known to have fish traps. However, the areas of impact would be expected to be minor and the duration of impacts to be temporary because they would be localized and short-term (due to fishing vessel displacement/floating trap displacement).

Additionally, the reduction in the Brayton Point export cable corridor equates to a 2 to 3 percent reduction of the total miles of installed offshore cable. For most fishers, the exposed revenue that could be affected would not differ greatly from that under the Proposed Action. When considering all of the IPFs, the incremental impacts of Alternative C on commercial fisheries and for-hire recreational fishing would still be **minor** to **major adverse**.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, BOEM anticipates that cumulative impacts on commercial fisheries and for-hire recreational fishing associated with Alternatives C-1 and C-2 would be **major adverse**, the same level as under the Proposed Action, because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely.

3.6.1.7 Impacts of Alternative D (Preferred Alternative) on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternative D: Alternative D would eliminate six WTGs in the northeastern portion of the Lease Area to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals. By reducing the overall footprint, Alternative D would provide more area in the northeastern portion of the Lease Area for commercial fishing vessels to operate and fish without potential impacts from structures, slightly reducing the potential for gear entanglement and loss, as well as allisions. According to VMS and vessel trip reporting data from the Northeast Ocean Data Portal, fisheries benefiting the most from removal of the WTGs under Alternative D would be the squid and pelagic fisheries and fisheries engaged in bottom trawling (COP Appendix V, Figure 2-18 and Figure 2-19; SouthCoast Wind 2024). Given the small size of the added structure-free area, any additional revenue realized by the commercial fishery would likely be minimal and dependent on the targeted species that may be in that particular area and whether commercial fishers would willing to fish that part of the Lease Area.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to or slightly less than those described under the Proposed Action.

Conclusions

Incremental Impacts of Alternative D: The anticipated **minor** to **major adverse** impacts associated with Alternative D would not be substantially different than those of the Proposed Action. While Alternative D would slightly reduce the impacts on commercial fisheries and for-hire recreational fishing by installing six fewer WTGs, ultimately the same or highly similar construction, O&M, and decommissioning impacts would still occur. Any additional revenue realized by commercial fisheries would be minimal, and for-hire recreational fishing may see a slight decrease due to fewer structures providing reef habitat for targeted species. When considering all of the IPFs, the incremental impact on commercial fisheries and for-hire recreational fishing would still be minor to major.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts on commercial fisheries and for-hire recreational fishing associated with Alternative D would be **major adverse**, the same level as under the Proposed Action, because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely.

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

Impacts of Alternative E: Alternative E includes the use of all piled (Alternative E-1), all suction bucket (Alternative E-2), or all GBS (Alternative E-3) foundations for WTGs and OSPs. For 147 WTGs including scour protection, the maximum permanent footprint would be smallest under Alternative E-1 with a total footprint of 370 acres (150 hectares) (monopile) or 384 acres (155 hectares) (pin-pile), Alternative E-2 with a footprint of 720 acres (292 hectares), and Alternative E-3 with a footprint of 1,698 acres (687 hectares) (COP Volume 1, Table 37; SouthCoast Wind 2024). For five OSPs including scour protection, the maximum permanent footprint would be smallest for Alternative E-2 at 25 acres (10 hectares), Alternative E-1 at 49 acres (20 hectares), and Alternative E-3 at 58 acres (23 hectares).

Alternative E-1 would likely not provide any additional impacts on commercial and recreational fishing than the Proposed Action. Compared to Alternative E-1, Alternatives E-2 and E-3 would expand space taken up in the water column and/or benthos from WTGs, OSPs, and scour protection that would need to be avoided by bottom-tending mobile gear, increasing the potential for gear entanglement and loss and displacement of bottom-tending mobile gear fishing vessels from the Lease Area. Conversely, the larger foundations would increase artificial reef effects that may benefit recreational fisheries and pot/trap commercial fisheries. Further, Alternatives E-2 and E-3 may reduce the potential for displacement, injury, and mortality of commercial/recreational fish species, from construction noise, as impulsive pile-driving would not be used.

Cumulative Impacts of Alternative E: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative E would be similar to those described under the Proposed Action for Alternative E-1 and would be greater than those described under the Proposed Action for Alternatives E-2 and E-3.

Conclusions

Incremental Impacts of Alternative E: The anticipated **minor to major adverse** impacts associated with Alternative E would not be substantially different than those of the Proposed Action. While this alternative could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, O&M, and decommissioning impacts would still occur, with the potential exception of non-impulsive construction noise associated with Alternatives E-2 and E-3. Impacts on commercial and recreational fishers would be long-term, for the duration of O&M.

Revenue realized by commercial fisheries across the alternatives would be similar, and for-hire recreational fishing may see a slight increase due to differences in structures providing reef habitat for targeted species. When considering all of the IPFs, the incremental impacts of Alternative E on commercial fisheries and for-hire recreational fishing would still be minor to major.

Cumulative Impacts of Alternative E: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative E on commercial fisheries and for-hire recreational fishing would be **major adverse**, the same level as under the Proposed Action, because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely.

3.6.1.9 Impacts of Alternative F on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternative F: Under Alternative F, the Falmouth offshore export cable route would include up to three cables (compared to up to five cables under the Proposed Action), which would reduce seafloor disturbance by approximately 700 acres (283 hectares). The total width of disturbance of the cables would be reduced from 98.5 feet (assuming a 19.7-foot-wide disturbance per cable; COP Volume 1, Table 3-29; SouthCoast Wind 2024) under the Proposed Action to 59.1 feet under Alternative F. Impacts from cable emplacement and anchoring may be reduced due to the lesser number of cables installed. To the extent that the installation of fewer cables would reduce construction activity, BOEM anticipates that behavioral responses, such as avoidance of the area, from target species may also be reduced, but any difference in impacts compared to the Proposed Action would be minimal and temporary during construction. Installation of only three cables would require less hard cable protection, which would reduce the potential for gear entanglement and loss. While some reduction in impacts would occur—because temporary construction impacts and long-term operational impacts from cable installation would still occur and there would be no change in other offshore components—the overall impact magnitude would be the same as the Proposed Action. The use of an HVDC converter OSP is not anticipated to have a meaningful difference in impacts on commercial fisheries compared to the Proposed Action. Refer to Section 3.5.5.9 for a discussion of the potential effects on fish from HVDC converter OSPs under Alternative F.

Cumulative Impacts of Alternative F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative F would be similar to those described under the Proposed Action.

Conclusions

Incremental Impacts of Alternative F: The anticipated **minor** to **major** impacts associated with Alternative F would not be substantially different than those of the Proposed Action. Therefore, the incremental Impacts associated with construction and installation would be short-term; however, any impacts resulting from hardtop scour protection would be long-term.

Cumulative Impacts of Alternative F: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative F would result in **major**

impacts, the same level as under the Proposed Action, because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely.

3.6.1.10 Comparison of Alternatives

Commercial Fisheries

Alternatives C-F would have similar or slightly reduced adverse impacts on commercial fisheries relative to the Proposed Action; however, the overall impact magnitudes would not change under any of the action alternatives. Relative to the Proposed Action, Alternative D would result in the removal of specific WTG positions (positions nearest to the Nantucket Shoals), which would reduce noise impacts during construction, thus potentially benefiting any commercial or recreational species that uses the Nantucket Shoals, and would reduce the impacts from gear entanglement, as six turbines and foundations would not be disturbed.

Alternatives C and F would also provide reductions in adverse impacts on commercial fisheries compared to other action alternatives because they would reduce the amount of export cables installed in the water. Alternative C would avoid almost all construction and O&M impacts to fisheries that operate in the Sakonnet River area. Alternative F would reduce the number of cables used for the Falmouth ECC, thus reducing the area of secondary cable protection and thus also the risk of gear entanglement from secondary cable protection.

Under Alternative E-1, the use of monopiles or jacket foundations would have greater impacts to commercial fish species during construction from impact pile driving. This may cause shifts in species distribution during construction. During the O&M phase, however, these foundation types take up less space in the water column, potentially reducing the risk of gear entanglement for fishermen that operate in the Lease Area. Conversely, the use of suction-bucket (Alternative E-2) or GBS foundations (Alternative E-3), would reduce impacts from noise but would take up more space in the water column and have greater benthic impacts. While this may increase the risk of gear entanglement, both Alternatives E-2 and E-3 may increase the artificial reef effect compared to other alternatives, due to more surface area for biotic components to grow on foundations and providing more complex habitats in the water column.

For-Hire Recreational Fisheries

Relative to the other action alternatives, Alternatives D and E would have fewer differences in impacts on for-hire recreational fisheries resulting from a reduced number of WTGs or different foundation types in the Lease Area, primarily due to the distance of the Lease Area from shore where recreational fishing is less likely to occur. Alternative C would reduce temporary impacts on for-hire recreational fishing compared to the Proposed Action as no cable laying activities would occur in the Sakonnet River. Under Alternative F, a reduction in the number of cables for the Falmouth ECC would reduce the likelihood of displacement of recreational fishermen during construction.

3.6.1.11 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 3.6.1-33. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on commercial fisheries and for-hire recreational fishing could be further reduced.

Table 3.6.1-32. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): commercial fisheries and for-hire recreational fishing

Measure	Description	Effect
EFH Conservation Recommendations	EFH Conservation Recommendations from NMFS were transmitted by letter dated September 23, 2024. EFH Conservation Recommendations for activities under BOEM's jurisdiction were provided for WTG and cable installation and relocation (micrositing), anchoring, temperate reef avoidance, spill prevention, anti-corrosion measures, habitat alteration minimization, boulder relocation, marine debris removal, scour protection, noise mitigation, contents Implementation of Conservation Recommendations, including micrositing WTGs and cables, scour protection material and avoidance, anchoring avoidance and practices, reduced distance in boulder/cobble relocation, sand bedform removal avoidance, conservation of submarine topography and benthic features, overtrenching and sufficient cable burial depth, cable cross-mapping, and seafloor EFH Conservation Recommendations for activities under USACE's jurisdiction were provided for inshore/estuarine habitat impact minimization, mitigation of impacts on scientific surveys, temperate reef avoidance and in situ impact monitoring, and provision of locations of relocated boulders, created berms, and scour protection.	Implementation of Conservation Recommendations, including micrositing WTGs and cables, scour protection material and avoidance, anchoring avoidance and practices, reduced distance in boulder/cobble relocation, sand bedform removal avoidance, conservation of submarine topography and benthic features, overtrenching and sufficient cable burial depth, cable cross-mapping, and seafloor surveying and monitoring would minimize known or reasonably foreseeable adverse impacts on benthic habitats and features, sensitive habitats, sand bedforms, Nantucket shoals, NOAA Complex Category habitats, the Sakonnet River, Mount Hope Bay, Southern New England HAPC, and the Narragansett Bay Estuary minimizing the potential for elimination/conversion of existing benthic habitats. Conservation Recommendations for inshore/estuarine and nearshore areas, including the use of HDD, micrositing, and re-rerouting during cable installation, the avoidance of sidecasting and open-water disposal during trenching activities, the use of a closed clamshell/environmental bucket dredge and upland disposal during dredging activities in areas with elevated levels of contaminants, and the restoration of disturbed areas to preconstruction conditions would minimize impacts on inshore/estuarine and nearshore benthic habitats and species. Conservation Recommendations for noise during construction, such as the use of additional noise dampening/mitigation measures during all impact pile driving, mandatory quiet periods during pile driving of at least 4 hours per 24 hours, and noise mitigation protocols in consultation with resource agencies prior to

Measure	Description	Effect
		construction activities, would avoid and minimize potential noise impacts on benthic species and habitat. Conservation Recommendations for spill preventative measures, anti-corrosion measures, and marine debris removal would minimize potential impacts from any marine debris collected during pre-lay grapnel runs and chemicals, contaminant emissions, anti-corrosive coatings and sacrificial anodes to benthic habitats and species. Conservation Recommendations to revise the Benthic Habitat Monitoring Plan would benefit benthic habitat and species by ensuring robust experimental design, methods, and data collection/analysis to assess changes in benthic communities in the Project area. The Conservation Recommendation to mitigate impacts on NMFS scientific surveys would ensure that NMFS can continue to monitor the status and health of trust resources. The Conservation Recommendations to develop a Project-specific in situ Monitoring Program and to perform pre-, during, and post-construction in situ monitoring of temperate reefs would benefit benthic habitat and species by assessing the stressors created by Project operation on benthic communities in the Project area, and stressors created by Project construction and operation on temperate reefs, from the presence of turbines, construction and operational noise, heat and EMF exposure, and oceanic-wind wake effects, as well as monitor impacts on fish behavior, species occurrence, community composition, and density and abundance on temperate reefs. Conservation Recommendations to provide the locations of relocated boulders, created berms, scour protection, and cables requiring wet storage to relevant marine users would minimize impacts on benthic habitat by reducing the potential of gear obstructions, which would disturb benthic habitat. Although the Conservation Recommendations would provide incremental reductions in impacts on sensitive and complex habitats and temperate reefs, reductions in the overall impact rating are not anticipated for any of the Proposed Action's IPFs.

Table 3.6.1-33. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): commercial fisheries and for hire recreational fishing

Measure	Description	Effect
Compensation for lost fishing income	The lessee shall implement a compensation program for lost income for commercial and recreational fishermen and other eligible fishing interests for construction and operations consistent with BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 or as modified in response to public comment.	This measure, if adopted, would reduce impacts from the IPF presence of structures by compensating commercial and recreational fishing interests for lost income during construction and a minimum of 5 years post-construction. Levels of funding required by SouthCoast Wind to be set aside for fulfilling verified claims would be commensurate with those estimates in the SouthCoast Wind COP (COP Volume 2, Section 11.1.1.4.1, Tables 11-10 through 11-12; SouthCoast Wind 2024). If adopted, this measure would reduce the minor to major impact level from the presence of structures to minor to moderate. This is because a compensation scheme could mitigate "indefinite" impacts to a level where the fishing community would have to adjust somewhat to account for disruptions due to impacts but income losses would be mitigated.
Mobile gear friendly cable protection measures	Cable protection measures should reflect the pre-existing conditions at the site. This mitigation measure chiefly ensures that seafloor cable protection does not introduce new hangs for mobile fishing gear. Thus, the cable protection measures should be trawl-friendly with tapered/sloped edges. If cable protection is necessary in "non-trawlable" habitat, such as rocky habitat, then the lessee should consider using materials that mirror the benthic environment.	This measure would reduce negative impacts resulting from mobile gear loss by using materials that would minimize the potential for introducing new hangs associated with cable protection features.
Fishing Gear and Anchor Strike Incident Reporting	SouthCoast Wind will report fishing gear and anchor strike incidents that fall below or are not captured by the regulatory thresholds outlined in 30 CFR §§ 285.832 and 285.833. Reports will be filed annually during construction and decommissioning, and every 5 years during operations.	This measure would reduce negative impacts resulting from static gear loss from anchoring. This measure would allow for fishermen to more effectively file for compensation for gear loss and damage.
Shoreside seafood business analysis	In addition to the compensation proposed by SouthCoast Wind, BOEM would require SouthCoast Wind to ensure that compensation includes losses to shoreside businesses. The lessee shall analyze the impacts to shoreside seafood businesses adjacent to ports. The shoreside seafood business analysis would be used to further	This measure would reduce negative impacts associated with shoreside economic activity specifically resulting from revenue exposure and potential for reduced catch due to the SouthCoast Wind Project.

Measure	Description	Effect
	supplement funds available for settling claims of lost (unrecovered) economic activity as a result of the SouthCoast Wind project.	

SouthCoast Wind would implement a compensation program for lost income for commercial and recreational fishers and other eligible fishing interests for construction and operations consistent with BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 or as modified in response to public comment. This measure, if adopted, would reduce impacts from the IPF presence of structures by compensating commercial and recreational fishing interests for lost income during construction and a minimum of 5 years post-construction. Funding would be required to be set aside by SouthCoast Wind to fulfill verified claims of lost fishing income. verified claims If adopted, this measure would reduce the minor to major impact level from the presence of structures to minor to moderate. This is because a compensation scheme could mitigate "indefinite" impacts to a level where the fishing community would have to adjust somewhat to account for disruptions due to impacts but income losses would be mitigated. These measures, if adopted, would have the effect of reducing the overall minor to major impact from the Proposed Action to minor to moderate. This is driven largely by compensatory mitigation that would mitigate "indefinite" impacts to a level where the fishing community would have to adjust somewhat to account for disruptions due to impacts but income losses would be mitigated. The impact levels for Alternatives C through F would also reflect an overall reduction in impacts similar to under the Proposed Action. BOEM anticipates that the overall impacts on commercial fisheries and for-hire recreational fishing associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be unchanged (major) because some commercial and for-hire recreational fisheries and fishing operations could experience substantial disruptions indefinitely, even with these Project-specific mitigation measures.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.6.1-33 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, *Impacts of Alternative B – Proposed Action on Commercial Fisheries and For-Hire Recreational Fishing,* would not change, these measures would ensure the effectiveness of, and compliance with, environmental protection measures already analyzed as part of the Proposed Action.

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 NHPA Section 106 at 36 CFR Part 800 (Protection of Historic Properties). See Appendix I, Section I.1.3, *Area of Potential Effects*, 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.
- 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 (i.e., the time prior to the arrival of Europeans in North America), post-Contact, or both periods. The range of common resource types includes archaeological sites, buildings, structures, objects, districts, and traditional cultural places (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 USC § 300308), refers to any "prehistoric or historic district, site, building, structure, or object included on, 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.

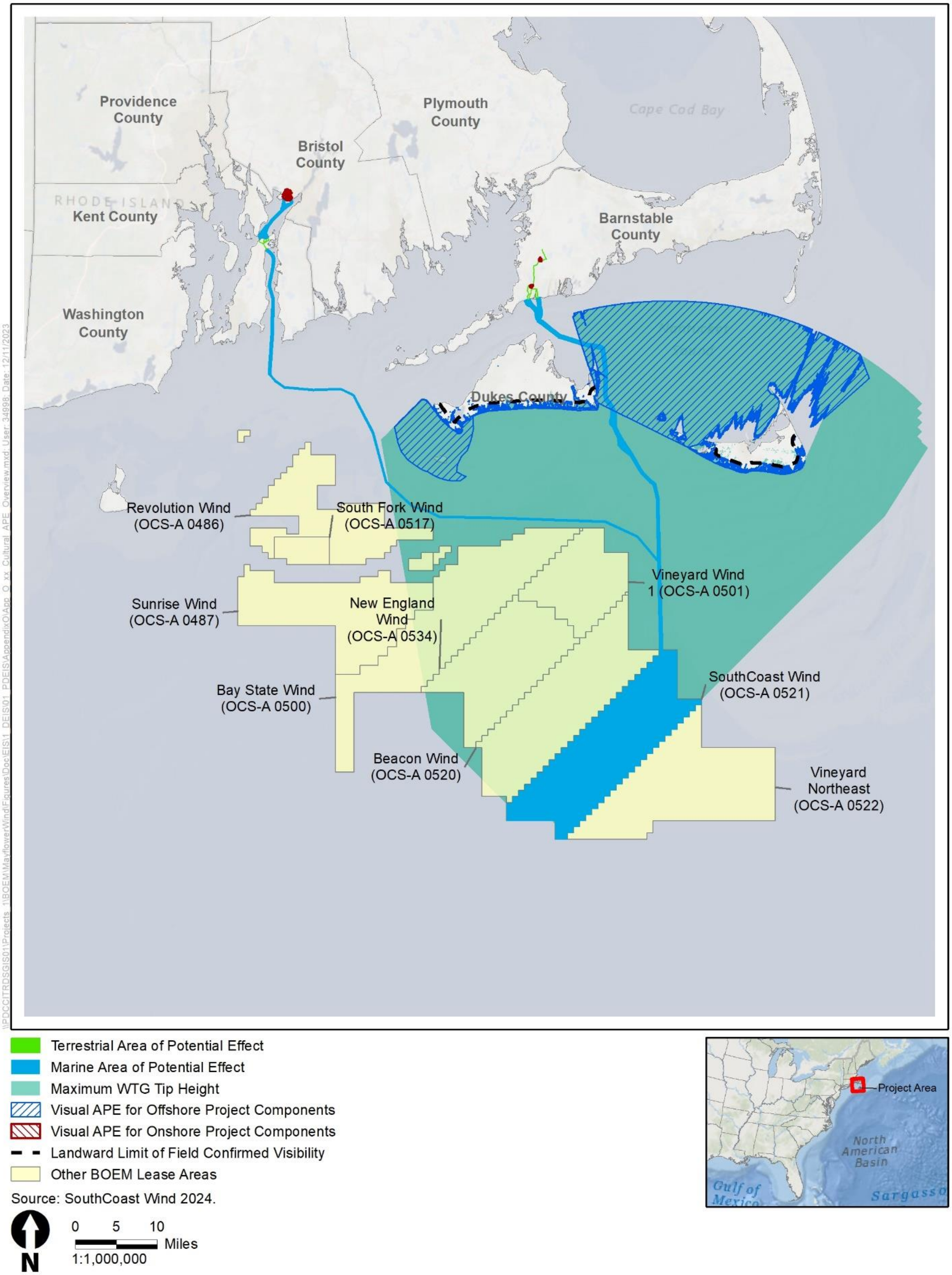


Figure 3.6.2-1. Cultural resources geographic analysis area for the Proposed Action

3.6.2.1 Description of the Affected Environment

This section discusses baseline conditions in the geographic analysis area for cultural resources as described in the COP (Volume 2, Section 7.0; SouthCoast Wind 2024), supplemental COP cultural resources studies (COP Appendices S, Q, and R; SouthCoast Wind 2024), and Appendix I, *Finding of Adverse Effect for the SouthCoast Wind Construction and Operations Plan*. 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 both the Proposed Action and other offshore wind projects would be visible simultaneously.

SouthCoast Wind 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. Table 3.6.2-1 presents a summary of the pre-Contact and post-Contact cultural context of the Project area in Massachusetts and Rhode Island and is largely based on the Project's Terrestrial Archaeological Resources Assessment (COP Appendix R; SouthCoast Wind 2024).

Table 3.6.2-1. Cultural context of the Project area in coastal Massachusetts and Rhode Island

Period	Date	Description
Paleoindian	12,500–10,000 BP	Earliest human occupation of American continents. Glacial lakes provided the basis for hunting and gathering opportunities. Populations may have been big-game hunters but also may have favored a flexible generalist subsistence strategy exploiting a wide range of food resources. People organized in small, mobile groups. Use of fluted projectile points, though known affiliated archaeological resources are scarce, likely due to inundation from post-glacial sea level rise.
Archaic	10,000–3,000 BP	Period subdivided into Early (10,000–8,000 BP), Middle (8,000–6,000 BP), and Late (6,000–3,000 BP) phases. Refers to pre-ceramic populations that occupied the deciduous forests of Eastern Woodlands. Compared to Paleoindian period, larger bands, increasing population, longer stays at base camps, and increased activities at camps. Increase in tool types for access to broader resource base.
Woodland	3,000–450 BP	Development of ceramic technologies. Cultivation of domesticated plants and intensification of plant food base. Increased sedentism, permanent settlements, and population sizes. Diversifying stone toolkit over the period.
Contact	450–300 BP/ AD 1500–1620	Evidence of European exploration within New England by 1498, at which time Cape Cod is home to thousands of Native Americans. Native Americans engaged in agricultural activities. Economic exchange among Europeans and Native Americans occurs. Disease and violence brought by Europeans leads to catastrophic depopulation of Native Americans in region, shaping relations.

Period	Date	Description
Plantation	AD 1620–1675	Plymouth Plantation founded in 1620 as the first permanent European settlement within region. Plymouth Colony given legal patent for claim to Cape Cod in 1630, leading to establishment of Sandwich (1638), Barnstable (1638), and Yarmouth (1639). Agriculture, animal husbandry, fishing, and whaling are primary industries across Cape Cod, Plymouth Colony, and Nantucket Island. Increased tensions between Native Americans and Europeans as more European settlers arrive and Native American land disappears. Inequalities grow between the English and Native Americans.
Colonial	AD 1675–1775	King Philip's War (1675 to 1678) spurred by tensions between Wampanoags and English and execution at Plymouth of three Wampanoags. Cape Cod largely unaffected by the war. Following King Philip's War, historical accounts of Native Americans decrease, and English presence within Cape Cod greatly increases. In addition to farming and fishing, whaling becomes important within Cape Cod; Native Americans are employed in industry as means of survival. Dispersed farms settled throughout Cape Cod. French and Indian War occurs from 1754 to 1763, though Cape Cod itself does not see battles. Between the 1760s and 1770s, "English-style" homes begin to replace wigwams as the Mashpee seek to improve perceived social ranking.
Federal	AD 1775–1830	During the Revolution, Cape Cod becomes an important area for defense of the coast. Military service greatly affects Cape Cod. By 1777, people of Cape Cod are lacking basic needs, and industry is at a stand-still. After the war, industry and commerce returns to Cape Cod, including sheep husbandry, agriculture, fishing, salt production, and manufacturing. Transportation within Cape Code increases. Similarly, Nantucket Island is an active seaport and its whaling industry provides the primary source of commerce in the town. The War of 1812, between United States and England, lasts from 1812 to 1815 and greatly affects Cape Cod. From 1775 to 1830, Native American population and their land holdings decline. Overall, there is limited information on Native Americans during this time.
Early Industrial	AD 1830–1870	During the nineteenth century, whaling continued to decrease, particularly in towns near the Onshore Project area. There is variety of industrial and agricultural activities including salt production, livestock, and agriculture. Packet boats, steam ships, and stagecoaches are popular modes of travel until the opening of railroad in 1848. Native Americans continue to live on Cape Cod. The Mashpee Revolt of 1833 illustrates how Native Americans were able to exercise political agency over their lands within framework of an otherwise oppressive system. In the three decades leading to the Civil War, Cape Cod acts as a port of entry for the Underground Railroad. Cape Cod was only affected by military recruitments during the Civil War, as battles did not occur north of Pennsylvania; over 2,000 men from Cape Cod served.
Late Industrial	AD 1870–1915	Following the Civil War, Cape Cod experiences general decline in all economic sectors, principally agriculture and fishing. In the 30 years following the Civil War, the fishing industry steadily declines and never returns to its peak. By the end of the nineteenth century, tourism increasingly plays a large role in Cape Cod's economy and is aided by development and improvement of railroads, increase in housing construction, and the vacancy of land formerly used for agriculture. Other commercial ventures include clothing stores, a hardware store, jewelry stores, a shoe store, and druggists. Manufacturing on Cape Cod is

Period	Date	Description
		not as prevalent until the later nineteenth century. By the end of the century, few records mention Native Americans.
Modern	AD 1915–Present	By the twentieth century, railroad use declines as the automobile becomes the primary means of transportation. Prior to World War II, Cape Cod was identified as a viable candidate for a new National Guard camp, with land on Cape Cod approved for military training. Cape Cod becomes less isolated from construction of roads, establishment of commercial air service, and widening of the Cape Cod Canal. Economy primarily relies on tourism and tourist-related services for Cape Cod and Nantucket Island. Other economic activities included whaling, fishing, and agriculture, with whaling disappearing around 1920. During World War II, farming slightly increases on Cape Cod but continues to decline after the war.

Source: COP Appendix R; SouthCoast Wind 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 Appendix Q; SouthCoast Wind 2024). Marine geophysical archaeological surveys performed for the Proposed Action identified 46 potential marine archaeological resources in the marine APE: 5 in the Lease Area, 16 in the Falmouth ECC, and 25 in the Brayton Point

ECC[1] (Appendix I, Table I-4; COP Appendix Q; SouthCoast Wind 2024). Four other marine archaeological resources that were identified in SouthCoast Wind's surveys are outside of the marine APE and, therefore, not subject to potential impacts from the Project. These resources include both known and potential shipwrecks and related debris fields from the historic and recent (i.e., less than 50 years ago) eras. A total of 32 of the 46 resources in the marine APE were recommended to be 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 nine ASLFs in the marine APE (Appendix I, Table I-5; COP Appendix Q; SouthCoast Wind 2024). Seven other ASLFs that were identified in SouthCoast Wind's surveys are below the maximum vertical extent of the marine APE and, therefore, not subject to potential impacts from the Project. Additionally, one TCP previously determined eligible for listing in the NRHP (i.e., Nantucket Sound) was identified in the marine APE. ASLFs within or near the defined Nantucket Sound TCP boundary may be considered as contributing elements to the TCP. 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 resource investigations performed for the Proposed Action in the terrestrial portion of the APE (hereafter referred to as the *terrestrial APE*) identified two terrestrial archaeological resources that may be eligible for listing in the NRHP and one historic aboveground resource presently listed in the NRHP (Mount Hope Bridge) (COP Appendix R; SouthCoast Wind 2024). The terrestrial APE intersects the Mount Hope Bridge boundary as defined by the National Park Service (NPS). Mount Hope Bridge has been determined to be significant and eligible for listing in the NRHP under criteria unrelated to potential archaeological elements, and the structure itself is not subject to physical impacts from the Proposed Action.

Because of logistical limitations related to Project developments and landowner permissions, archaeological surveys have not been fully completed in the terrestrial APE. As such, currently undiscovered but potential terrestrial archaeological resources may exist in presently unsurveyed areas of the terrestrial APE. In consultation with BOEM and the relevant state historic preservation office (SHPO), SouthCoast Wind will be using a process of phased identification and evaluation of historic properties as defined in 36 CFR 800.4(b)(2) for the remaining areas of the terrestrial APE identified in the Terrestrial Archaeology Phased Identification Plan (Appendix I, Section I.5, *Phased Identification and Evaluation*). 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 Memorandum of Agreement (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 Tribal Nations,

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[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

SHPO(s), and consulting parties; and implementing measures to avoid, minimize, or mitigate impacts 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 September 30, 2024.

The visual portion of the APE (hereafter referred to as the *visual APE*) includes a visual APE for offshore Project components and visual APE for onshore Project components. Cultural resources review of the visual APE for offshore Project components identified 16 historic aboveground resources and three TCPs (i.e., Chappaquiddick Island, Nantucket Sound, and Vineyard Sound and Moshup's Bridge). Of these resources, 14 would have a potential view of the offshore Project components, including one National Historic Landmark (NHL), three NRHP-listed historic properties, seven historic aboveground resources presently unevaluated for NRHP eligibility, and all three NRHP-eligible TCPs. Cultural resources review of the visual APE for the onshore Project components (i.e., landfall locations of the two export cable corridors and possible substations or converter stations) identified 13 historic aboveground resources; two historic aboveground resources are within the Falmouth, Massachusetts, portion of the visual APE for onshore components, and 11 historic aboveground resources are in the Brayton Point, Massachusetts, portion of the visual APE for onshore components (COP Volume 2, Section 7.3, Appendices S and S.1; SouthCoast Wind 2024). Of these 13 historic aboveground resources in the visual APE for onshore Project components, two would have views of the proposed Lawrence Lynch substation in Falmouth. For the purposes of this Project, previously identified historic aboveground resources and TCPs without previous eligibility determinations are considered eligible for listing in the NRHP.

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).	A. Some damage to cultural resources from ground- or seabed-disturbing activities, but there is no loss of	A. No physical impacts (i.e., alteration or demolition of resources) and some limited visual disruptions to the historic or

Impact Level	Historic Properties under Section 106 of the NHPA	Archaeological Resources and ASLFs	Historic Aboveground Resources and TCPs
	This can include avoidance measures.	scientific or cultural value from the resources; or B. Disturbances to cultural resources are avoided or limited to areas lacking scientific or cultural value.	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).
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, *Planned Activities Scenario.*

Impacts of the No Action Alternative

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 in 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.

Ongoing offshore wind activities in the geographic analysis area that would contribute to impacts on cultural resources include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and 2 OSPs) in OCS-A 0486. Ongoing construction of these projects would result in impacts on cultural resources through the primary IPFs of accidental releases, anchoring, cable emplacement and maintenance, gear utilization, land disturbance, lighting, noise, and presence of structures. Ongoing construction of these projects would have the same type of impacts on cultural resources that are described in *Cumulative Impacts of the No Action Alternative* for all ongoing and planned offshore wind activities in the geographic analysis area but would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action). Other 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 (refer to Appendix D, Section D.2, for a complete 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 ongoing and planned offshore wind activities on cultural resources during construction, O&M, and decommissioning of the projects. Ongoing and planned offshore wind projects in the geographic analysis area that would contribute to impacts on cultural resources include those projects within all or portions of OCS-A-0486 (Revolution Wind), OCS-A-0487 (Sunrise Wind), OCS-A-0500 (Bay State Wind), OCS-A 0501 (Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A-0520 (Beacon Wind), OCS-A 0522 (Vineyard Wind Northeast, formerly Liberty Wind), and OCS-A 0534 (New England Wind) (Appendix D, Table D2-1). Impacts on cultural resources are expected 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 Massachusetts. 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 best management practices 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 temporary to permanent, geographically extensive, and large-scale major impacts on cultural resources.

Anchoring: Anchoring associated with ongoing commercial and recreational activities and the development of future offshore wind projects has the potential to cause permanent, adverse impacts on marine cultural resources. These activities would increase during the construction, O&M, and eventual decommissioning of future 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 of future offshore wind infrastructure would have permanent, geographically extensive, adverse impacts on cultural resources. Future offshore wind projects would result in seabed disturbance from construction of structure foundations and interarray and offshore export cables. Other offshore wind development projects that are expected to lay cable in the geographic analysis area include Vineyard Wind 1 (Lease Area OCS-A 0501) and New England Wind (OCS-A 0534 and portion of OCS-A 0501), which would lay cables that cross the same offshore export cable corridor as the Proposed Action. There is the potential that other proposed projects in the Massachusetts and Rhode Island lease areas that do not yet have published COPs may propose cable routes that also intersect the geographic analysis area. The 2012 BOEM study and the Proposed Action studies (BOEM 2012; COP Appendix Q; SouthCoast Wind 2024) suggest that the offshore wind lease areas and export cable corridors of the future 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 future offshore wind project applicants 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 to minor. 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 terrestrial archaeological resources in these features logistically challenging and prohibitively expensive. As a result, offshore construction would result in geographically widespread and permanent adverse impacts on portions of these resources. For 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, 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 projects in the geographic analysis area (i.e., Bay State Wind, Beacon Wind, Vineyard Wind Northeast [formerly Liberty Wind], New England Wind, Revolution Wind, South Fork Wind, Sunrise Wind, and Vineyard Wind 1) have the potential to conduct these additional surveys. The 2012 BOEM study and the Proposed Action studies (BOEM 2012; COP Appendix Q; SouthCoast Wind 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 which could be subject to impacts from gear utilization.

As part of compliance with the NHPA, BOEM and SHPOs will require offshore wind project applicants 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, due to the permanent, irreversible nature of the impacts, unless these marine cultural resources can be avoided.

Land disturbance: The construction of onshore components associated with offshore wind projects, such as electrical export cables and onshore substations, 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 future 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 OSPs during operation. Up to 901 WTGs, associated with other offshore wind projects excluding the Proposed Action, with a maximum blade tip height of 1,171 feet (357 meters) would be added within the geographic analysis area for cumulative visual effects on historic properties between 2023 and 2030 (Appendix D, Table D2-1).

Construction and decommissioning lighting would be most noticeable if construction activities occur at night. Some of the offshore wind projects could require nighttime construction lighting, and all would require nighttime hazard lighting during operations. Construction lighting from any project would be temporary, lasting only during nighttime construction, and could be visible from shorelines and elevated locations, although such light sources would be limited to individual WTGs or offshore substation sites rather than the entirety of the lease areas in the geographic analysis area. Aircraft and vessel hazard lighting systems would be in use for the entire operational phase of each future 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 aboveground cultural resources, such as historic aboveground resources and TCPs, on the coast of Massachusetts for which a dark nighttime sky is a character-defining feature that contributes to the historic significance and integrity of the resource. The intensity of lighting impacts would be limited by the distance between resources and the nearest lighting sources. While some WTGs in the geographic analysis area are as close as 12 miles (19 kilometers) from viewing areas, the vast majority of WTGs are over 15 miles (24 kilometers) from shoreline (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 temporary, intermittent, and localized minor 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 ADLS is used to meet FAA aircraft hazard lighting requirements. ADLS would activate the aviation lighting on WTGs and offshore substations 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 to less than 1 percent of the normal operating time that would occur without using ADLS. The use of ADLS on future offshore wind projects other than the Proposed Action would likely result in similar limits on the frequency of WTG and offshore substation 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 negligible to moderate. Lighting impacts would be negligible when ADLS is inactive and moderate for the duration of the system activation.

Onshore structure lighting associated with future offshore wind projects 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. As such, lighting associated with onshore components from future offshore wind activities could have long-term, continuous, negligible to minor impacts on cultural resources.

Noise: 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 OSPs, 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.

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 coasts of Massachusetts and Rhode Island. Up to 920 WTGs and OSPs would be added in the geographic analysis area for cumulative visual impacts on historic properties (Appendix D, Table D-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 eligibility for listing in the NRHP. While some WTGs in the geographic analysis area are as close as 12 miles (19 kilometers) from viewing areas, the vast majority of WTGs are over 15 miles (24 kilometers) from shoreline. Due to the distance between the reasonably foreseeable wind development projects and the nearest historic aboveground resources and TCPs, 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, *Scenic and Visual Resources*). 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, 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 Massachusetts and Rhode Island. 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.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, cultural resources would continue to be subject to impacts from existing environmental trends and ongoing activities. 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 include 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** impacts on cultural resources.

Cumulative Impacts of the No Action Alternative: 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. Planned activities would contribute to impacts on cultural resources due to disturbance, damage, disruption, and destruction of individual cultural resources located onshore and offshore. BOEM anticipates that the cumulative impacts of the No Action Alternative would likely be **major** due to the extent of known cultural resources in the region subject to impacts.

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 SouthCoast Wind would embed the WTGs and OSPs 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, historic aboveground resources, TCPs), depending on the location of onshore ground-disturbing activities.
- Visual impacts on cultural resources (e.g., historic aboveground resources), depending on the design, height, number, and distance of WTGs, offshore substations, 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 OSP number, size, and location: If marine cultural resources cannot be avoided, impacts can be minimized with fewer WTGs and OSP 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 OSP 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, depth of burial, and burial method could minimize disturbance or destruction of marine cultural 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 corridor could decrease potential for unanticipated disturbance of terrestrial archaeological 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.

SouthCoast Wind has committed to several measures to avoid, minimize, or mitigate impacts on cultural resources as described in Appendix G, *Mitigation and Monitoring*, 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. For additional information, refer to Section 3.6.2.11, *Proposed Mitigation Measures*, and Appendix I, Attachment A.

3.6.2.5 Impacts of Alternative B – Proposed Action on Cultural Resources

Under the Proposed Action, SouthCoast Wind would install up to 147 WTGs, up to 5 OSPs, up to 2 onshore converter stations (at Brayton Point) and/or one onshore substation (at Falmouth; would be constructed only if Falmouth is selected as the POI for Project 2), and onshore and offshore cables, which would have negligible to minor impacts on most cultural resources but would potentially have moderate to major impacts on marine archaeological resources, ASLFs, terrestrial archaeological resources, historic aboveground resources, and TCPs.

Specifically, the Proposed Action may have negligible to major physical impacts on 46 marine archaeological resources (COP Appendix Q; SouthCoast Wind 2024), 9 ASLFs (COP Appendix Q; SouthCoast Wind 2024), and 2 known terrestrial archaeological resources (COP Appendix R; SouthCoast Wind 2024). The proposed Project may also have negligible visual impacts on 23 aboveground historic properties and moderate visual impacts on 2 aboveground historic properties (Nantucket Historic District NHL and Oak Grove Cemetery) and 1 TCP (Chappaquiddick Island) (COP Appendices S and S.1; SouthCoast Wind 2024). Lastly, the Project may have moderate physical and visual impacts on one TCP (Nantucket Sound) (COP Appendices S and S.1; SouthCoast Wind 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, OSPs, and onshore substation associated with the Proposed Action would include storage for a variety of potential chemicals such as coolants, oils, lubricants, and diesel fuel (COP Volume 1, Table 3-26; SouthCoast Wind 2024). The Proposed Action would also require use of several types of machinery, 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 1, Section 3.3.14; SouthCoast Wind 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 best management practices 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, and 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 temporary to 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 scale of accidental releases.

Anchoring: Anchoring associated with offshore activities of the Proposed Action could have impacts on marine cultural resources. SouthCoast Wind's marine geophysical archaeological surveys identified 46 marine archaeological resources in the marine APE: five in the Lease Area, 16 in the Falmouth ECC, and 25 in the Brayton Point ECC. Additionally, the Nantucket Sound TCP and nine ASLFs—some of which may be contributing elements to the Nantucket Sound TCP—were identified in the marine APE. The severity of impacts of this IPF would depend on the horizontal and vertical extent of disturbance relative to the size of the marine archaeological resource or ASLF subject to impacts. SouthCoast Wind has committed to avoiding 31 of the 32 marine archaeological resources that are historic properties and seven of the nine ASLFs recommended to be historic properties potentially eligible for listing in the NRHP; therefore, the Proposed Action would have negligible impacts on these resources (Appendix I, Tables I-4 and I-5). As SouthCoast Wind has not committed to avoidance of one other marine archaeological resource and two other ASLFs, these resources are anticipated to be subject to physical adverse impacts from the Proposed Action. A process for additional investigations of these resources and mitigation measures for resolving adverse effects on these resources per NHPA Section 106 were developed through BOEM's consultations with federally recognized Native American Tribes, the Massachusetts Historical Commission (the Massachusetts SHPO), the Rhode Island Historical Preservation & Heritage Commission (RIHPHC) (the Rhode Island SHPO), the Massachusetts Board of Underwater Archaeological Resources, and interested consulting parties and will be stipulated in the MOA (Appendix I, Attachment A).

Based on this information, impacts of the Proposed Action on marine cultural resources are expected to be localized and permanent and would range from negligible to major depending on SouthCoast Wind's commitments 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: Installation of interarray 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, AMMs, 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 cultural resources from this IPF are expected to be localized and permanent and range from negligible to major depending on the ability of SouthCoast Wind to avoid, minimize, or mitigate impacts.

Gear utilization: Construction, 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, AMMs, and potential range of severity and extent of impacts on marine archaeological resources under this IPF would be the same as those described under the *Anchoring* IPF for the Proposed Action. Overall, impacts of the Proposed Action on marine cultural resources from this IPF are expected to be localized and permanent and range from negligible to major depending on SouthCoast Wind's ability to avoid, minimize, or mitigate impacts.

Land disturbance: Land disturbance associated with the construction of onshore Project components would have impacts on cultural resources. Components of the onshore facilities that are proposed to be buried underground or constructed in areas that are historically and currently used for industrial purposes may involve visual impacts during construction. However, these would be temporary, short-term impacts, and the underground components would not have any long-term visual impacts once built and operational (COP Volume 2, Section 7.3.2.1.1 and Appendix S; SouthCoast Wind 2024). Overall, for historic aboveground resources, visual impacts of land disturbance related to the construction of onshore Project components would have negligible to minor impacts on the 13 historic aboveground resources identified in the visual APE for onshore Project components.

Ground-disturbing activities associated with construction (e.g., site clearing, grading, excavation, and filling) would 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 determined the Project would have adverse physical impacts on two terrestrial archaeological resources (COP Appendix R; SouthCoast Wind 2024). Mitigation measures for resolving adverse effects on these resources per NHPA Section 106 were developed through BOEM's consultations with Tribal Nations, RIHPHC, and consulting parties and will be stipulated in the MOA (Appendix I, Attachment A).

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, presently undiscovered terrestrial archaeological resources may exist in presently unsurveyed areas of the terrestrial APE. In consultation with BOEM and the relevant SHPO, SouthCoast Wind will use 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 additional archaeological resources in the terrestrial APE. BOEM will use the MOA to establish commitments for reviewing the sufficiency of any supplemental terrestrial archaeological investigations; assessing effects on historic properties; and implementing measures to avoid, minimize, or mitigate impacts 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, SouthCoast Wind has proposed several AMMs to reduce the risk of impacts on terrestrial archaeological resources, including siting onshore Project components to minimize impacts on terrestrial archaeological resources and monitoring in areas determined to have moderate to high potential for undiscovered archaeological resources (Appendix G, *Mitigation and Monitoring*).

Based on this information, 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 major. If terrestrial archaeological resources are identified through the phased identification process, BOEM will consult with Tribal Nations, the Massachusetts Historical Commission, RIHPHC, and consulting parties on the identification of historic properties eligible for the NRHP, assessment of effects to historic properties, and resolution of adverse effects, if necessary pursuant to the MOA. SouthCoast Wind would implement plans to avoid, minimize, or mitigate impacts on cultural resources per the MOA (Appendix I, Attachment A). More substantial impacts could occur if previously undiscovered resources are discovered during construction.

Lighting: Use of lighting on onshore and offshore Project components associated with the Proposed Action could result in a change to the integrity of the historic setting of historic aboveground resources or TCPs by introducing new sources of light into historic contexts, both onshore and offshore (COP Volume 2, Section 7.3.2.2; SouthCoast Wind 2024). Operational lighting would be required for the onshore substations and converter stations. SouthCoast Wind has committed to minimizing and mitigating lighting impacts by working with the Towns of Falmouth, Somerset, and Portsmouth to ensure the lighting scheme complies with town requirements by ensuring that the design of outdoor light fixtures at the onshore substation complies with night-sky lighting standards to the extent practicable, and by keeping lighting at the onshore substation to a minimum, with only a few lights illuminated for security reasons on dusk-to-dawn sensors and other lights using motion-sensing switches so that the majority of lights would be switched on for emergency situations only (COP Volume 2, Section 16; SouthCoast Wind 2024). Due to the developed nature of the visual APE for onshore Project components, lights are not expected to contribute significantly to the sky glow given the existing light sources present in their respective areas. As a result, the 13 historic aboveground resources identified in the visual APE for onshore Project components in Falmouth and Brayton Point, Massachusetts would likely experience negligible impacts from lighting.

Construction and decommissioning lighting impacts from the Proposed Action would be short term, and the intensity of nighttime construction lighting would be limited to the active construction area at any given time. All construction vessels would have continuous nighttime vessel lighting and construction area lighting at the offshore work locations in accordance with USCG regulations. During transit and nighttime or low-visibility conditions, vessels would use navigation and deck lighting as required by USCG and other applicable agencies and permit approval conditions, as necessary. Work lights are generally directed downward and would not typically be oriented horizontally where visibility on shore would be increased. Visibility of construction vessel lighting would be mostly obscured by the Earth's curvature due to the distance between the nearest construction area (i.e., the closest line of WTGs, which is approximately 23 miles from the southern shore of Nantucket Island) and the nearest cultural resources on the Massachusetts and Rhode Island coasts, and due to downward casting, though some diffuse light may be visible on the horizon at night. ADLS would not be operational during construction; therefore, WTG lighting would be active during construction. 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. Nighttime lighting impacts would be restricted to cultural resources for which a dark nighttime sky is a character-defining feature that contributes to the historic significance and integrity of the resource. Additionally, lighting for construction and decommissioning activities at Brayton Point would be visible but temporary and would result in short-term and negligible visual impacts (COP Appendix S.1; SouthCoast Wind 2024). Therefore, construction and decommissioning area lighting from the Proposed Action alone would have negligible impacts on cultural resources.

The Proposed Action would include nighttime and daytime use of operational phase aviation and vessel hazard avoidance lighting on WTGs and OSPs. SouthCoast Wind has committed to voluntarily implementing ADLS to reduce operational phase nighttime lighting impacts (COP Volume 1, Section 3.3.12; SouthCoast Wind 2024; Appendix G, *Mitigation and Monitoring*). ADLS would only activate the required FAA aviation obstruction lights on WTGs and OSPs when aircraft enter a predefined airspace and turn off when the aircraft are no longer in proximity to the Wind Farm Area. Based on estimates from SouthCoast Wind, ADLS-controlled obstruction lights would be activated for less than 5 hours per year (COP Appendix T, Section 5.1.3; SouthCoast Wind 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. As a result of ADLS, lighting impacts would be negligible when ADLS is inactive and moderate for the anticipated short duration of the system activation. Therefore, the use of operational lighting on WTGs by the Proposed Action would result in negligible impacts on cultural resources.

Noise: Airborne noise produced by the Project could change the integrity of the historic setting of historic aboveground resources by introducing modern sounds into historic contexts both onshore 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 construction and operational noise of the Project (COP Appendix U1; SouthCoast Wind 2024), noise generated by construction and O&M of Offshore Project components, including WTGs, is not expected to be audible at the nearest shorelines. Therefore, construction and O&M noise associated with the Offshore Project components is anticipated to have negligible impacts on cultural resources.

Construction and O&M of the onshore converter stations at Brayton Point and the onshore substation at Falmouth would generate noise. SouthCoast Wind would require construction equipment and operations comply with state and local noise ordinances (COP Appendix U1; SouthCoast Wind 2024; POWER Engineers 2023a, 2023b). The Analysis of Visual Effects to Historic Properties (AVEHP) for the Proposed Action determined that construction of the onshore Project components would adversely impact the Oak Grove Cemetery due to the temporary construction noise at the Lawrence Lynch substation site in Falmouth. The study determined that as a rural, garden-style cemetery that was designed to provide a natural sanctuary for mourners, a quiet setting is a key characteristic of its significance. While construction noise may result in short-term, localized impacts, SouthCoast Wind will comply with applicable sections of the MassDEP Air Quality Regulations and will employ the use of sound-emitting construction and operations equipment to reduce unnecessary noise to the extent practicable (COP Appendix S; SouthCoast Wind 2024; POWER Engineers 2023a, 2023b). Additionally, O&M of Lawrence Lynch substation has the potential increase sound levels at nearby receptors. The Oak Grove Cemetery is approximately 0.1 mile (0.16 kilometer) from the substation site with intervening vegetation; therefore, sound levels are expected to diminish over the distance to the cemetery. As such, no impacts from O&M of the Lawrence Lynch substation would occur because of operational noise (SouthCoast Wind 2024). Overall, noise associated with the construction and O&M of the onshore converter stations and the onshore substation is anticipated to have negligible to moderate impacts on historic aboveground resources.

Installation of the onshore export cables is anticipated to occur during typical work hours. However, in specific instances at some locations, minimal nighttime work may occur in coordination with municipalities. Noise from construction of onshore Project components would be reduced through minimizing the amount of work conducted outside of typical construction hours; installing and maintaining appropriate mufflers on construction equipment; maintaining construction equipment and using newer models to provide the quietest performance; requiring enclosures on continuously operating equipment such as compressors and generators; turning off construction equipment when not in use and minimizing idling times; and mitigating the impact of noisy equipment on sensitive locations by using temporary barriers or buffering distances as practical (COP Appendix U1; SouthCoast Wind 2024). Therefore, noise associated with installation of onshore export cables is anticipated to have negligible impacts on historic aboveground resources.

Overall, noise from onshore and offshore components of the Proposed Action is anticipated to have negligible to moderate impacts on cultural resources.

Presence of structures: The presence of structures, including foundations and scour protection for WTGs and OSPs, in the Lease Area could have impacts on cultural resources. The presence of onshore substations, converter stations, transmission lines, and other Project components could also have impacts on cultural resources in Falmouth and Brayton Point, Massachusetts. The AVEHP for the Proposed Action determined that the construction of WTGs would adversely impact the Nantucket

Historic District NHL and that the construction of onshore Project components would adversely impact the Oak Grove Cemetery (COP Appendix S; SouthCoast Wind 2024). BOEM, in review of this analysis, has determined that the Nantucket Sound TCP and Chappaquiddick Island TCP would also experience an adverse effect. The study determined that an unobstructed ocean view, free of modern visual elements, is a contributing element to the NRHP eligibility of the NHL and both TCPs. Although the operational life of the Project is 35 years, and the WTGs and OSPs would be removed after that period, the presence of visible WTGs from the Proposed Action alone would have long-term, continuous, widespread, moderate impacts on these resources.

The AVEHP further determined that NRHP-eligible Oak Grove Cemetery, would experience an adverse impact due to the presence of the proposed Lawrence Lynch substation in Falmouth. The cemetery is associated with the rural cemetery movement and, as such, setting is an integral part of its significance. The introduction of the immediately adjacent modern substation would change this setting and, while vegetation between the building and cemetery would minimize visibility, there would be views of the building from the cemetery (COP Appendix S; SouthCoast Wind 2024). Therefore, the presence of onshore Project components would have long-term, continuous, moderate impacts on this resource.

An AVEHP was also completed for the proposed onshore Project components in Brayton Point, Massachusetts. This AVEHP determined that the introduction of the onshore converter stations at Brayton Point would not adversely impact historic aboveground resources. While the introduction of new visual elements may result in viewshed impacts, they would either be temporary in nature or negligible. The maximum potential height of the converter stations would be 85 feet (24.4 meters). All but the uppermost portions of the highest converter station components would be screened from view and the remaining visible lightning-protection masts or other narrow, vertical components would be seen at a minimum distance of 0.44 mile (0.7 kilometer) and interspersed with existing industrial infrastructure, screening vegetation, or both. Therefore, potential visual impacts would not occur to an extent that would erode the historic integrity of setting for historic properties (COP Appendix S.1; SouthCoast Wind 2024). To further minimize and mitigate the Proposed Action's impacts, SouthCoast Wind has proposed to implement several AMMs, including consulting with Tribal Nations and SHPOs and designing the onshore substation to mitigate visual impacts (Appendix G, *Mitigation and Monitoring*).

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.

Cumulative Impacts of the 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 and offshore wind activities.

In context of reasonably foreseeable trends, impacts from accidental releases from offshore wind projects would be similar to those of the Proposed Action and be negligible in most cases, except for rare cases of large-scale accidental release that represent major impacts. The overall impacts on marine cultural resources from accidental releases from the Proposed Action combined with those from ongoing and planned activities would range from localized, short term, and negligible to geographically extensive, temporary to permanent, and major depending on the number and scales of accidental releases, if any. The Proposed Action, combined with impacts from ongoing and planned activities, could also impact marine cultural resources through anchoring, cable emplacement and maintenance, and gear utilization. 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 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, O&M, and decommissioning. BOEM has committed to working with applicants, consulting parties, federally recognized Native American Tribes, the Massachusetts Historical Commission, RIHPHC, and the Massachusetts Board of Underwater Archaeological Resources to develop specific mitigation measures to resolve effects on marine cultural resources that cannot be avoided by proposed offshore wind development projects. Development and implementation of project-specific mitigation measures would likely reduce the magnitude of 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, in context of reasonably foreseeable trends, the impacts on marine cultural resources from anchoring, cable emplacement and maintenance, and 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.

In context of reasonably foreseeable trends, 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. In context of reasonably foreseeable environmental trends, 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 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 that contributes to the historic significance and integrity of the resource. Permanent aviation and vessel warning lighting would be required on all WTGs and OSPs built by offshore wind projects. The Proposed Action would account for approximately 14 percent of the WTGs and OSPs in the geographic analysis area that could 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. Construction of other offshore wind projects in the geographic analysis area would contribute similar lighting impacts from nighttime vessel and construction and decommissioning area lighting as under the Proposed Action. Nighttime construction and decommissioning lighting associated with the Proposed Action and other ongoing and planned activities including offshore wind would have negligible impacts on cultural resources. Therefore, in the context of reasonably foreseeable environmental trends, the Proposed Action, combined with ongoing and planned activities, would result in negligible to moderate impacts on cultural resources.

BOEM conducted a Cumulative Historic Resources Visual Effects Assessment (CHRVEA) to evaluate visual impacts from the presence of structures on the adversely affected aboveground historic properties in the visual APE for offshore Project components, which are the Nantucket Historic District NHL, Nantucket Sound TCP, and Chappaquiddick Island TCP (BOEM 2023). The planned activities scenario assessment determined the maximum number of WTGs from the Proposed Action and future offshore wind projects that could be theoretically visible (based on distance, topography, vegetation, and intervening structures) from each historic property. Other offshore wind projects included in the cumulative WTG count from historic properties are Vineyard Wind Northeast (formerly Liberty Wind), Beacon Wind, Vineyard Wind 1, New England Wind, Bay State Wind, Sunrise Wind, South Fork Wind, and Revolution Wind.

The CHRVEA demonstrated that portions of the WTGs could theoretically be visible from all three historic properties. The study demonstrated that from the southern boundary of the Nantucket Sound TCP, portions of up to 744 WTGs would be theoretically visible and the closest WTG would be approximately 14.3 miles (23 kilometers) away. The Nantucket Historic District NHL would be subject to similar viewshed impacts, with portions of up to 743 WTGs theoretically be visible from the southern shores of the district and the closest WTG approximately 14.8 miles (23.8 kilometers) away from the resource. Finally, the study demonstrated that from the Chappaquiddick Island TCP, portions of up to 679 WTGs would be visible, the closest of which would be approximately 14.7 miles (23.6 kilometers) away. The Project WTG locations represent 12.66 to 17.36 percent of the total WTGs that are theoretically visible from the three historic properties in the planned activities scenario. For this reason, the Project WTGs would foreseeably be surrounded by other offshore wind energy development activities that would constitute 82.64 to 87.34 of the total WTGs potentially visible from the three historic properties (BOEM 2023).

The intensity of cumulative visual impacts on these historic properties would be limited by distance and environmental and atmospheric factors. As discussed in the VIA (COP Appendix T; SouthCoast Wind 2024), the visibility of WTGs would be further reduced by environmental and atmospheric factors such as meteorological conditions like low cloud cover, fog, or haze. 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, and moderate impacts on the Nantucket Historic District NHL, Nantucket Sound TCP, and Chappaquiddick Island TCP. The Proposed Action would contribute a noticeable increment to these impacts.

Conclusions

Impacts of the Proposed Action: The Proposed Action would have negligible to major impacts on individual cultural resources. Impacts would be reduced through the NHPA Section 106 consultation process as a result of the commitments made by SouthCoast Wind and implementation of AMMs to resolve 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 occur without the preconstruction NHPA requirements to identify historic properties, assess potential effects, and develop HPTPs to resolve effects through avoidance, minimization, or mitigation. These NHPA-required, "good-faith" efforts to identify historic properties and address impacts resulted in or contributed to SouthCoast Wind proposing several AMMs to reduce the magnitude of impacts on cultural resources (Appendix G, *Mitigation and Monitoring*).

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 the Proposed Action: In context of other reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from the Proposed Action in combination with other ongoing and planned activities would be appreciable. Considering all of the IPFs together, BOEM anticipates that the cumulative impacts on cultural resources associated with the Proposed Action and other ongoing and planned activities would be **major** due to the long-term or permanent and irreversible impacts on archaeological (terrestrial and marine) resources and ASLFs if they cannot be avoided, and long-term impacts on historic aboveground resources, including the Nantucket Historic District NHL, Nantucket Sound TCP, Chappaquiddick Island TCP, and Oak Grove Cemetery.

3.6.2.6 Impacts of Alternative C on Cultural Resources

Impacts of Alternative C: Alternative C includes two sub-alternatives (C-1 and C-2) to analyze alternate onshore cable route options developed to avoid installation of a portion of the proposed Brayton Point offshore export cable that runs through the Sakonnet River. Physical impacts from seabed- and ground-disturbing activities on marine cultural resources, terrestrial archaeological resources, and historic aboveground resources are subject to differ under Alternative C as compared to those anticipated under the Proposed Action. Since the cable route alternates proposed under Alternative C would be buried, no visual impacts on cultural resources are anticipated; as such, visual impacts on cultural resources are anticipated to be the same as the Proposed Action under this alternative.

The following analysis is based on the findings solely from cultural resources background research (PAL 2022; RCG&A 2022). As notated where applicable in the discussion, cultural resource and historic property identification and evaluation efforts for Alternative C have not been fully completed. Previously recorded cultural resources identified through background research and discussed here are those that are recorded through identification processes that have circumstantially occurred in areas overlapping with the Alternative C route options. These identification processes are unrelated to the Project's own cultural resource investigations and, therefore, do not necessarily encompass all areas subject to impacts under Alternative C. As such, the absence of previously recorded cultural resources in any of the Alternative C areas does not preclude the presence of currently unidentified but potential cultural resources to exist in those areas. Uninvestigated portions of Alternatives C-1 and C-2 may contain currently unidentified but potential cultural resources on which the Project may have adverse impacts should either sub-alternative be adopted.

Should federal and state-permitted agencies approve one of the Alternative C cable route options and not the full Brayton Point ECC as proposed under the Proposed Action, SouthCoast Wind will use a process of phased identification and evaluation of historic properties as defined in 36 CFR 800.4(b)(2) for completing cultural surveys for presently uninvestigated areas (COP Appendix R.2, Section 3.1; SouthCoast Wind 2024). BOEM will use the MOA to establish commitments for reviewing the sufficiency of any supplemental archaeological investigations; assessing effects on historic properties; and implementing measures to avoid, minimize, or mitigate impacts 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 as of September 25, 2024.

Alternative C-1

Alternative C-1 (Aquidneck Island, Rhode Island Route) involves the use of a cable route west of the Sakonnet River. Diverting from the Proposed Action's Brayton Point Offshore ECC to the west, this alternate route would traverse an offshore area that makes landfall at the Second Beach parking lot in Middletown, Rhode Island. The onshore route would then run the length of Aquidneck Island with two variations: the western variation (approximately 4.1 miles [6.6 kilometers] total distance) and eastern variation (approximately 4.0 miles [6.4 kilometers] total distance). From the point at which the western and eastern variations would rejoin, this alternate cable route would continue for approximately 4.5 miles (7.2 kilometers) before reaching Boyd's Lane, where the route continuing to Brayton Point, including the three options for entering Mount Hope Bay, would be the same as the Proposed Action. Alternative C-1 would decrease the total offshore area subject to Project development for the Brayton Point Offshore ECC, thereby potentially decreasing the potential for adverse impacts on marine cultural resources. Implementation of this sub-alternative would result in full avoidance of impacts that would otherwise occur from the Proposed Action on one ASLF located in the Sakonnet River (COP Appendix Q; SouthCoast Wind 2024). BOEM would require SouthCoast Wind to uphold the same applicable commitments to avoid specific marine cultural resources should this alternative be adopted (see the draft of the MOA as of September 25, 2024, in Appendix I, Attachment A for additional information). Though this sub-alternative would result in avoidance of the aforementioned resources, adoption of Alternative C-1 would have the same or similar adverse impacts as the Proposed Action on others or introduce new impacts to other individual marine cultural resources. Background research determined one potential marine archaeological resource may be subject to adverse impacts from the adoption of

Alternative C-1 (RCG&A 2022). This potential resource and other, currently unidentified but potential marine cultural resources may be present within a potential offshore ECC that would encompass this alternate route. Based on the available information, impacts on marine cultural resources under Alternative C-1 may be reduced, similar to, or increased as compared to those under the Proposed Action depending on the presence of marine cultural resources located within an offshore ECC for this sub-alternative.

Additionally, the onshore portion of the Alternative C-1 route would increase the potential for adverse impacts on terrestrial archaeological and historic aboveground resources. No cultural survey efforts have been completed for Alternative C-1. However, background research found that 10 known terrestrial archaeological resources and 21 known historic aboveground resources, including 6 historic properties listed in the NRHP and 6 historic cemeteries,[2] have the potential to be subject to adverse impacts under Alternative C-1 (PAL 2022). Of the individual known cultural resources identified in background research, adoption of the Alternative C-1 route with the western route variation would have the potential to impact 9 terrestrial archaeological resources and 18 historic aboveground resources, including 5 historic properties listed in the NRHP and 5 historic cemeteries (PAL 2022). Should Alternative C-1 adopt the eastern route variation, seven known terrestrial archaeological resources and 15 known historic aboveground resources, including 3 historic properties listed in the NRHP and 4 historic cemeteries, may be subject to impacts (PAL 2022). A table listing resources potentially subject to impacts under Alternative C-1 can be found in Appendix I, *Determination of Effect for NHPA Section 106 Consultation.*

A terrestrial archaeological sensitivity assessment was also conducted to determine the potential for a given area of the Alternative C-1 cable route to contain terrestrial archaeological resources (PAL 2022). Areas assessed as having high sensitivity are those in which previously unrecorded but potential terrestrial archaeological resources are most likely to be present; whereas areas assessed as having low sensitivity are those in which such resources are least likely to be present. This assessment found that the Alternative C-1 cable route contains 28 percent high sensitivity, 21 percent moderate sensitivity, and 51 percent low sensitivity areas.

Alternative C-2

Alternative C-2 (Little Compton/Tiverton, Rhode Island Route) involves the use of a cable route located east of the Sakonnet River. Diverting from the Proposed Action's Brayton Point Offshore ECC to the east, this alternate route traverses an offshore area that makes landfall on the ocean-facing side of

[2] Rhode Island General Law (RIGL) 23-18-11 et seq. (State Cemeteries Act) conditionally prohibits any town or city from permitting "construction, excavation or other ground disturbing activity within twenty-five (25) feet of a recorded historic cemetery" unless the "boundaries of the cemetery are adequately documented and there is no reason to believe additional graves exist outside the recorded cemetery." As such, BOEM assumes historic cemeteries within 25 feet of the Project would be subject to adverse impacts without the adoption of AMM measures.

Breakwater Point. The onshore route then runs approximately 15.8 miles before entering into Mount Hope Bay and then continuing to Brayton Point along the same route as the Proposed Action.

Alternative C-2 would decrease the total offshore area subject to Project development for the Brayton Point Offshore ECC, thereby potentially decreasing the potential for adverse impacts on marine cultural resources. Implementation of this sub-alternative would result in full avoidance of impacts that would otherwise occur from the Proposed Action one ASLF (COP Appendix Q; SouthCoast Wind 2024; RCG&A 2022). BOEM would require SouthCoast Wind to uphold the same applicable commitments to avoid specific marine cultural resources should this alternative be adopted (see a draft of the MOA as of September 25, 2024, in Appendix I, Attachment A for additional information). Though this sub-alternative would result in avoidance of the aforementioned resources, adoption of Alternative C-2 may introduce impacts on other individual marine cultural resources. Unlike the Alternative C-1 cable route, the Alternative C-2 cable route has two, noncontiguous offshore portions: one portion in Mount Hope Bay and another in Rhode Island Sound. Background research has demonstrated there are no known marine cultural resources in either offshore portions of this alternate route (RCG&A 2022); however, cultural surveys for these presently uninvestigated areas have not been completed. Other, currently unidentified but potential marine cultural resources may be present in a potential offshore ECC that would encompass this alternate route. Based on the available information, impacts on marine cultural resources under Alternative C-2 may be reduced, similar to, or increased as compared to those under the Proposed Action depending on the presence of marine cultural resources located in an offshore ECC for this sub-alternative.

Additionally, the onshore portion of the Alternative C-2 route would increase the potential for adverse impacts on terrestrial archaeological and historic aboveground resources. No cultural survey efforts have been completed for Alternative C-2. However, background research found that three known terrestrial archaeological resources and 23 known historic aboveground resources, including four historic properties listed in the NRHP and eight historic cemeteries, have the potential to be subject to adverse impacts under Alternative C-2 (PAL 2022). A table listing resources potentially subject to impacts under Alternative C-2 can be found in Appendix I.

A terrestrial archaeological sensitivity assessment was also conducted to determine the potential for a given area of the Alternative C-2 cable route to contain terrestrial archaeological resources (PAL 2022). This assessment found that the Alternative C-2 cable route contains 8 percent high sensitivity, 61 percent moderate sensitivity, and 31 percent low sensitivity areas.

Cumulative Impacts of Alternative C: In the context of other reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be the same as under the Proposed Action.

Conclusions

Impacts of Alternative C: The impacts resulting from individual IPFs associated with Alternative C alone on cultural resources may be reduced, the same as, similar to, or increased compared to impacts under the Proposed Action depending on the presence of cultural resources in areas subject to seabed- or ground-disturbing activities under this alternative. Based on the preliminary background research, quantitative and qualitative assessments suggest adoption of either Alternative C-1 or C-2 would introduce adverse impacts on a larger number of individual cultural resources as compared to the Proposed Action. However, the Alternatives C-1 and C-2 routes are predominantly proposed to occur within or along public road ROWs, shoulders, and medians and may not contribute any additional adverse impacts on potential cultural resources located in these previously disturbed areas.

BOEM anticipates that Alternative C would have similar **major** impacts on cultural resources as the Proposed Action that may be avoided, minimized, or mitigated depending on SouthCoast Wind's implementation of AMMs developed through the NHPA Section 106 consultation process. Should federal- and state-permitted agencies approve one of the Alternative C cable route options and not the full Brayton Point ECC as proposed under the Proposed Action, SouthCoast Wind would use a process of phased identification and evaluation of historic properties as defined in 36 CFR 800.4(b)(2) for completing offshore and onshore cultural resources investigations (COP Appendix R.2, Section 3.1; SouthCoast Wind 2024). BOEM would use the MOA to establish commitments for reviewing the sufficiency of any supplemental archaeological investigations as phased identification; assessing effects on historic properties; and implementing measures to avoid, minimize, or mitigate impacts in these areas prior to construction.

Cumulative Impacts of Alternative C: In the context of other reasonably foreseeable environmental trends, the cumulative impacts associated with Alternative C would be the same as for the Proposed Action—**major**.

3.6.2.7 Impacts of Alternative D (Preferred Alternative) on Cultural Resources

Impacts of Alternative D: Alternative D involves the elimination of six WTGs in the northeastern portion of the Lease Area to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals. Proposed activities under Alternative D would not involve changes to any onshore Project components; therefore, impacts on historic aboveground resources and TCPs 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 marine cultural resources, as well as historic aboveground resources and TCPs located in the visual APE for offshore Project components are subject to differ under Alternative D as compared to those anticipated under the Proposed Action.

Implementation of this alternative is not anticipated to result in a reduction of impacts or impact severity on marine cultural resources as no known marine cultural resources are located in the area from which WTG positions would be eliminated. However, removal of these offshore Project components would reduce potential impacts on currently undiscovered marine archaeological resources that may be present in these areas. Additionally, while Alternative D 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. As such, the impacts and severity of impacts on historic aboveground resources in the visual APE for offshore Project components are anticipated to be similar compared to those under the Proposed Action despite the slight decreased visibility of the Project.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative D: The impacts resulting from individual IPFs associated with Alternative D on cultural resources would be the same as or similar to those of 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 D would have similar **major** impacts on cultural resources as the Proposed Action that may be avoided, minimized, or mitigated depending on SouthCoast Wind's implementation of AMMs developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative D. In the context of other reasonably foreseeable environmental trends, the cumulative impacts associated with Alternative D would be the same as the Proposed Action—**major**.

3.6.2.8 Impacts of Alternative E on Cultural Resources

Impacts of Alternative E: Alternative E includes three sub-alternatives (E-1, E-2, and E-3) to analyze the maximum design scenario for each of the three different foundation categories that could be used for WTGs and OSPs. 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. Additionally, differences in foundation type are not anticipated to result in measurable differences in visual impact on historic aboveground resources or TCPs 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 E are anticipated to be the same as those under the Proposed Action.

Impacts on marine cultural resources are subject to differ under Alternative E as compared to those anticipated under the Proposed Action. These impacts would be caused by seabed disturbances that would occur during construction of WTGs and OSPs. The maximum area of seabed disturbance for each of the foundation types is anticipated to differ (COP Volume 1, Tables 3-26 and 3-37; SouthCoast Wind 2024). Under Alternative E-1, piled foundations would be used for all WTGs and OSPs. While the pin-pile jacket foundation subtype would cause greater maximum seabed disturbance than the monopile subtype, the difference in disturbance between the two subtypes of piled foundations would be negligible in terms of impacts on cultural resources. Piled foundations involve the least amount of seabed disturbance compared to suction-bucket or GBS foundations. Under Alternative E-2, suction-bucket foundations would be used for all WTGs and OSPs. Suction-bucket foundations involve a greater amount of seabed impacts compared to piled foundations and a lesser amount compared to GBS foundations. Under Alternative E-3, GBS foundations would be used for all WTGs and OSPs. GBS foundations involve the greatest amount of seabed disturbance compared to piled or suction-bucket foundations.

In summary, foundations proposed under Alternative E-1 would result in the least potential for, and severity of, impacts on marine cultural resources as a result of having the least area of maximum seabed disturbance. Alternative E-3 would result in the greatest potential for and severity of impacts on marine cultural resources as a result of having the greatest area of maximum seabed disturbance. Overall, the anticipated range of impact severity on individual marine cultural resources under Alternative E would be the same as those under the Proposed Action; while some individual marine cultural resources may experience reduced negligible or minor impacts due to use of a foundation type with a smaller seabed disturbance area, other individual marine cultural resources may still experience moderate or major impacts due to use of the same foundation type regardless of its smaller seabed disturbance area.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative E would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative E: The impacts resulting from individual IPFs associated with Alternative E 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 marine cultural resources in relation to proposed WTGs and OSPs. The severity of impacts on marine cultural resources 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 E would have similar **major** impacts on cultural resources as the Proposed Action that may be avoided, minimized, or mitigated depending on SouthCoast Wind’s implementation of AMMs developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative E: In the context of other reasonably foreseeable environmental trends, the cumulative impacts associated with Alternative E would be the same as under the Proposed Action—**major**.

3.6.2.9 Impacts of Alternative F on Cultural Resources

Impacts of Alternative F: Under Alternative F, the Falmouth offshore export cable route would be limited to the installation of up to three cables (as opposed to up to five cables under the Proposed Action). Proposed activities under this alternative are not anticipated to change impacts on terrestrial archaeological or historic aboveground resources; therefore, impacts on these resource types under Alternative F would be the same as those under the Proposed Action.

Impacts on marine cultural resources—including marine archaeological resources, ASLFs, and the Nantucket Sound TCP—are subject to differ under Alternative F as compared to those anticipated under the Proposed Action. The Nantucket Sound TCP and four ASLFs—some of which may be contributing elements to the TCP—have been identified in the Falmouth Offshore ECC. Reduction of the number of installed cables would reduce the overall area subject to potential seabed disturbance, thereby reducing potential adverse impacts on marine cultural resources including the Nantucket Sound TCP. BOEM would require SouthCoast Wind to uphold the same applicable commitments to avoid specific marine archaeological resources and ASLFs located in the Falmouth Offshore ECC should this alternative be adopted (see a draft of the MOA as of September 25, 2024, in Appendix I, Attachment A for additional information). However, BOEM finds that the resources for which there are presently no commitments to avoidance from SouthCoast Wind would still be subject to physical adverse impacts. Additionally, the majority of marine cultural resources, and cultural resources in general, subject to impacts from the Project are located in other areas unaffected by this alternative.

Cumulative Impacts of Alternative F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative F would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative F: Impacts resulting from individual IPFs associated with Alternative F alone on cultural resources may be reduced or similar compared to those under the Proposed Action. A reduction in impacts would depend on the presence of marine cultural resources in the areas subject for offshore Project component removal under this alternative. If no marine cultural resources are located in these areas, no reduction in impacts on cultural resources would occur. However, overall, the nature and physical extent of proposed activities under this alternative would be largely comparable to those of the Proposed Action and would result in similar impacts. 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 SouthCoast Wind's implementation of AMMs developed through the NHPA Section 106 consultation process.

Cumulative Impacts of Alternative F. In the context of other reasonably foreseeable environmental trends, cumulative impacts associated with Alternative F would be the same as for the Proposed Action—**major**.

3.6.2.10 Comparison of Alternatives

Modifications under Alternatives C, D, E, and F are not anticipated to result in substantive differences in impacts on cultural resources as compared to the Proposed Action and would, therefore, result in similar impacts as those of the Proposed Action: **major**. In context of reasonably foreseeable environmental trends, the contribution of Alternatives C, D, E, and F to the impacts of individual IPFs from ongoing and planned activities would primarily be the same as that of the Proposed Action: **minor** to **major** for the Proposed Action and **major** for Alternatives C, D, E and F.

3.6.2.11 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 September 25, 2024).

Table 3.6.2-3. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): cultural resources

Measure	Description	Effect
CUL-1, 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, Mashantucket (Western) Pequot Tribal Nation, Mashpee Wampanoag Tribe, Wampanoag Tribe Of Gay Head (Aquinnah), The State Historic Preservation Officers of Massachusetts and Rhode Island, Southcoast Wind Energy LLC, and The Advisory Council on Historic Preservation Regarding the SouthCoast Wind Project* (hereafter referred to as the MOA) as developed by BOEM through NHPA Section 106 consultations with federally recognized Tribes, Massachusetts and Rhode Island SHPOs, 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.	Compliance with stipulations in the MOA would result in the resolution of adverse effects on historic properties through AMMS.
CUL-2, 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 for 31 identified marine archaeological resources and seven ASLFs 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.
CUL-3, Funding and Implementation of Historic Properties Treatment Plan for	Per MOA Stipulation III.C.1 and the associated HPTP (MOA, Attachment 8), the lessee will implement the measures described in the HPTP and fund these	Implementation of HPTPs detailing and specifying processes, responsibilities, and schedule for completion associated with fulfilling compensatory mitigation actions

Measure	Description	Effect
Historic Properties in the Marine Area of Potential Effects	measures per the agreed-upon amounts in *Mitigation Funding Amounts* (MOA, Attachment 5) to resolve adverse effects on historic properties in the marine APE.	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.
CUL-4, Marine Archaeology Post-Review Discovery Plan	Per MOA Stipulation XI, 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 described in the post-review discovery plan for marine archaeology (MOA, Attachment 13).	Implementation of a post-review discovery plan 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.
CUL-5, Archaeological Monitoring in the Terrestrial Area of Potential Effects	Per MOA Stipulation I.A.2, the lessee will implement a construction monitoring program consistent with the monitoring plan for terrestrial archaeology (MOA, Attachments 3 and 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.
CUL-6, Funding and Implementation of Historic Properties Treatment Plans for Historic Properties in the Terrestrial Area of Potential Effects	Per MOA Stipulation III.D.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* (MOA, Attachment 5) to resolve adverse effects on historic properties in the terrestrial 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.
CUL-7, Terrestrial Archaeology Post-	Per MOA Stipulation XI, if historic properties are discovered that may be historically significant or unanticipated effects on historic properties are found, or in the event	Implementation of a post-review discovery plan would reduce potential impacts on any archaeological resources discovered during construction and installation, O&M, or

Measure	Description	Effect
Review Discovery Plan	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 described in the post-review discovery plan for terrestrial archaeology (MOA, Attachment 14).	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.
CUL-8, Minimization of Adverse Effects on Historic Properties in the Visual Area of Potential Effects	Per MOA Stipulation II.A, the lessee will implement measures for minimizing adverse effects on historic properties in the visual APE to decrease visual clutter, reduce visual contrast, and reduce light intrusion.	Implementation of measures to minimize the Proposed Action's visual impacts would reduce visual impacts of the Proposed Action and ensures no additional aboveground historic properties are visually adversely affected by the Proposed Action beyond those already identified per NHPA Section 106.
CUL-9, Funding and Implementation of Historic Properties Treatment Plans for Historic Properties in the Visual Area of Potential Effects	Per MOA Stipulation III.C.1 and the associated HPTPs (MOA, Attachments 8–11), the lessee will implement the measures described in these HPTPs and fund these measures per the agreed-upon amounts in *Mitigation Funding Amounts* (MOA, Attachment 5) to resolve adverse effects on historic properties in the visual 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.

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 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 in the terrestrial APE that could not be surveyed prior to publication of the Final EIS. Implementation of post-review discovery plans 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.

3.6.3 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.

3.6.4 Environmental Justice

This section discusses environmental justice impacts from the proposed Project, alternatives, and ongoing and planned activities in the environmental justice geographic analysis area. The geographic analysis area for environmental justice, as shown on Figure 3.6.4-1, includes the counties where proposed onshore infrastructure and potential port cities are located, as well as the counties closest to the Wind Farm Area and from which Project components would be visible: Barnstable, Bristol, Dukes, Nantucket, Plymouth, and Essex Counties, Massachusetts; Newport, Bristol, Washington and Providence Counties, Rhode Island; New London County, Connecticut; Baltimore County, Maryland; Nueces and San Patricio Counties, Texas; and Charleston County, South Carolina. These counties and municipalities are the most likely to experience beneficial or adverse environmental justice impacts from the proposed Project related to onshore and offshore construction and decommissioning, O&M, and use of port facilities.

3.6.4.1 Description of the Affected Environment

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Subsection 1-101). When determining whether environmental effects are disproportionately high and adverse, agencies are to consider whether there is or will be an impact on the natural or physical environment that significantly and adversely affects a minority population, low-income population, or Indian tribe, including ecological, cultural, human health, economic, or social impacts; and whether the effects appreciably exceed those on the general population or other appropriate comparison group (CEQ 1997). Beneficial impacts are not typically considered environmental justice impacts; however, this section identifies beneficial effects on environmental justice populations, where appropriate, for completeness.

Executive Order 12898 directs federal agencies to consider the following with respect to environmental justice as part of the NEPA process (CEQ 1997).

- The racial and economic composition of affected communities;
- Health-related issues that may amplify project effects on minority or low-income individuals; and
- Public participation strategies, including community or tribal participation in the NEPA process.

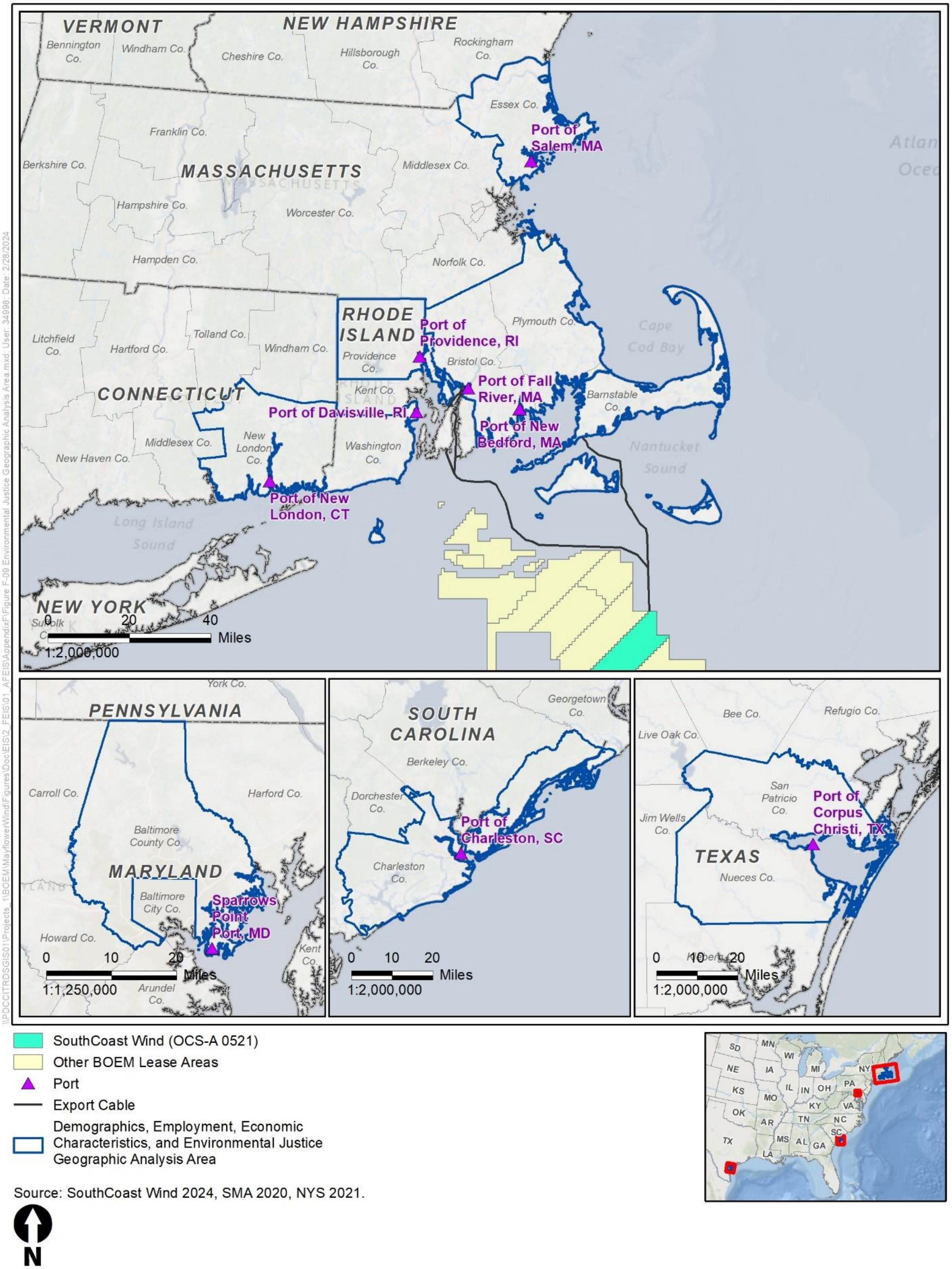


Figure 3.6.4-1. Environmental justice geographic analysis area

USEPA Environmental Justice Community Definition

For the purposes of this analysis, an environmental justice community is defined as the union of federal and, if available, state-specific criteria. According to USEPA guidance, environmental justice analyses must address disproportionately high and adverse impacts on minority populations (i.e., who are non-White, or who are White but have Hispanic ethnicity) when minority populations represent over 50 percent of the population of an affected area or when the percentage of minority or low-income populations in the affected area is "meaningfully greater" than the minority percentage in the "reference population"—defined as the population of a larger area in which the affected population resides (i.e., a county, state, or region depending on the geographic extent of the analysis area). Low-income populations are those that fall within the annual statistical poverty thresholds from the U.S. Department of Commerce, Bureau of the Census, Population Reports, Series P-60 on Income and Poverty (USEPA 2016). CEQ and USEPA guidance do not define *meaningfully greater* in terms of a specific percentage or other quantitative measure.

Commonwealth of Massachusetts Environmental Justice Community Definition

In the Commonwealth of Massachusetts, an environmental justice population, as defined by Chapter 8 of the Massachusetts State Legislature Session Laws Acts of 2021, is any census block group, as determined in accordance with the most recent United States census data, in which (MAEEA 2021):

- The annual median household income is not more than 65 percent of the statewide annual median household income;
- Minorities comprise 40 percent or more of the population;
- 25 percent or more of households lack English language proficiency (defined as a household that meets U.S. Census criteria for "linguistic isolation," specifically households where no one over the age of 14 speaks only English or English very well [MAEEA 2021]); or
- Minorities comprise 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.

Using these definitions and the community demographic data provided by the Massachusetts Executive Office of Energy and Environmental Affairs on its environmental justice web page, environmental justice populations meeting the minority or low-income criteria in the Massachusetts portion of the geographic analysis area are clustered around larger cities and towns including near the potential ports, as well as the potential point of cable interconnection at Brayton Point (Figure 3.6.4-2, Figure 3.6.4-3, and Figure 3.6.4-4) and are primarily located in and near Falmouth and Barnstable (Barnstable County); Attleboro, Taunton, Fall River, and New Bedford (Bristol County); Aquinnah and Tisbury (Dukes County); Nantucket (Nantucket County); Gloucester, Haverhill, Methuen, Lawrence, Lynn, and Salem (Essex County); and Brockton and Wareham (Plymouth County) (MAEEA 2022). Environmental justice populations meeting both the minority and low-income criteria are present in and near Bourne, Barnstable, New Bedford, Fall River, Brockton, and Taunton. Environmental justice populations meeting the minority and English isolation and/or income and English isolation criteria are located in Brockton, Lawrence, and New Bedford.

State of Rhode Island Environmental Justice Community Definition

RIDEM defers to USEPA's environmental justice community thresholds, but in its 2009 *Policy for Considering Environmental Justice in the Review of Investigation and Remediation of Contaminated Properties* defined the minority "reference population" as the entire state (RIDEM 2009). RIDEM published a revised Environmental Justice Policy in 2023 (RIDEM 2023) defining environmental justice. RIDEM (2023) additionally identified as Environmental Justice Focus Areas those in which the percent of the block group that is minority or low-income (under twice the federal poverty level) are high enough to rank in the top 15 percent of block groups statewide. This analysis therefore defines an environmental justice community as a block group that either (1) has an annual median household income is not more than 65 percent of the statewide annual median household income, minority population is equal to or greater than 40 percent of the population, and 25 percent or more of the households lack English proficiency, or (2) minorities comprise 25 percent or more of the population and the annual median household income of the municipality in the proposed area does not exceed 150 percent of the statewide annual median household income. USEPA's Environmental Justice Screening and Mapping Tool's (EJSCREEN) data were used to assess the 50 percent criterion and the top 15 percent criterion for Rhode Island (USEPA 2022a). Based on the top 15 percent criterion, this analysis will consider any block group in Rhode Island above the 85th percentile for low-income population to be an environmental justice community. According to EJSCREEN data, the 85th percentile in Rhode Island equals a block group in which 47 percent of the population qualifies as low-income. Environmental justice communities meeting the minority or income criteria are present within and near Providence (Providence County), and communities meeting the income criterion are present in and near Middletown (Newport County). Figure 3.6.4-5 provides a map of environmental justice community locations in the geographic analysis area in Rhode Island.

State of Connecticut Environmental Justice Community Definition

The state of Connecticut defines environmental justice communities in terms of low-income but not minority populations. Connecticut's House Bill No. 7008 defines an environmental justice community as "a United States census block group, as determined in accordance with the most recent United States census, for which 30 percent or more of the population consists of low-income persons who are not institutionalized and have an income below two hundred per cent of the federal poverty level" or is one of the 25 towns that Connecticut designates as "distressed municipalities" due to their low rankings in income, employment, education, and other areas as compared to the rest of the state (State of Connecticut 2020). This analysis defines environmental justice populations in Connecticut as the union of USEPA's 50 percent criterion for race, the state of Connecticut's 30 percent criterion for low income, and the state of Connecticut's definition of distressed municipality. Based on these criteria, environmental justice communities meeting the low-income or low income and minority criteria in the geographic analysis area for Connecticut are concentrated around the Port of New London (Figure

3.6.4-6). As of 2021, the city of New London is also considered a distressed municipality by the state of Connecticut (DECD 2021).

State of Maryland Environmental Justice Community Definition

The state of Maryland does not define specific environmental justice community parameters separate from the guidance provided by USEPA. This analysis, therefore, defines an environmental justice community in Maryland as a block group that meets USEPA's "50 percent" criterion for race, or is in the 80th percentile or above of block groups for minority or low-income status in Maryland. USEPA's EJSCREEN data were used to assess the 50 percent criterion and the 80th percentile criterion for Maryland (USEPA 2022a). Environmental justice communities meeting the minority and/or income criteria are dispersed throughout southern Baltimore County. Populations meeting both the minority and low-income criteria are in the area directly adjacent to Sparrows Point Port. Figure 3.6.4-7 provides a map of environmental justice community locations in the geographic analysis area in Maryland.

State of South Carolina Environmental Justice Community Definition

The state of South Carolina does not define specific environmental justice community parameters separate from the guidance provided by USEPA. This analysis, therefore, defines an environmental justice community as a block group that meets USEPA's "50 percent" criterion for race, or is in the 80th percentile or above of block groups for minority or low-income status in South Carolina. USEPA's EJSCREEN data were used to assess the 50 percent criterion and the 80th percentile criterion for South Carolina (USEPA 2022a). While the Port of Charleston is not located within any environmental justice communities, environmental justice communities meeting the minority criteria or both the minority and income criteria are present in North Charleston, near the port; communities meeting the minority criteria are present elsewhere in Charleston County, including McClellanville in the east and Ravenel in the west. Figure 3.6.4-8 provides a map of environmental justice community locations in the geographic analysis area in South Carolina.

State of Texas Environmental Justice Community Definition

The state of Texas does not define specific environmental justice community parameters separate from the guidance provided by USEPA. This analysis therefore defines an environmental justice community in Texas as a block group that meets USEPA's "50 percent" criterion for race or is in the 80th percentile or above of block groups for minority or low-income status in Texas. USEPA's EJSCREEN data were used to assess the 50 percent criterion and the 80th percentile criterion for Texas (USEPA 2022a). Environmental justice communities meeting both the minority and/or income criteria are present within and near the Port of Corpus Christi and throughout most of both Nueces and San Patricio Counties. Figure 3.6.4-9 provides a map of environmental justice community locations in the geographic analysis area in Texas.

Table 3.6.4-1 summarizes trends for non-White populations and the percentage of individuals with incomes below the federally defined poverty line in the counties studied in the geographic analysis area. The percentage of population living under the poverty level generally increased from 2000 to 2010 and declined slightly by 2020. The non-White population percentage generally increased throughout the geographic analysis area between 2000 and 2020. Figure 3.6.4-2 through Figure 3.6.4-9 depict the environmental justice communities within the geographic analysis area. The census tracts represented in these figures are listed in Appendix B, *Supplemental Information and Additional Figures and Tables*.

Table 3.6.4-1. State and county low-income and minority status

Jurisdiction	Percentage of Population below the Federal Poverty Level			Non-White Population Percentage [a]		
	2000	2010	2020	2000	2010	2020
Commonwealth of Massachusetts	**9.3**	**11.4**	**9.8**	**18.1**	**23.9**	**32.4**
Barnstable County	6.9	11.3	6.7	6.6	8.6	15.0
Bristol County	10.0	12.9	10.7	10.6	14.4	23.1
Dukes County	7.3	NA	7.5	10.0	13.7	21.2
Essex County	8.9	10.3	10.1	16.9	24.0	33.8
Nantucket County	7.5	NA	6.3	13.1	19.5	30.6
Plymouth County	6.6	8.0	6.7	12.4	16.1	23.3
State of Rhode Island	**11.9**	**14.0**	**11.6**	**18.1**	**23.6**	**31.3**
Bristol County	6.3	NA	7.1	3.9	5.7	12.1
Newport County	7.1	5.8	7.7	9.9	12.1	17.2
Providence County	15.5	17.6	14.0	26.2	33.9	42.7
Washington County	7.3	8.7	8.2	6.1	7.5	8.5
State of Connecticut	**7.9**	**10.1**	**9.8**	**22.5**	**28.8**	**36.8**
New London County	6.4	8.8	8.5	15.3	21.7	27.4
State of Maryland	**8.5**	**9.9**	**9.0**	**37.9**	**45.2**	**49.7**
Baltimore County	6.5	8.1	9.3	26.5	37.4	43.8
State of South Carolina	**14.1**	**18.2**	**14.7**	**33.8**	**35.6**	**36.3**
Charleston County	16.4	18.9	12.8	39.0	37.7	35.1
State of Texas	**15.4**	**17.9**	**14.2**	**47.6**	**54.8**	**58.6**
Nueces County	18.2	19.6	16.2	62.3	67.3	71.3
San Patricio County	18.0	23.1	15.2	54.1	58.1	62.1

Sources: USCB 2000a, 2000b, 2010, 2020.
[a] Non-White population percentage is 100 percent minus the not Hispanic or Latino, White alone population percentage.

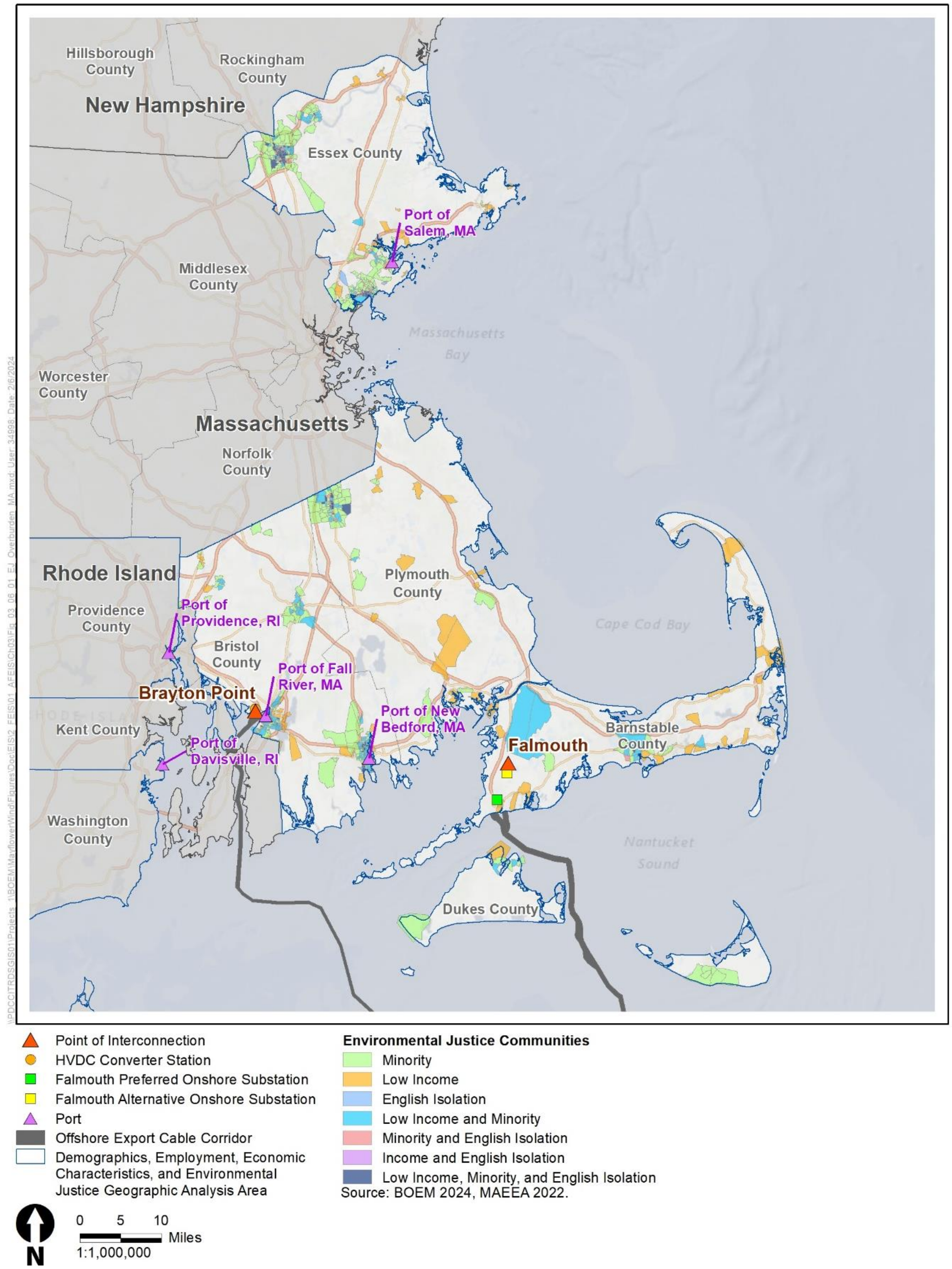


Figure 3.6.4-2. Environmental justice populations in Massachusetts

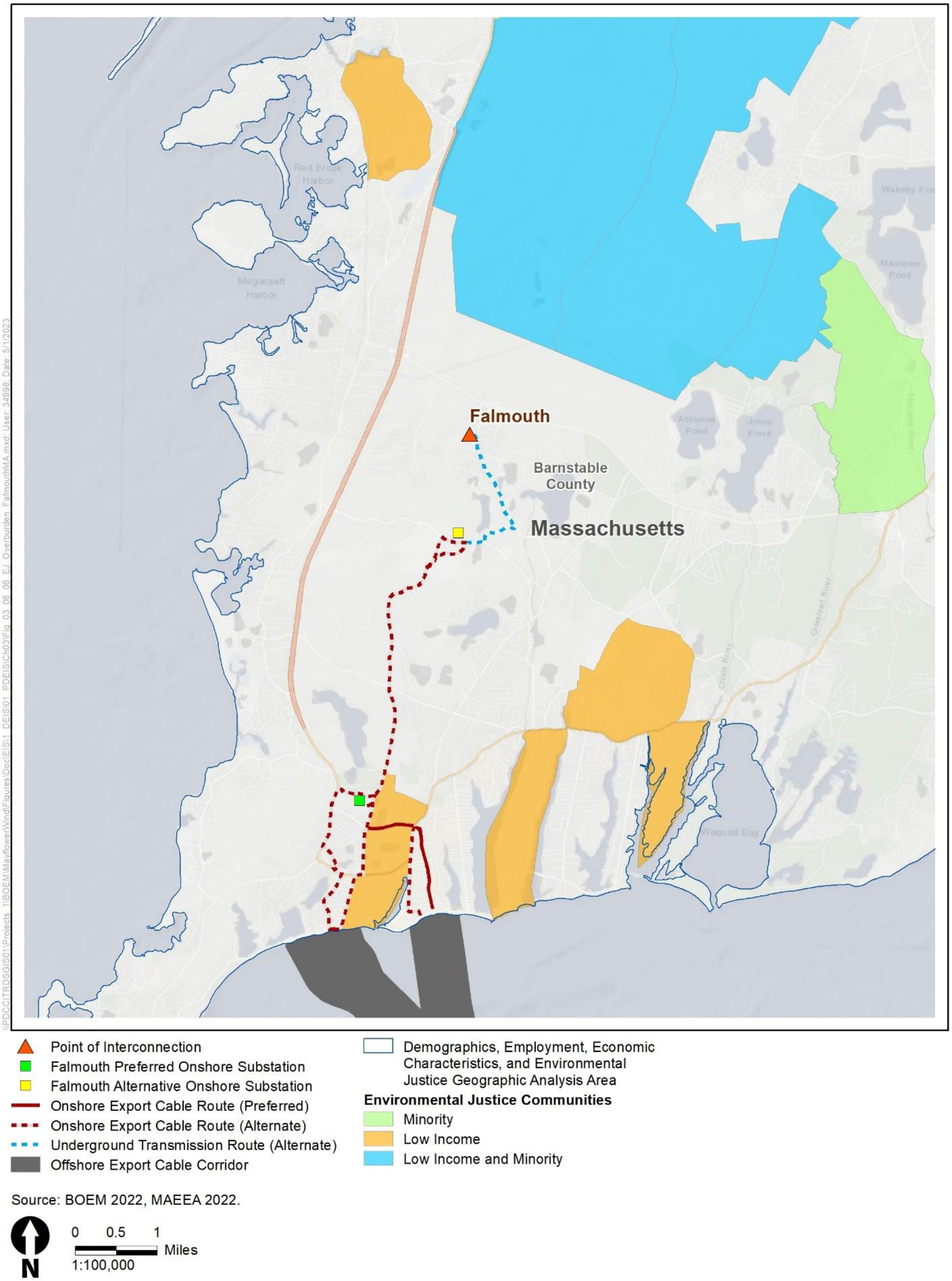


Figure 3.6.4-3. Environmental justice populations around the Falmouth Onshore Project area

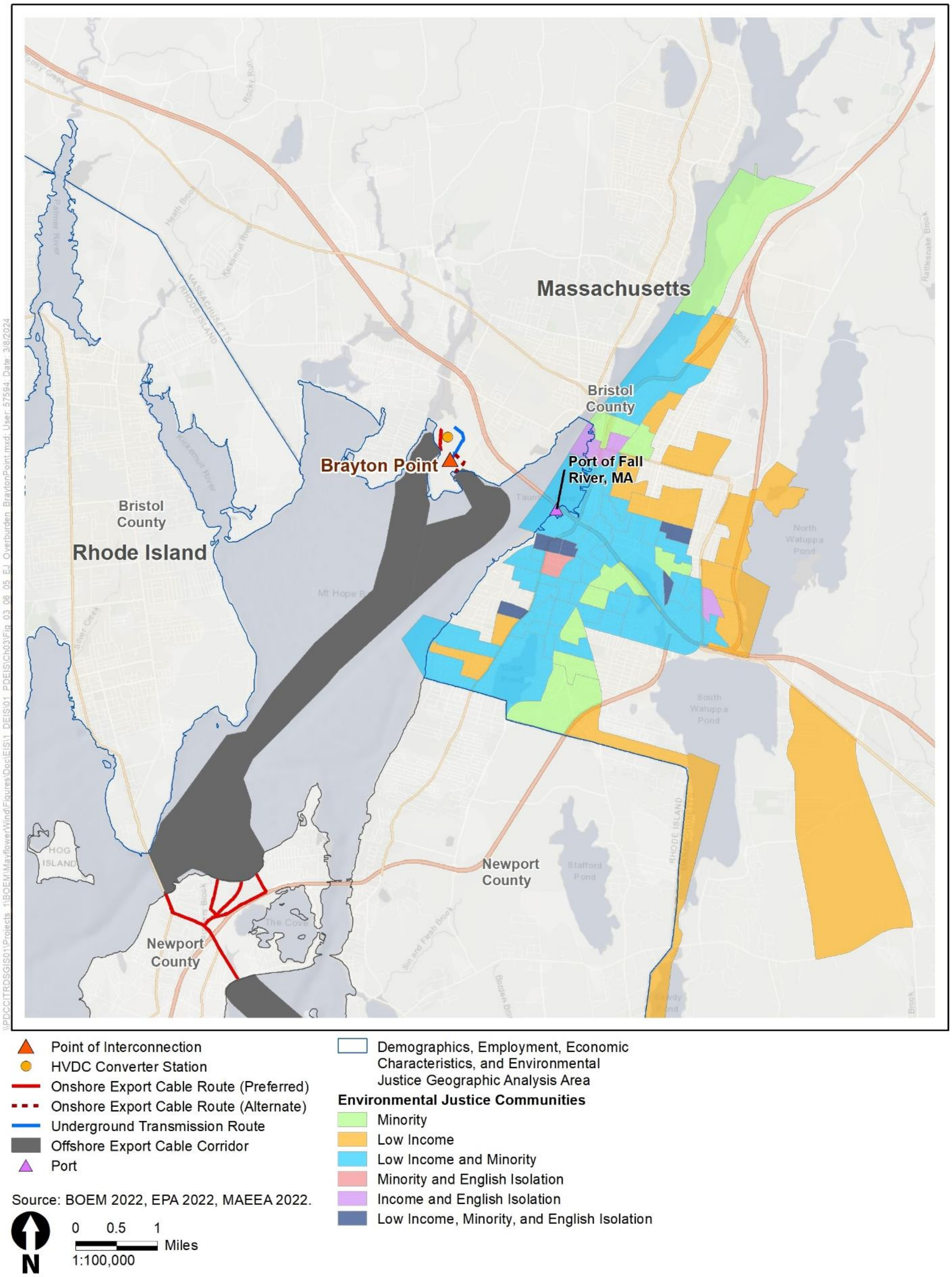


Figure 3.6.4-4. Environmental justice populations around the Brayton Point Onshore Project area

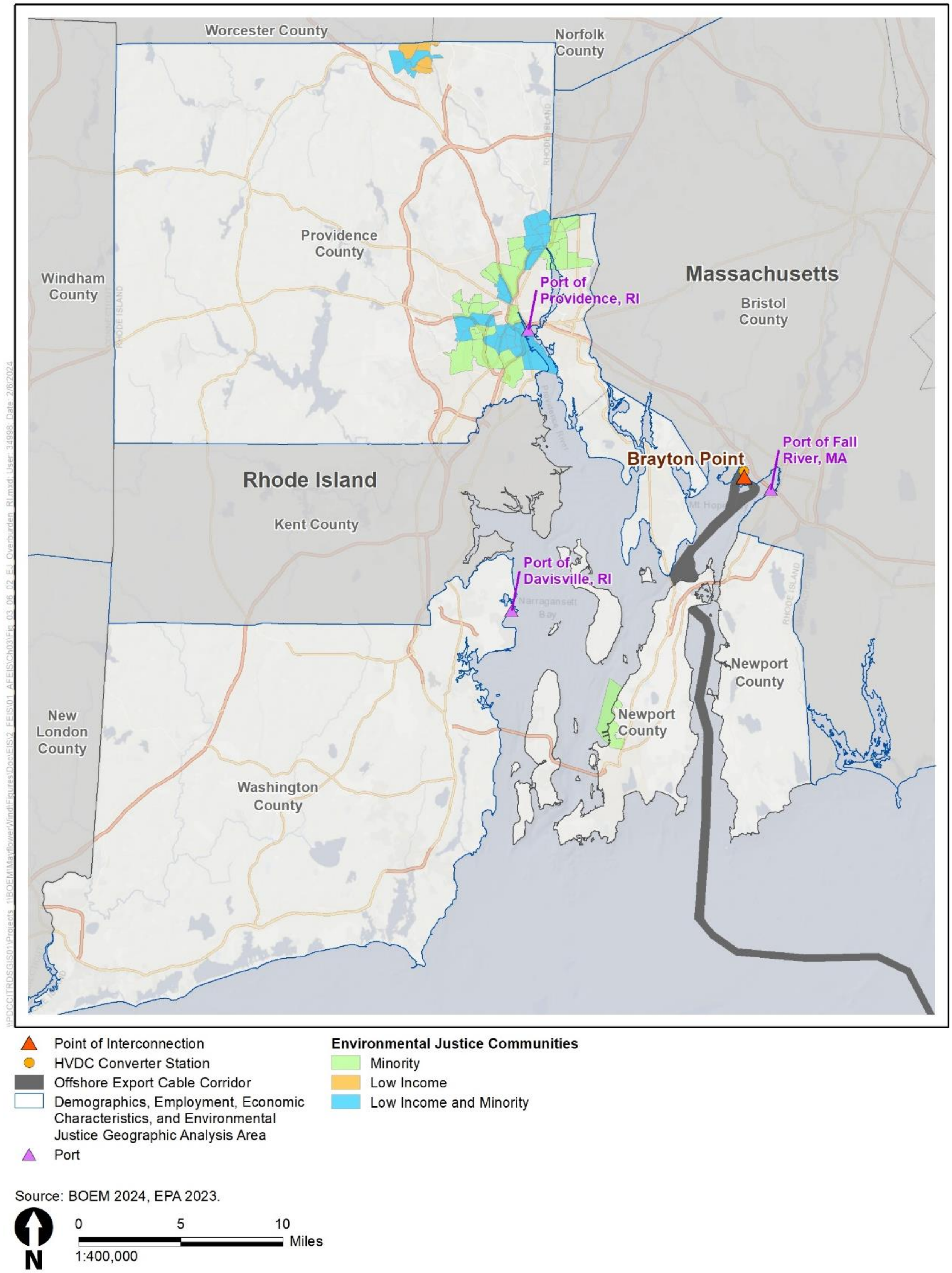


Figure 3.6.4-5. Environmental justice populations in Rhode Island

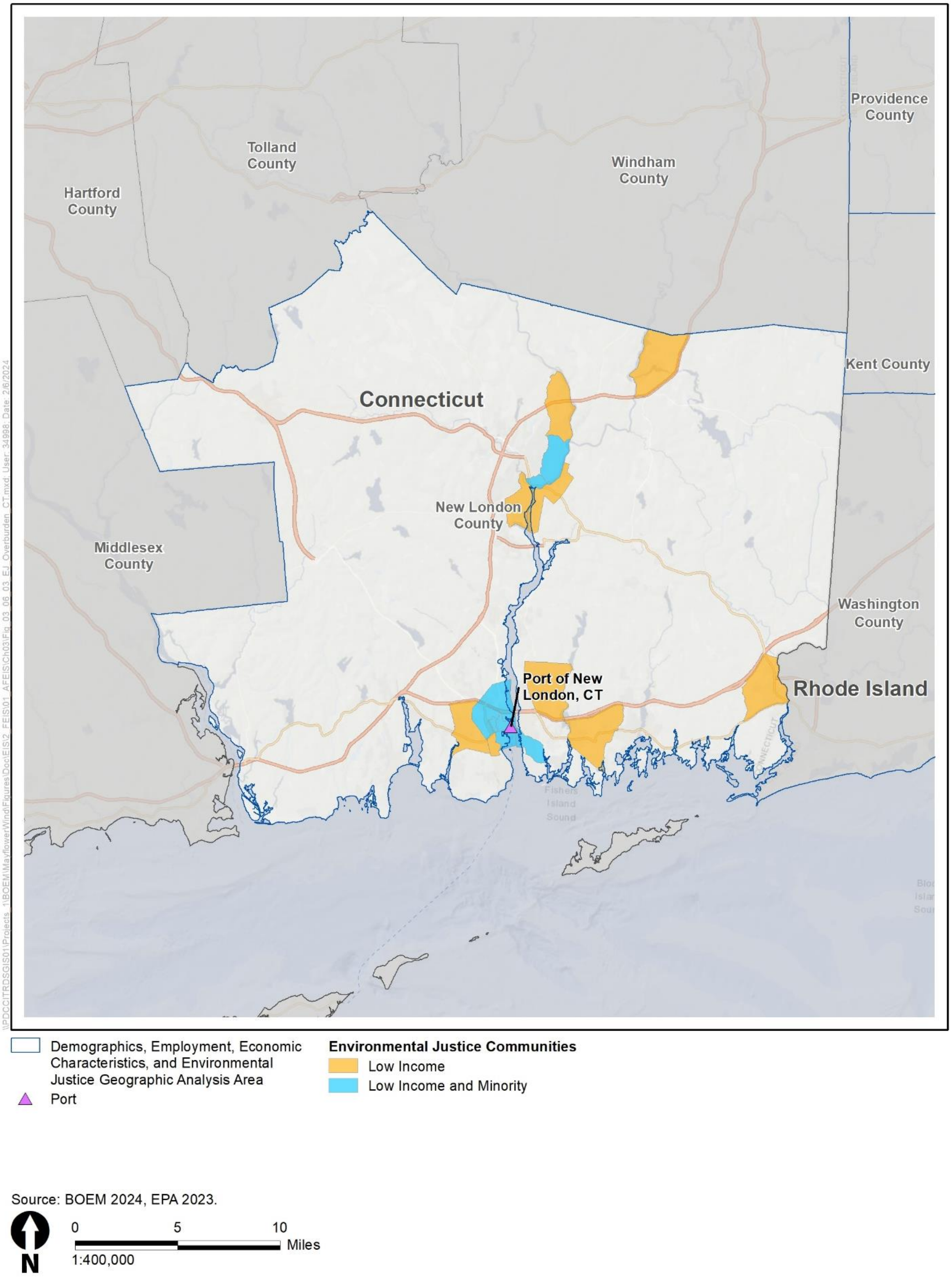


Figure 3.6.4-6. Environmental justice populations in Connecticut

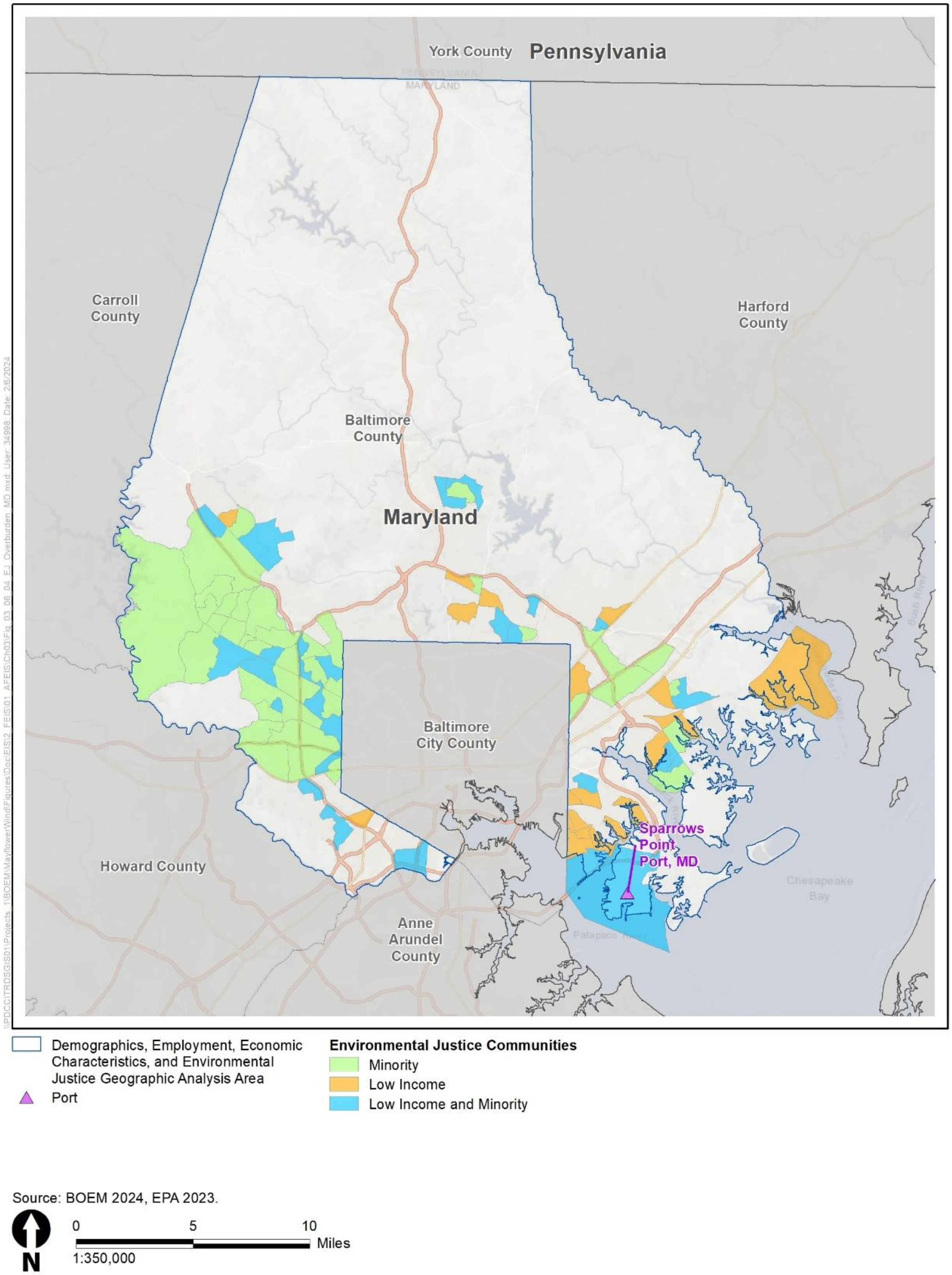
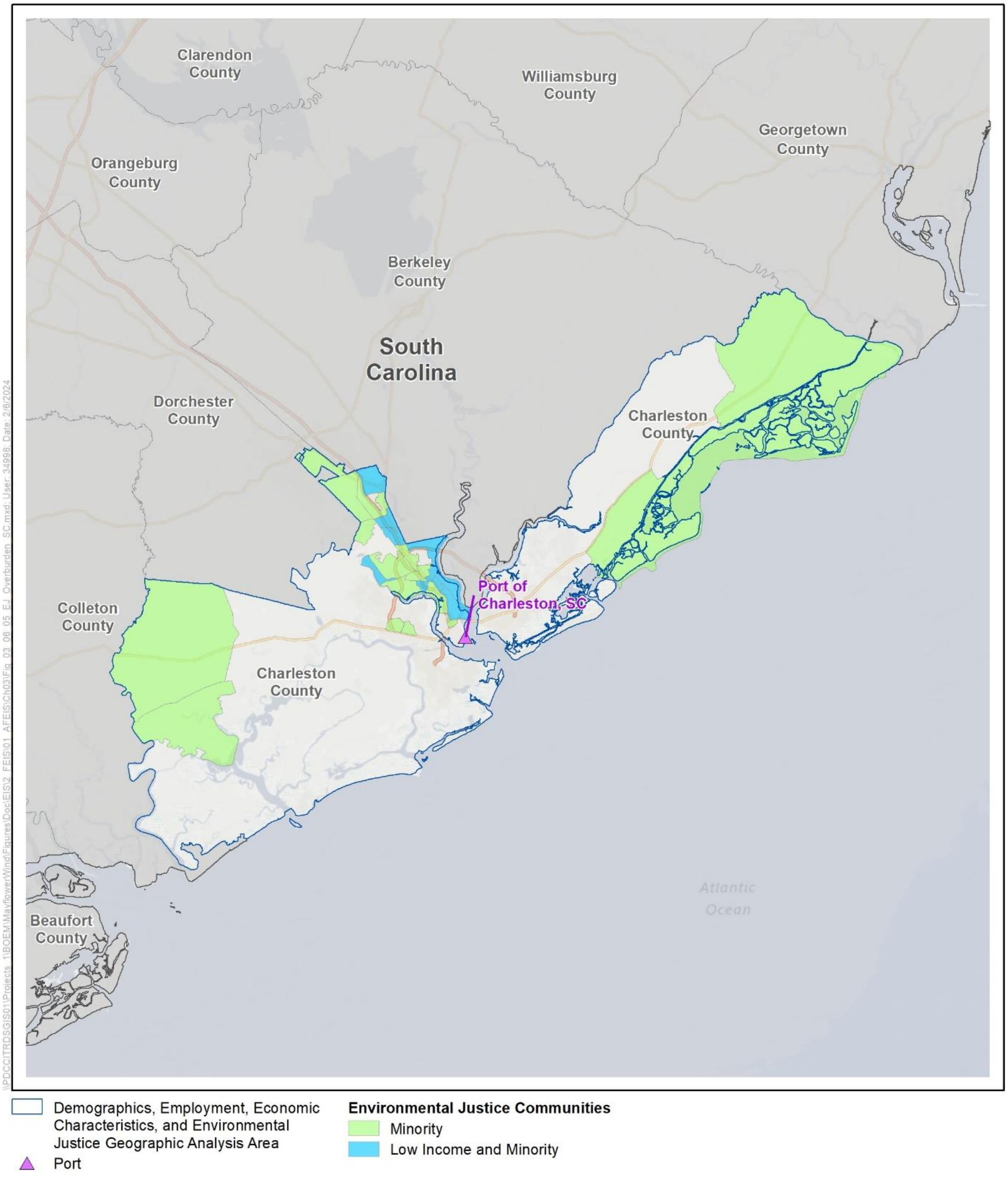


Figure 3.6.4-7. Environmental justice populations in Maryland



Source: BOEM 2024, EPA 2023.

N 0 5 10 Miles 1:750,000

Figure 3.6.4-8. Environmental justice populations in South Carolina

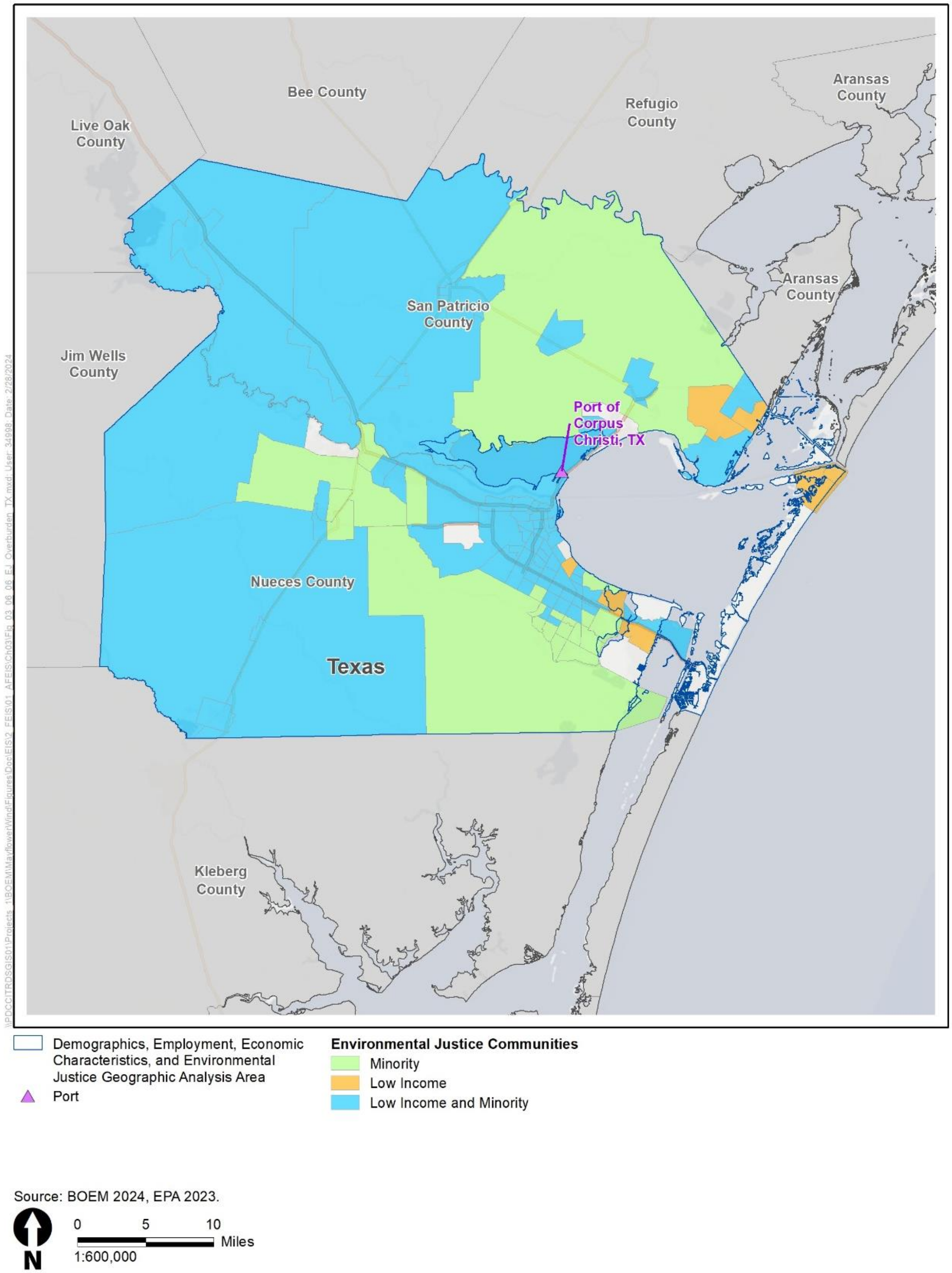


Figure 3.6.4-9. Environmental justice populations in Texas

Low-income and minority workers may be employed in commercial fishing and supporting industries that provide employment on commercial fishing vessels, at seafood processing and distribution facilities, and in trades related to vessel and port maintenance, or operation of marinas, boat yards, and marine equipment suppliers and retailers.

NOAA's social indicator mapping (NOAA 2022) was used to identify environmental justice populations in the geographic analysis areas that also have a high level of recreational or commercial fishing engagement or fishing reliance. Due to the limited and short-term (during Proposed Action construction) contribution to port use in the Maryland, South Carolina, Texas, and Connecticut regions of the geographic analysis area, those ports and surrounding communities were not considered in this portion of the analysis.

The fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities.

- **Commercial fishing engagement measures:** the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. A high rank indicates more engagement.
- **Commercial fishing reliance measures:** the presence of commercial fishing in relation to the population size of a community through fishing activity. A high rank indicates more reliance.
- **Recreational fishing engagement measures:** the presence of recreational fishing through fishing activity estimates. A high rank indicates more engagement.
- **Recreational fishing reliance measures:** the presence of recreational fishing in relation to the population size of a community. A high rank indicates increased reliance.

As shown on Figure 3.6.4-10, the coastal communities of Barnstable, Hyannis, New Bedford, Plymouth, and Chatham, Massachusetts, and Narragansett, Rhode Island, have high levels of commercial fishing engagement. Chatham also has a high level of commercial fishing reliance. Within these communities that have a high level of commercial fishing engagement or reliance, Barnstable and New Bedford are determined to contain environmental justice populations (Figure 3.6.4-2). Barnstable, Narragansett, and a portion of Nantucket Island in Massachusetts have a high level of recreational fishing engagement (Figure 3.6.4-10). Among these communities that have a high level of recreational fishing engagement, only Barnstable is determined to contain environmental justice populations (Figure 3.6.4-2). The coastal community of Bourne, Massachusetts, has a high level of recreational fishing reliance (Figure 3.6.4-10); areas within or near Bourne contain environmental justice populations (Figure 3.6.4-2). One of the three ports in Massachusetts that may be used for the Project, the Port of New Bedford, is located in an area with high levels of commercial fishing engagement (Figure 3.6.4-10). The Port of Providence in Rhode Island, which is an area with environmental justice populations, is not in an area with high levels of commercial or recreational fishing engagement or reliance. The Port of Davisville, Rhode Island, has high commercial fishing engagement but is not an area with environmental justice populations.

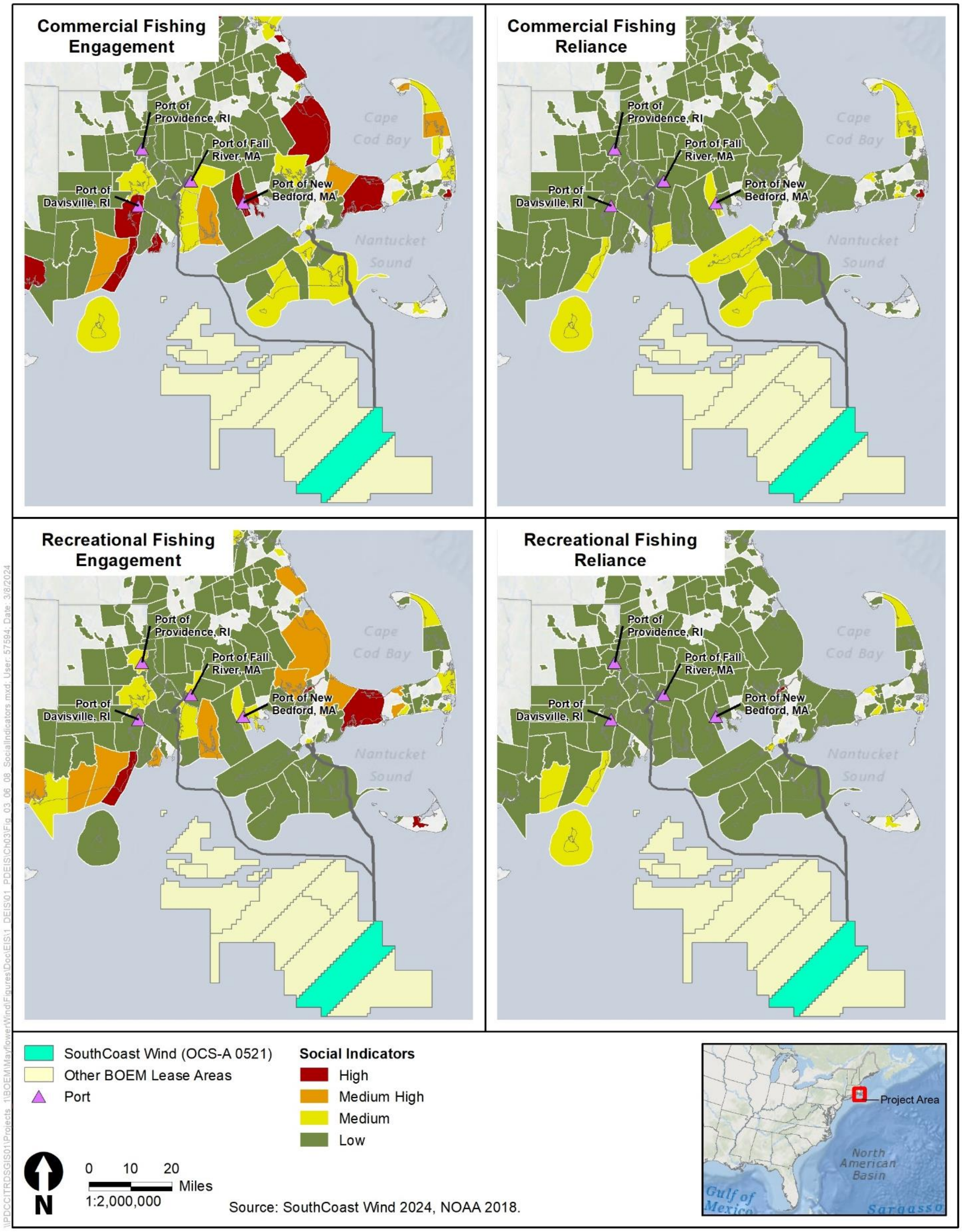


Figure 3.6.4-10. Commercial and recreational fishing engagement or reliance of coastal communities

Within the geographic analysis area, recreational fisheries may be used by low-income and minority residents who rely on subsistence fishing as a food source, as well as tribal members for whom fishing is also a cultural practice. Due to the lack of subsistence fishing reliance indicators, this analysis uses recreation fishing reliance, as defined by the NOAA social indicator, as a proxy for subsistence fishing reliance. Based on the NOAA social indicator mapping (Figure 3.6.4-10), only the community of Bourne, Massachusetts, has high levels of recreational fishing reliance and contains environmental justice populations. BOEM consultation with Native American tribes for the Vineyard Wind 1 project indicate that tribal subsistence fishing and clamming occur off Chappaquiddick Island (BOEM 2020).

NOAA has also developed social indicator mapping related to gentrification pressure (NOAA 2022). The gentrification pressure indicators measure factors that, over time, may indicate a threat to the viability of a commercial or recreational working waterfront. Gentrification indicators are related to housing disruption, retiree migration, and urban sprawl.

- Housing disruption represents factors that indicate a fluctuating housing market where some displacement may occur due to rising home values and rents including changes in mortgage values. A high rank means more vulnerability for those in need of affordable housing and a population more vulnerable to gentrification.
- Retiree migration characterizes communities with a higher concentration of retirees and elderly people in the population including households with inhabitants over 65 years, population receiving social security or retirement income, and level of participation in the work force. A high rank indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living.
- Urban sprawl describes areas experiencing gentrification through increasing population density, proximity to urban centers, home values, and the cost of living. A high rank indicates a population more vulnerable to gentrification.

NOAA (2022) gentrification indices shows medium high to high levels of housing disruption in coastal communities in Newport, Rhode Island; Wareham, Tisbury, Nantucket, Plymouth, and most of Cape Cod, with the exception of the town of Truro, Massachusetts. The mapping shows medium high to high retiree migration in and near Chilmark, Siasconset, and Cape Cod, except for Barnstable where there are medium levels of retiree migration. In Little Compton, Rhode Island, the mapping shows medium high levels of retiree migration. Urban sprawl in the geographic analysis area exhibits medium high to high pressure in Fall River, Acushnet, Marion, Woods Hole, Aquinnah, Chilmark, Nantucket, and Provincetown, Massachusetts. Overall, mapping identifies higher gentrification pressure in the environmental justice analysis area compared to other nearby coastal areas due to medium high to high levels of housing disruption and retiree migration, but generally low levels of urban sprawl.

Environmental justice analyses must also address impacts on Native American tribes. Federal agencies should evaluate “interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action,” and “recognize that the impacts within…Indian tribes may be different from impacts on the general population due to a community’s distinct cultural practices” (CEQ 1997). Factors that could lead to disproportionately high and adverse impacts for environmental justice populations include loss of significant cultural or historical resources and the impact's relation to other cumulatively significant impacts (USEPA 2016).

Massachusetts formally recognizes two federally recognized tribes, the Wampanoag Tribe of Gay Head (Aquinnah) and the Mashpee Wampanoag Tribe, as well as the Nipmuc Nation, which is not federally recognized. The state of Rhode Island recognizes the Narraganset Indian Tribe, which is also federally recognized (NCSL 2019). The Wampanoag Tribe of Gay Head (Aquinnah) and the Mashpee Wampanoag Tribe both reside in the geographic analysis area. The Narraganset people's headquarters are located in Washington County, Rhode Island, part of the geographic analysis area. The Nipmuc people do not reside within the geographic analysis area. The state of Connecticut recognizes five tribes, two of which are federally recognized: the Mashantucket Pequot Tribe and the Mohegan Tribe of Indians of Connecticut (NCSL 2019). The three non-federally recognized tribes in Connecticut do not reside in the geographic analysis area.

The state of Maryland has no federally recognized tribes but recognizes three tribes at the state level: the Piscataway Indian Nation, Piscataway Conoy Tribe, and the Accohannock Tribe. A little over 5,000 people living in the Baltimore area are Lumbee, a tribe based in North Carolina (NPS 2023). The Piscataway Nation and Conoy Tribe traditional homelands are in southern Maryland, outside of the geographic analysis area (Southern Maryland National Heritage Area 2024). The Accohannock Tribe's current and historical homeland is also outside the geographic analysis area (Lutz 2015). Lumbee Tribe members living in Baltimore County specifically would experience impacts due to proximity to a port used for construction operations, described below. In South Carolina, one Native American tribe, the Catawba Indian Nation, is federally recognized and resides in the state. The state recognizes several additional tribes and groups, with one tribe, the Wassamasaw Tribe of Varnertown Indians, residing in proximity to the South Carolina geographic analysis area (South Carolina Commission for Minority Affairs 2024). There are three federally recognized tribes with reservations in the state of Texas: the Alabama-Coushatta, Tigua, and Kickapoo. The state recognizes the Lipan Apache Tribe of Texas (Bullock Museum n.d.). None of the Texas tribes currently or have historically resided in the geographic analysis area.

BOEM has invited the following federally recognized tribes with ancestral associations to lands within the Project area to participate in government-to-government consultations: Delaware Indian Tribe, Mashantucket Pequot Tribal Nation, Mashpee Wampanoag Tribe, Mohegan Tribe of Connecticut, Narragansett Indian Tribe, Shinnecock Indian Nation, and Wampanoag Tribe of Gay Head (Aquinnah). BOEM is also consulting with these federally recognized tribes, and the Chappaquiddick Wampanoag Tribe, a historical Massachusetts tribe, as part of the NHPA Section 106 consultation process.

Pre-Existing Health Condition Considerations

Environmental justice analyses should also address the pre-existing health conditions that exist in the geographic analysis area. To estimate these conditions, BOEM analyzed the Centers for Disease Control and Prevention's (CDC's) Environmental Justice Index (CDC 2022) data at the county level and presented the results in Table 3.6.4-2. New London County, Connecticut; Baltimore County, Maryland; Essex and Bristol Counties, Massachusetts; Bristol, Providence, and Washington Counties, Rhode Island; and

Nueces and San Patricio Counties, Texas are all counties in proximity to ports with higher rates of at least some pre-existing health conditions than their respective state's average. Barnstable, Dukes, and Plymouth Counties, Massachusetts are not in proximity to ports to be used for the Proposed Action but have higher rates than the state average for at least some pre-existing health conditions.

Table 3.6.4-2. State and county/city pre-existing public health conditions within the analysis area

Jurisdiction	High Blood Pressure	Asthma	Cancer	Mental Health	Diabetes
Commonwealth of Massachusetts					
Barnstable County	33.5%	10.1%	9.5%	12.3%	9.7%
Bristol County	30.2%	11.5%	7.1%	15.8%	9.1%
Dukes County	29.7%	10.2%	7.9%	12.7%	9.0%
Essex County	29.7%	10.4%	7.1%	13.0%	9.1%
Nantucket County	26.9%	9.6%	6.6%	12.0%	7.3%
Plymouth County	29.6%	10.1%	7.5%	13.8%	8.6%
State Total	28.3%	10.4%	6.8%	13.5%	8.4%
State of Rhode Island					
Bristol County	28.7%	10.4%	7.8%	12.5%	8.4%
Newport County	29.9%	10.5%	8.0%	12.1%	8.7%
Providence County	32.3%	12.1%	6.6%	14.5%	10.8%
Washington County	30.3%	11.3%	7.8%	12.8%	8.7%
State Total	32.0%	11.7%	7.1%	13.9%	10.2%
State of Connecticut					
New London County	29.6%	10.3%	7.1%	12.6%	9.4%
State Total	29.7%	10.3%	7.1%	12.2%	9.1%
State of Maryland					
Baltimore County	33.4%	9.9%	7.3%	12.8%	10.9%
State Total	32.4%	9.6%	6.4%	12.3%	10.9%
State of South Carolina					
Charleston County	33.2%	9.4%	6.4%	13.9%	10.3%
State Total	36.9%	9.6%	6.7%	15.0%	12.1%
State of Texas					
Nueces County	33.8%	8.5%	5.7%	13.8%	13.4%
San Patricio County	34.9%	9.0%	6.2%	14.3%	14.0%
State Total	31.6%	9.0%	5.5%	14.0%	11.8%

Source: CDC 2022.

3.6.4.2 Scope of the Environmental Justice Analysis

To define the scope of the environmental justice analysis, BOEM reviewed the impact conclusions for each resource analyzed in the EIS to assess whether the Proposed Action and action alternatives would result in major impacts that would be considered “high and adverse” and whether major impacts had the potential to affect environmental justice populations given the geographic extent of the impact relative to the locations of environmental justice populations. Major impacts that had the potential to affect environmental justice populations were further analyzed to determine if the impact would be disproportionately high and adverse. Although the environmental justice analysis considers impacts of other ongoing and planned activities, including other future offshore wind projects, determinations as to whether impacts on environmental justice populations would be disproportionately high and adverse are made for the Proposed Action and action alternatives alone.

As shown on Figure 3.6.4-2 and Figure 3.6.4-5, onshore Project infrastructure including cable landfalls, onshore substations/converter stations, and points of interconnection are in areas where environmental justice populations have been identified. IPFs from onshore construction, including air emissions, cable emplacement, and noise, may all affect environmental justice communities near ports and cable routes. Because onshore construction would affect environmental justice populations identified in the geographic analysis area, impacts associated with construction, O&M, and decommissioning of onshore Project components are carried forward for further analysis of disproportionately high and adverse effects within the environmental justice analysis. SouthCoast Wind is considering multiple ports for construction including New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; Corpus Christi, Texas; as well as some international ports. O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts; New London, Connecticut, or Providence, Rhode Island, with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina. As shown on Figure 3.6.4-2 through Figure 3.6.4-9, most of the domestic ports being considered for the Proposed Action are in areas where environmental justice populations have been identified. Therefore, port utilization is carried forward for analysis of disproportionately high and adverse effects in this environmental justice analysis under the port utilization and air emission IPFs.

Construction, O&M, and decommissioning of offshore structures (WTGs and OSPs) could have major impacts on some commercial fishing operations that use the Lease Area, with potential for indirect impacts on employment in related industries that could affect environmental justice populations. Cable emplacement and maintenance and construction noise would also contribute to impacts on commercial fishing. The long-term presence of offshore structures (WTGs and OSPs) would also have major impacts on scenic and visual resources and viewer experience from some onshore viewpoints that could affect environmental justice populations. Therefore, impacts of construction, O&M, and decommissioning of offshore Project components are carried forward for analysis of disproportionately high and adverse effects in this environmental justice analysis.

Section 3.6.2, *Cultural Resources,* determined that construction of offshore wind structures and cables could result in major impacts on marine cultural, terrestrial archaeological, or architectural resources if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction. BOEM has committed to working with the lessee, consulting parties, Native American tribes, and the SHPOs to develop specific treatment plans to address impacts on cultural resources that cannot be avoided and are also historic properties listed or eligible for listing in the NRHP. Development and implementation of Project-specific treatment plans, agreed to by all consulting parties, would likely reduce the magnitude of otherwise unmitigated impacts on cultural resources; however, the magnitude of these impacts would remain moderate to major due to the permanent, irreversible nature of the impacts, unless these resources can be avoided.

Consultation with Native American tribes via NHPA Section 106 consultation and government-to-government consultation is ongoing. As discussed in Section 3.6.2, *Cultural Resources,* SouthCoast Wind's cultural resource background research identified three TCPs in the cultural resources geographic analysis area, two of which may be subject to impacts from the Project (COP Appendices Q and R; SouthCoast Wind 2024): Chappaquiddick Island and Nantucket Sound. Both TCPs have been previously determined to be sites of religious and cultural significance to state and federally recognized tribes and are eligible for listing in the NRHP. ASLFs within or in proximity to the Nantucket Sound TCP may be elements contributing to the TCP's eligibility for the NRHP and in the Project's marine area of potential effects would be subject to physical impacts by the Project. ASLFs are also identified as sacred sites by tribes. Both TCPs are subject to visual impacts from the visibility of Project components. Additionally, SouthCoast Wind's archaeological investigations identified terrestrial archaeological resources with pre-contact Native American components in the geographic analysis area; these resources may bear significance to Native American tribes. No other tribal resources, such as cultural landscapes, burial sites, treaty-reserved rights to usual and accustomed fishing or hunting grounds, or other potentially affected tribal resources have been identified to date. BOEM will continue to consult with Native American tribes throughout development of the EIS and will consider impacts on tribal resources identified through consultation in the environmental justice analysis if they are discovered. For more information on cultural resources and historic properties, see Section 3.6.2, *Cultural Resources*, and Appendix I, *Finding of Adverse Effect for the SouthCoast Wind Construction and Operations Plan*.

Other resource impacts that concluded less-than-major impacts for the Proposed Action and action alternatives or were unlikely to affect environmental justice populations were excluded from further analysis of environmental justice impacts. This includes impacts related to bats; benthic resources; birds; coastal habitat and fauna; finfish, invertebrates, and EFH; land use and coastal infrastructure; marine mammals; navigation and vessel traffic; sea turtles; water quality; and wetlands.

3.6.4.3 Impact Level Definitions for Environmental Justice

Environmental justice impacts are characterized for each IPF as negligible, minor, moderate, or major using the four-level classification scheme outlined in Table 3.6.4-3. A determination of whether impacts are "disproportionately high and adverse" in accordance with Executive Order 12898 is provided in the conclusion sections for the Proposed Action and action alternatives.

Definitions of impact levels are provided in Table 3.6.4-3. Determination of a *major* impact corresponds to a *high and adverse* impact for the environmental justice analysis. Major (or high and adverse) impacts have been further analyzed to determine if those impacts would be disproportionately high and adverse for low-income or minority populations.

Table 3.6.4-3. Impact level definitions for environmental justice

Impact Level	Type of Impact	Definition
Negligible	Adverse	Adverse impacts on environmental justice populations would be small and unmeasurable.
	Beneficial	Beneficial impacts on environmental justice populations would be small and unmeasurable.
Minor	Adverse	Adverse impacts on environmental justice populations would be small and measurable but would not disrupt the normal or routine functions of the affected population.
	Beneficial	Environmental justice populations would experience a small and measurable improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.
Moderate	Adverse	Environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts.
	Beneficial	Environmental justice populations would experience a notable and measurable improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.
Major	Adverse	Environmental justice populations would have to adjust to significant disruptions due to notable and measurable adverse impacts. The affected population may experience measurable long-term effects.
	Beneficial	Environmental justice populations would experience a substantial long-term improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.

3.6.4.4 Impacts of the No Action Alternative on Environmental Justice

When analyzing the impacts of the No Action Alternative on environmental justice, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for environmental justice. 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, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for environmental justice (3.6.4.1, *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 non-offshore activities that affect environmental justice populations include onshore development and land uses; utilization of ports, marinas, and working waterfronts; port improvements or expansions; and commercial fishing operations. Ongoing activities support beneficial employment and also generate sources of air emissions, noise, lighting, and vehicle and vessel traffic that can adversely affect the quality of life in affected communities.

BOEM used USEPA's EJScreen to identify community exposure to environmental justice indices, such as air emissions, in the geographic analysis area (USEPA 2023). EJScreen's environmental justice indices take into account not only the percentile of exposure to each index, but the presence of environmental justice communities (per the USEPA definition) experiencing such exposure. Neighborhoods in the vicinity of the Proposed Action's preferred Falmouth onshore substation have substantially lower levels of exposure with regard to most indices when compared to Massachusetts as a whole, ranging from the 8th percentile for diesel particulate matter to the 54th percentile for air toxics cancer risk. Ozone exposure levels in Falmouth are as high as the 68th percentile in areas near the proposed Falmouth onshore substation. The area surrounding the Port of New Bedford has similarly low levels of exposure for some indices, ranging from the 27th percentile for $PM_{2.5}$ to the 54th percentile for air toxics cancer risk. The area directly surrounding the Port of New Bedford, which includes an environmental justice community, has relatively high levels of diesel particulate matter exposure (ranging from the 57th percentile in the neighborhoods within the vicinity of the port to the 82nd percentile for the area directly including and adjacent to the port), and for ozone, which exceeds the 80th percentile and is as high as the 92nd percentile in the areas near the port. Similarly, the neighborhoods around the Port of Salem have somewhat high levels of diesel particulate matter exposure, as high as the 64th percentile in the areas directly adjacent to the port. For other indices, the areas around the Port of Salem range from the 38th percentile for $PM_{2.5}$ to the 79th percentile for air toxics respiratory hazard index. In Washington County, Rhode Island, near the Port of Davisville, the $PM_{2.5}$ index is relatively low compared to the rest of the state, reaching the 49th percentile near Quonset State Airport but elsewhere not exceeding the 16th percentile; ozone levels are comparatively high, reaching the 99th percentile in areas closest to the port, also near Quonset State Airport. The same area reaches the 53rd percentile for diesel particulate matter. Air toxics cancer risk reaches the 84th percentile nearest to the port.

In Baltimore County, Rhode Island, near Sparrows Point Port, the air toxics respiratory hazard index reaches the 97th percentile in parts of the county. $PM_{2.5}$ levels are as high as the 81st percentile, while ozone levels reach the 97th percentile in parts of the county. The diesel particulate matter EJ Index reaches the 94th percentile. Further from the port in Baltimore County, air toxics cancer risk reaches as high as the 96th percentile. In Charleston County, South Carolina, the diesel particulate matter index reaches the 99th percentile in areas nearest to the Port of Charleston. Ozone levels are also high relative to the state of South Carolina, reaching the 95th percentile directly next to the port and maintaining between the 80th and 90th percentiles in much of the county. $PM_{2.5}$ levels are somewhat lower, maxing out at the 71st percentile in Charleston County. Air toxics cancer risk and respiratory hazard index are both relatively high, reaching the 99th percentile in communities surrounding the port. Near the Port of Corpus Christi, $PM_{2.5}$ levels are as high as the 80th percentile. Ozone levels are relatively low compared to the state of Texas, not exceeding the 29th percentile anywhere in Nueces or San Patricio Counties. The diesel particulate matter index reaches the 87th percentile directly adjacent to the port, but otherwise does not exceed the 80th percentile anywhere else in Nueces or San Patricio Counties. The air toxics cancer risk index does not exceed the 50th percentile anywhere in either county; the air toxics respiratory hazard index is as high as the 73rd percentile in an area of Nueces County near the port.

Coastal development that leads to gentrification of coastal communities may create space-use conflicts and reduce access to coastal areas and working waterfronts that communities rely on for recreation, employment, and commercial fishing. Gentrification can also lead to increased tourism and recreational boating and fishing that provide employment opportunities in recreation and tourism (refer to Section 3.6.4.1, *Description of the Affected Environment*, for a description of gentrification in the geographic analysis area). Housing disruption caused by rising home values and rents can displace affordable housing, with disproportionate effects for low-income and minority populations.

Ongoing offshore wind activities in the geographic analysis area for environmental justice include OCS-A 0517 (South Fork Wind), OCS-A 0501 (Vineyard Wind 1), and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of these projects would affect environmental justice through the primary IPFs of air emissions, cable emplacement and maintenance, noise, port utilization, presence of structures, and land disturbance. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would have the same type of impacts on environmental justice that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative 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 environmental justice populations include dredging and port improvement, construction and maintenance of coastal infrastructure (marinas, docks, and bulkheads), and onshore coastal development that can lead to gentrification of coastal communities and working waterfronts (see Appendix D, *Planned Activities Scenario,* for a description of planned activities). Planned non-offshore wind activities would have impacts similar to those of ongoing non-offshore wind activities.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on environmental justice during construction, O&M, and decommissioning of the projects. Ongoing and planned offshore wind projects in the geographic analysis area are planned within lease areas OCS-A 0487 (Sunrise Wind), OCS-A 0486 (Revolution Wind), OCS-A 0501 (Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A 0534 (New England Wind, which also spans a portion of Lease Area OCS-A 0501), OCS-A 0520 (Beacon Wind), OCS-A 0500 (Bay State Wind), and OCS-A 0522 (Vineyard Wind Northeast). These projects are estimated to collectively install 920 structures (WTGs and OSPs) and 3,520 statute miles (5,665 kilometers) of submarine export cables and interarray cables in the geographic analysis area between 2023 and 2030 (Appendix D, Table D2-1).

Offshore wind projects other than the Proposed Action both within and outside of the environmental justice analysis area have prompted several studies of the impacts of such projects on local communities and environmental justice communities particularly. A 2019 report on the future of clean energy in the

United States by the Brookings Institute found that clean energy jobs, including those for offshore wind, on average offer higher wages than the national all-industry average wage. The report further found that jobs in the burgeoning clean energy industry often do not require formal education for employment, which may be a barrier to employment for individuals from environmental justice communities (Muro et al. 2019). Other studies have examined the potential adverse effects of future offshore wind projects on environmental justice areas. One 2022 study specifically criticized the exclusion of indigenous peoples from discussions of offshore wind development (Bacchiocchi et al. 2022).

BOEM expects future offshore wind activities to affect environmental justice populations through the following primary IPFs.

Air emissions: Increased port activity would generate short-term, variable increases in air emissions. Emissions for regulated air pollutants would occur during construction from equipment such as onshore construction equipment, helicopters, drones, vessels, and generators (COP Volume 2, Table 5-4; SouthCoast Wind 2024). Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice communities. However, environmental justice communities near ports or onshore project components could experience disproportionate air quality impacts depending on the locations that are used, ambient air quality, and the increase in emissions at any given location. Onshore, some industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it.

Other future offshore wind projects constructed in the geographic analysis area would contribute to regional air quality impacts. As stated in Section 3.4.1, *Air Quality*, during the construction phase, the total emissions of criteria pollutants and ozone precursors from offshore wind projects other than SouthCoast Wind proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 34,496 tons of CO, 165,807 tons of NO_X, 8,808 tons of PM_{10}, 5,589 tons of $PM_{2.5}$, 4,441 tons of SO_2, 5,732 tons of VOCs, and 11,228,498 tons of CO_2 (Appendix D, Table D2-4). This area is larger than the environmental justice geographic analysis area; therefore, a large portion of the emissions would be generated along the vessel transit routes and at the offshore work areas. Emissions of NO_X and CO are primarily due to diesel construction equipment, vessels, and commercial vehicles.

Emissions would vary spatially and temporally during construction phases even for overlapping projects. Offshore wind projects other than the Proposed Action that would be constructed in the Massachusetts/Rhode Island, New York/New Jersey, Delaware/Maryland, and Virginia/North Carolina lease areas may utilize the same ports during construction as the Proposed Action, with periods of overlapping construction between 2023 and 2030. Emissions from vessels, vehicles, and equipment operating in ports could affect environmental justice communities adjacent or close to those ports. With the exception of the Port of Davisville, all of the proposed ports that could support SouthCoast Wind construction are either located within or are in proximity to environmental justice communities: Ports of New London, Providence, New Bedford, Fall River, Salem, Sparrows Point, Charleston, and Corpus Christi. The port locations are in attainment of the NAAQS, except for the Port of New London, Connecticut, which is in a nonattainment area for ozone, and Sparrows Point Port, Maryland, which is in nonattainment for the SO_2 and ozone NAAQS (Section 3.4.1, *Air Quality*). Emissions at the Port of New London and Sparrows Point Port would therefore contribute to air quality impacts that are already exceeding federal air quality standards. Emissions from other offshore wind projects affecting specific neighborhoods have not been quantified; however, it is assumed that offshore wind project emissions at ports would contribute a small proportion of total emissions from those facilities. Therefore, air emissions during construction would have small, short-term, variable impacts on environmental justice communities due to temporary increases in air emissions. The air emissions impacts would be greater if multiple offshore wind projects simultaneously use the same port for construction staging. If construction staging is distributed among several ports, the air emissions would not be concentrated near certain ports and impacts on proximal environmental justice communities would be lower.

As explained in Section 3.4.1, *Air Quality*, operational activities from other offshore wind projects within the air quality geographic analysis area would generate 1,297 tons per year of CO, 5,073 tons per year of NO_X, 152 tons per year of PM_{10}, 137 tons per year of $PM_{2.5}$, 75 tons per year of SO_2, 100 tons per year of VOCs, and 412,263 tons per year of CO_2. Operational emissions would overall be intermittent and widely dispersed throughout the vessel routes from the onshore O&M facility and would generally contribute to small and localized air quality impacts. Emissions would largely be due to vessel traffic related to O&M and operation of emergency diesel generators. These emissions would be intermittent and widely dispersed, with small and localized air quality impacts. Only the portion of those emissions resulting from ship engines and port-based equipment operating within and near the ports proposed for O&M activity (primarily New Bedford, Fall River, New London, or Providence) would affect environmental justice communities. Therefore, during operations of offshore wind projects, the air emissions volumes resulting from port activities are not anticipated to be large enough to have impacts on environmental justice communities.

The power generation capacity of offshore wind development could potentially lead to lower regional air emissions by displacing fossil fuel plants for power generation, resulting in a potential reduction in regional GHG emissions, as analyzed in further detail in Section 3.4.1, *Air Quality*. A 2019 study found that nationally, exposure to fine particulate matter from fossil fuel electricity generation in the United States varied by income and by race, with average exposures highest for Black individuals, followed by non--Hispanic white individuals. Exposures for other groups (i.e., Asian, Native American, and Hispanic) were somewhat lower. Exposures were higher for lower-income populations than for higher-income populations, but disparities were larger by race than by income (Thind et al. 2019). A 2019 study of the Northeastern and Mid-Atlantic states found greater mortality rates associated with $PM_{2.5}$ exposure among Black participants and participants who were eligible for Medicaid (Yitshak-Sade et al. 2019).

Exposure to air pollution is linked to health impacts, including respiratory illness, increased health care costs, and mortality. A 2016 study for the Mid-Atlantic region found that offshore wind could produce measurable benefits related to health costs and reduction in loss of life due to displacement of fossil fuel power generation (Buonocore et al. 2016). Environmental justice populations tend to have disproportionately high exposure to air pollutants, likely leading to disproportionately high adverse health consequences. Accordingly, offshore wind generation would have potential benefits for environmental justice populations through reduction or avoidance of air emissions and concomitant reduction or avoidance of adverse health impacts.

Cable emplacement and maintenance: Cable emplacement for offshore wind projects in the Massachusetts and Rhode Island lease areas would result in seafloor disturbance and temporary increases in turbidity. Cable emplacement could displace other marine activities temporarily within cable installation areas. As described in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, cable installation and maintenance would have localized, temporary, short-term impacts on the revenue and operating costs of commercial and for-hire fishing businesses. Commercial fishing operations may temporarily be less productive during cable installation or repair, resulting in reduced income and also leading to short-term reductions in business volumes for seafood processing and wholesaling businesses that depend upon the commercial fishing industry. Business impacts could affect environmental justice populations due to the potential loss of income or jobs by low-income and minority workers in the commercial fishing industry. In addition, cable installation and maintenance could temporarily disrupt recreational fisheries used by low-income and minority residents who rely on subsistence fishing as a food source, as well as tribal members for whom fishing is also a cultural practice. As noted in Section 3.6.8, *Recreation and Tourism*, most recreational fishing in the analysis area occurs close to shore. Additionally, BOEM consultation with Native American tribes for the Vineyard Wind 1 project indicates that tribal subsistence fisheries occur predominately in inshore areas (BOEM 2020). Therefore, while temporary impacts on recreational subsistence fishing may occur near cable landfall sites, future development of offshore cables occurring further offshore, are expected to result in short-term, negligible to minor, localized impacts on the recreational and subsistence fishing activities of environmental justice populations.

Noise: As described in greater detail in Section 3.6.3, *Demographics, Employment, and Economics* and Section 3.6.8, *Recreation and Tourism*, noise from site assessment G&G survey activities, pile driving, trenching, and vessels is likely to result in a revenue reduction of economic activity for commercial fishing and marine recreational businesses that operate in the areas offshore from the geographic analysis area for environmental justice. Construction noise, especially site assessment G&G surveys and pile driving, would affect fish and marine mammal populations, with impacts on commercial and for-hire fishing and marine sightseeing businesses. The localized impacts of offshore noise on fishing could also affect subsistence fishing. In addition, noise would affect some for-hire fishing businesses or marine sightseeing businesses, as these visitor-oriented services are likely to avoid areas where noise is being generated. The impacts of offshore noise on marine businesses and subsistence fishing would have short-term, localized impacts on low-income and minority workers in marine-dependent businesses as well as residents who practice subsistence fishing and clamming, resulting in impacts on environmental justice populations.

Noise generated by offshore wind staging operations at ports would potentially have impacts on environmental justice communities if the port is near such communities. Within the geographic analysis area for environmental justice populations, the ports of New Bedford, Fall River and Salem, Massachusetts; Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas are within or near environmental justice communities. The noise impacts from increased port utilization would be short term and variable, limited to the construction period, and would increase if a port is used for multiple offshore wind projects during the same time period.

Port utilization: Offshore wind project installation would require port facilities for berthing, staging, and loadout. Future offshore wind development would also support planned expansions and modifications at ports in the geographic analysis area. Offshore wind projects that utilize ports in or near environmental justice communities, such as the port cities of Fall River, New Bedford, and Salem, Massachusetts; Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas (Figure 3.6.4-2, Figure 3.6.4-5, Figure 3.6.4-6, Figure 3.6.4-7, Figure 3.6.4-8, Figure 3.6.4-9) may contribute to adverse impacts on these communities from increased air emissions, lighting, vessel traffic, and noise generated by port utilization or expansion (see discussions under *Air emissions, Noise*, and *Presence of Structures* IPFs). Ongoing and planned offshore wind development may contribute to vessel congestion in ports within the geographic analysis area, creating a short-term disruption of normal vessel traffic conditions for environmental justice communities that utilize ports for commercial or recreational vessel trips.

As described in Appendix D, Section D.2.6, several ports in the geographic analysis area are undergoing improvements to accommodate the offshore wind industry at large. For example, the Port of New Bedford is expanding its North Terminal, with construction occurring in 2023 and beyond (NBPA 2022). The Port of New London is also undergoing various improvements to support the offshore wind industry as noted in Appendix D. These ports are located near communities meeting environmental justice criteria for their respective states. Environmental justice populations would be affected by use of vessels, vehicles, and equipment at ports that generate air emissions, noise, and vessel and vehicle traffic.

Port use and expansion would also have beneficial impacts on employment at ports. Port utilization for offshore wind would have short-term, beneficial impacts for environmental justice populations during construction and decommissioning, resulting from employment opportunities, support for other local businesses by port-related businesses, and employee expenditures. Beneficial impacts would also result from port utilization during offshore wind operations, but these impacts would be of lower magnitude.

Presence of structures: Construction, decommissioning, and, to a lesser extent, O&M of future offshore wind projects could affect employment and economic activity generated by commercial fishing and marine-based businesses. Commercial fishing businesses would need to adjust routes and fishing grounds to avoid offshore work areas during construction and to avoid WTGs and OSPs during operations. Concrete cable covers and scour protection could result in gear loss and would make some fishing techniques unavailable in locations where the cable coverage exists. For-hire recreational fishing businesses would also need to avoid construction areas and offshore structures. A decrease in revenue, employment, and income within commercial fishing and marine industries could affect low-income and minority workers in communities with a high level of commercial fishing engagement or reliance (Figure 3.6.4-10). The impacts during construction would be short term and would increase in magnitude when multiple offshore construction areas exist at the same time. Impacts during operations would be long term and continuous but may lessen in magnitude as business operators adjust to the presence of offshore structures and as any temporary marine safety zones needed for construction are no longer required.

In addition to the potential impacts on commercial and for-hire recreational fishing activity and supporting businesses, WTGs are anticipated to provide new opportunities for subsistence and recreational fishing through fish aggregation and reef effects, and to provide attraction for recreational sightseeing businesses, potentially benefitting subsistence fishing and low-income and minority employees of marine-dependent businesses.

The long-term presence of WTGs associated with future offshore wind may also cause major adverse impacts on scenic and visual resources in coastal communities that are within the viewshed of future offshore wind projects. The level of impact on onshore viewers would depend on the distance to the WTGs offshore, the number and height of the WTGs associated with each future offshore wind project, and the design of the aviation warning lighting system, which could introduce continuous nighttime lighting.

The presence of structures could also have physical or visual impacts on tribally important cultural resources in the geographic analysis area as discussed in Section 3.6.4.2, *Scope of the Environmental Justice Analysis*. The construction of these structures for other offshore wind projects in this area, including offshore export cables from Vineyard Wind 1 and New England Wind, could contribute to impacts on TCPs and other tribally sensitive marine cultural resources. As described in Section 3.6.2, *Cultural Resources*, all projects would be required to adhere to the NHPA and would be required to avoid, minimize, or mitigate impacts on marine cultural resources if they are identified. If marine cultural resources cannot be avoided, the magnitude of impacts would be moderate to major, due to the permanent, irreversible nature of the impacts.

Land disturbance: Offshore wind development would require onshore cable installation, and substation construction or expansion. Based upon information in published COPs, export cables and related onshore project components for the Vineyard Wind 1 project and for the New England Wind project would be installed in the environmental justice analysis area between 2023 and 2026 in Barnstable, Massachusetts. Depending on siting, land disturbance could result in temporary, localized, variable disturbances of neighborhoods and businesses near cable routes and construction sites due to typical construction impacts such as increased noise, dust, traffic, and road disturbances. Potential short-term, variable impacts on environmental justice communities could result from land disturbance, depending upon the particular location of onshore construction for each offshore wind project.

Onshore construction noise may disrupt visitors, workers, and residents near sites where onshore cables, substations, or port improvements are installed to support offshore wind development. Impacts would depend upon the location of onshore construction in relation to businesses or environmental justice communities. Impacts on environmental justice communities could be short term and intermittent, similar to those of other onshore utility construction activity.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, environmental justice populations within the geographic analysis area would continue to be influenced by regional environmental, demographic, and economic trends and ongoing activities. BOEM expects ongoing activities to have continuing impacts on environmental justice populations through the following trends: ongoing population growth and new development; resulting traffic increases and industrial development, possibly increasing emissions near environmental justice communities; ongoing gentrification of coastal communities; ongoing commercial fishing, seafood processing, and tourism industries that provide job opportunities for low-income residents; and construction-related air pollutant emissions and noise when these occur near environmental justice communities. BOEM anticipates that the environmental justice impacts as a result of ongoing activities associated with the No Action Alternative would be **minor adverse**.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and environmental justice would continue to be affected by the primary IPFs of air emissions, cable emplacement and maintenance, presence of structures, and port utilization. Planned non-offshore wind activities, including dredging and port improvement, construction and maintenance of coastal infrastructure (marinas, docks, and bulkheads), and onshore coastal development, would also contribute to impacts on environmental justice communities.

Ongoing and planned offshore wind activities would contribute to environmental justice impacts through increased vehicle and vessel traffic, which could lead to an increase in air emissions; additional offshore structures posing navigational hazards for recreational and commercial fishing; impacts on tribally important cultural resources; and the possible need for port upgrades beyond those currently envisioned due to increased port activity.

BOEM anticipates that the cumulative impact of the No Action Alternative would be minor because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. However, BOEM recognizes that impacts could increase to **major** if tribally important cultural resources in the geographic analysis area cannot be avoided.

BOEM also anticipates that the impacts associated with future offshore wind activities in the geographic analysis area would result in **minor beneficial** effects on minority and low-income populations through economic activity and job opportunities in marine trades and the offshore wind industry. Additional beneficial effects may result from reductions in air emissions if offshore wind projects displace energy generation using fossil fuels.

3.6.4.5 Relevant Design Parameters and Potential Variances in Impacts

Effects on environmental justice communities would occur when the Proposed Action's adverse effects on other resources, such as air quality, water quality, employment and economics, cultural resources, recreation and tourism, commercial fishing, or navigation, are felt disproportionately within environmental justice communities, due either to the location of these communities in relation to the Proposed Action or to their higher vulnerability to impacts.

This 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 environmental justice impacts.

- Overall size of the Project and number of WTGs.
- The Project layout including the number, type, height, and placement of the WTGs and OSPs, and the design and visibility of lighting on the structures.
- The extent to which SouthCoast Wind hires local residents and obtains supplies and services from local vendors.
- The port(s) selected to support construction, installation, and decommissioning and the port(s) selected to support O&M.
- The PDE parameters that could affect commercial fishing because impacts on these activities affect employment and economic activity.
- Arrangement of WTGs and accessibility of the Wind Farm Area to recreational boaters.
- The time of year during which onshore and nearshore construction occurs.

Variability of the proposed Project design exists as outlined in Appendix C. Below is a summary of potential variances in impacts on members of environmental justice communities who depend on subsistence fishing or jobs in commercial/for-hire fishing or marine recreation.

- WTG number, size, location, and lighting: More WTGs and closer spacing could increase space-use conflicts with commercial and for-hire recreational fishing vessels. Arrangement and type of lighting systems would affect nighttime visibility of WTGs onshore.
- Utilization of ports that are near or within low-income and minority populations would have greater impacts.

SouthCoast Wind has committed to measures to minimize impacts on environmental justice communities, which include, but are not limited to, maintaining a stakeholder engagement plan, encouraging the hiring of skilled and unskilled labor in the Project region, and developing a Traffic Management Plan to minimize disruptions to the communities in the vicinity of construction, as well as committing to making at least 75 percent of the O&M workforce, procurement, and services local (COP Volume 2; Table 16-1 SouthCoast Wind 2024).

3.6.4.6 Impacts of the Proposed Action on Environmental Justice

Impacts on environmental justice communities from the Proposed Action from the IPFs below would result from views of WTGs and impacts on shellfish, fish, and marine mammal populations. The Proposed Action would also include effects on low-income and minority workers in the commercial/for-hire fishing, marine recreation, and supporting industries. The most impactful IPFs would likely include cable emplacement and presence of offshore structures because of the potential impacts of these IPFs on marine businesses (fishing and recreational), as well as views of WTGs.

The most impactful IPFs would also include higher levels of air emissions and noise at port facilities and visual impacts near environmental justice communities, as well as the presence of offshore structures that would affect navigation and commercial fishing. Beneficial economic effects would result from port utilization and reduction in air emissions, due to the displacement of fossil fuel electricity generation. Impacts are characterized by onshore and offshore activities during each period of the Project (construction, O&M, and decommissioning).

Air emissions: Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice communities. However, environmental justice communities near ports could experience disproportionate air quality impacts, depending upon the ports that are used. As identified in Appendix D, *Planned Activities Scenario,* offshore wind projects along the East Coast may utilize the proposed ports of the Proposed Action during periods of overlapping construction between 2023 and 2030. The Proposed Action would contribute to increased air emissions at the ports of Fall River, New Bedford, and Salem, Massachusetts; Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas (Figure 3.6.4-2 through Figure 3.6.4-7), which are predominantly, or are adjacent to, environmental justice communities. Greater air quality impacts may occur at ports where existing air quality is lower, including at the Port of New London, Connecticut, which is in a nonattainment area for ozone, and Sparrows Point, Maryland, which is in a nonattainment area for SO_2 and ozone; all other ports are in attainment. Emissions at port locations are not quantitatively evaluated; however, as stated in Section 3.4.1, *Air Quality*, overall air emissions impacts would be minor during Proposed Action construction, O&M, and decommissioning, with the greatest quantity of emissions produced in the Wind Farm Area and by vessels transiting from ports to the Wind Farm Area. Increased short-term and variable emissions from Proposed Action construction and operations would have negligible to minor disproportionate, adverse impacts on the communities near these ports.

Net reductions in air pollutant emissions resulting from the Proposed Action alone would result in long-term benefits to communities (regardless of environmental justice status) by displacing emissions from fossil-fuel-generated power plants. As explained in Section 3.4.1, *Air Quality,* by displacing fossil fuel power generation, once operational, the Proposed Action would result in annual avoided emissions of 692 tons of NO_X, 313 tons of SO_2, and 4,038,482 tons of CO_2 (COP Volume 2, Table 5-5; SouthCoast Wind 2024). Estimates of annual avoided health effects would range from 13.6 to 35.1 million dollars in health benefits and 1.4 to 3.2 avoided mortality cases (Section 3.4.1). Minority and low-income populations are disproportionately affected by emissions from fossil fuel power plants nationwide and by higher levels of air pollutants (USEPA 2022b). Therefore, the Proposed Action alone could benefit environmental justice communities by displacing fossil fuel power–generating capacity within or near the geographic analysis area.

Cable emplacement and maintenance: Offshore cable emplacement for the Proposed Action would temporarily affect commercial/for-hire fishing businesses, marine recreation, and subsistence fishing during cable installation and infrequent maintenance. As noted in Sections 3.6.1 *Commercial Fisheries and For-Hire Recreational Fishing*, and 3.6.3, *Demographics, Employment, and Economics*, installation of the Proposed Action's cables would have short-term, localized, minor impacts on marine businesses (commercial fishing or recreation businesses) and subsistence fishing. Cable installation could affect fish and mammals of interest for fishing and sightseeing through dredging and turbulence, although species would recover upon completion of installation activities (Section 3.5.6, *Marine Mammals,* and Section 3.5.7, *Sea Turtles*). Installation and construction of offshore components for the Proposed Action could therefore have a short-term, minor impact on low-income and minority workers in marine businesses.

Noise: Noise from Proposed Action construction (primarily pile driving) could temporarily affect fish and marine mammal populations, hindering fishing and sightseeing near construction activity within the Wind Farm Area, which could discourage some businesses from operating in these areas during pile driving (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, and Section 3.6.8, *Recreation and Tourism*). This would result in a localized, short-term, negligible impact on low-income jobs supported by these businesses, as well as on subsistence fishing. Noise generated by the Proposed Action's staging operations at ports could also potentially affect environmental justice communities, where the ports are near such communities. The ports proposed for use by SouthCoast Wind have other industrial and commercial sites, as well as major roads, which generate ongoing noise, and therefore any additional noise from Proposed Action activity would be consistent with existing uses, and impacts would be short term and negligible.

Port utilization: The Proposed Action would require port facilities for berthing, staging, and loadout. Air emissions and noise generated by the Proposed Action's activities would potentially affect environmental justice communities at ports in or near these communities, including New Bedford, Fall River, and Salem, Massachusetts; Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas (see discussions under the *Air emissions* and *Noise* IPFs), although these effects are anticipated to be negligible. Increased vessel activity at ports due to the Proposed Action could have a minor adverse effect on environmental justice communities that utilize ports for commercial or recreational vessel trips, due to a short-term, measurable disruption of normal vessel traffic conditions. The Proposed Action would have a beneficial impact on environmental justice from port utilization due to greater economic activity and increased employment at the ports in the geographic analysis area, primarily during construction and decommissioning and to a lesser extent during operations. There is no port expansion included as part of the Proposed Action. The Proposed Action would have minor beneficial impacts on environmental justice through increased job availability.

Presence of structures: The Proposed Action's establishment of offshore structures, including up to 147 WTGs, 5 OSPs, and hardcover for cables, would result in both adverse and beneficial impacts on marine businesses (i.e., commercial and for-hire recreational fishing businesses, offshore recreational businesses, and related businesses) and subsistence fishing. Adverse impacts would result from navigational complexity within the Wind Farm Area, disturbance of customary routes and fishing locations, and the presence of scour protection and cable hardcover, leading to possible equipment loss and limiting certain commercial fishing methods. Beneficial impacts would be generated by the reef effect of offshore structures, providing additional opportunity for tour boats and for-hire recreational fishing businesses. As discussed in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, 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 due to differences in target species abundance in the Project area, gear type, and predominant location of fishing activity. BOEM expects that impacts of the Proposed Action on commercial fishing and for-hire recreational fishing would range from negligible to major, depending on the fishery and fishing operation.

Impacts of the Proposed Action on commercial fishing and for-hire recreational fishing would have a greater impact on communities that have a high level of commercial or recreational fishing engagement or reliance. As shown on Figure 3.6.4-10, Barnstable, Hyannis, New Bedford, Plymouth, and Chatham, Massachusetts, and Narragansett, Rhode Island, have high levels of commercial fishing engagement, while Chatham also has a high level of commercial fishing reliance. Of these communities, only Barnstable and New Bedford are determined to also have environmental justice populations (Figure 3.6.4-2). The other communities do not contain environmental justice populations and maintain the same or higher levels of commercial fishing engagement and reliance than Barnstable and New Bedford. Therefore, BOEM has determined that commercial fishing impacts on environmental justice populations in Barnstable and New Bedford would not be disproportionate. Impacts of the Proposed Action on commercial fishing landings and secondary impacts for employment at onshore seafood processors and distributors would vary depending on the specific fisheries and fishing operations affected by the presence of structures in the Offshore Project area. Because onshore seafood processors and distributors process catch from a broad geographic area and because the impact on specific fishing operations would vary and would not be industry-wide, BOEM expects that secondary impacts for employment on fishing vessels and at onshore seafood processing and distribution facilities would be moderate overall. Because these secondary impacts would not be major or specific to environmental justice workers in these industries, BOEM has determined these impacts would not be disproportionately high and adverse.

Many coastal communities along the Massachusetts and Rhode Island shores have a high level of recreational fishing engagement (Figure 3.6.4-10), and most of these communities do not contain an environmental justice population, with the exception of Barnstable, Massachusetts (Figure 3.6.4-2). Impacts on for-hire recreational fishing are also not high and adverse, as impacts of the Proposed Action could include long-term, minor adverse and minor beneficial impacts for some for-hire recreational fishing operations due to space-use conflicts and the artificial reef effect, respectively. Therefore, BOEM has determined that impacts of the Proposed Action on for-hire recreational fishing would not be disproportionately high and adverse for environmental justice populations.

Overall, the offshore structures for the Proposed Action alone would have minor to major impacts on marine businesses (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing,* Section 3.6.3, *Demographics, Employment and Economics*, and Section 3.6.8, *Recreation and Tourism*), resulting in long-term, continuous impacts on environmental justice populations due to the impact on low-income and minority workers in marine industries and low-income and minority residents who rely on subsistence fishing. As noted previously, because most recreational and subsistence fishing occurs near shore, development of the offshore structures in the Wind Farm Area would have negligible to minor impacts on environmental justice populations. SouthCoast Wind has committed to hire at least 75 percent of O&M workers from the local workforce and encourage the hiring of personnel from the proposed Project region for any construction positions created (COP Volume 2, Section 10.1.2.1; SouthCoast Wind 2024). The plan to hire locally could reduce the impact on environmental justice populations if it results in job opportunities for low-income or minority populations, but it is not anticipated to reduce the overall impact level.

Based on analysis in Section 3.6.9, *Scenic and Visual Resources,* Proposed Action WTGs would have negligible to major impacts on viewer experience within the geographic analysis area. As discussed in greater detail in Section 3.6.8, *Recreation and Tourism*, the impact of visible WTGs on recreation and tourism activities would be long term, continuous, and minor. Seaside locations on Nantucket and Martha's Vineyard, which include communities with minority populations (Figure 3.6.4-2) in the viewshed of the Project's WTGs, could experience some reduced recreational and tourism activity, but the visible presence of WTGs would be unlikely to affect shore-based or marine recreation and tourism in the geographic analysis area as a whole. The impact of visible WTGs on tourism businesses that employ environmental justice populations are therefore expected to be minor, while views of WTGs would be sustained from many coastal communities along the shore and would not disproportionately affect environmental justice populations. Therefore, BOEM has determined that impacts of the Proposed Action on viewer experience would not be disproportionately high and adverse for environmental justice populations.

As noted in Section 3.6.2, *Cultural Resources*, the Proposed Action's construction and presence of structures could have impacts on cultural resources of tribal significance. Three TCPs have been identified in the cultural resources geographic analysis area, two of which may be subject to impacts from the Project (COP Appendices Q and R; SouthCoast Wind 2024): Chappaquiddick Island and Nantucket Sound. Both TCPs have been previously determined to bear significance to state and federally recognized tribes and are eligible for listing in the NRHP. ASLFs within or in proximity to the Nantucket Sound TCP may be elements contributing to the TCP's eligibility for the NRHP and in the Project's marine area of potential effects would be subject to physical impacts by the Project from installation of the Falmouth offshore export cables. The construction and presence of structures could contribute to impacts on the Nantucket Sound TCP, which would be disproportionately felt by environmental justice populations due to the unique cultural importance of the landforms to the tribes residing within or maintaining cultural associations to the geographic analysis area, resulting in major impacts. Both the Chappaquiddick Island and Nantucket Sound TCPs are also subject to visual impacts from the visibility of Project components. Because visual impacts from the Project's offshore components are widespread across the geographic analysis area, impacts would not be disproportionately felt by tribal nations.

Land disturbance: As shown on Figure 3.6.4-3, the preferred Falmouth onshore substation, preferred and alternative export cable routes, and their landfalls are adjacent to neighborhoods that meet environmental justice criteria. The Falmouth alternative onshore substation is not located within or adjacent to any environmental justice communities. Land use around the Falmouth Onshore Project area includes residential, recreational, and commercial uses. For Brayton Point, the intermediate landfall on Aquidneck Island and the site of the converter stations are not located in areas with environmental justice populations (Figure 3.6.4-4). The current land use around the Brayton Point cable corridor is primarily a mixture of industrial, parks and open space, and urban uses.[1]

As discussed in Section 3.6.5, *Land Use and Coastal Infrastructure*, construction of the onshore export cables, onshore substations, and other onshore Project components would temporarily disturb neighboring land uses through construction noise, vibration, and dust and other air emissions, and cause delays in travel along the affected roads. Noise from temporary HDD activities at the Falmouth landfalls during construction and long-term operational noise at the substation sites could disproportionately affect environmental justice populations near these sites. However, the noise levels would be reduced below applicable regulatory and Project-specific thresholds with implementation of applicant-proposed mitigation measures, such as installation of noise barriers, and noise impacts on environmental justice populations would be minor. SouthCoast Wind has committed to a construction schedule that avoids the height of summer tourism seasons (COP Volume 2, Section 12.2.2.1; SouthCoast Wind 2024), which would avoid impacts on tourism business that may employ environmental justice populations. Land disturbance during construction would have short-term, variable, minor impacts on environmental justice communities. During operation, the Falmouth onshore export cable infrastructure, including cable landfall sites and onshore cables, would be underground and primarily within roads and utility ROWs, while the substations would operate in industrial areas. As a result, operations and occasional maintenance or repair operations from the Proposed Action alone would have negligible impacts and would not result in disproportionately high and adverse impacts on environmental justice communities.

Cumulative Impacts of the 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. Ongoing and planned non-offshore wind activities that affect environmental justice in the geographic analysis area include onshore development and land uses; utilization of ports, marinas, and working waterfronts; port improvements or expansions; and continued commercial fishing operations.

Other offshore wind projects using ports within the geographic analysis area for environmental justice populations would overlap with the Project's operations phase, and short-term air quality impacts during the construction phase would be likely to vary from minor to moderate significance levels. Cumulative impacts on environmental justice populations from air emissions would likely be negligible to minor, due to short-term emissions near ports, of which the Proposed Action would contribute a noticeable increment. The combined reduction in air emissions from all ongoing and planned offshore

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

wind projects that displace fossil fuel power generation would have a long-term beneficial impact on environmental justice populations.

Ongoing and planned cable emplacement and maintenance for other offshore wind activities would generate comparable types of impacts to those of the Proposed Action, including impacts on subsistence fishing and reduced employment and income of workers employed in industries supporting commercial fishing. The incremental impacts contributed by the Proposed Action to the combined offshore cable emplacement impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely be noticeable, resulting in overall short term and minor cumulative impacts. Cable emplacement and the presence of structures from the Proposed Action and other offshore wind projects, including Vineyard Wind 1 and New England Wind, could contribute to impacts on tribally important TCPs, which would be disproportionately felt by environmental justice populations. Impacts on these tribal resources are anticipated to be localized and permanent and range from negligible to major depending on the ability of offshore wind projects to avoid, minimize, or mitigate impacts on TCPs and any contributing ASLFs.

Reasonably foreseeable activities would occasionally generate additional pile-driving noise or other construction noise near ports and marinas, some of which may be near environmental justice communities. Future offshore wind activities would have similar contributions as the Proposed Action over a wider area and longer time period. The increased impacts would affect the fishing and sightseeing businesses that rely on these species, resulting in impacts on employment, income, and subsistence fishing (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*, Section 3.6.3, *Demographics, Employment, and Economics*, and Section 3.6.8, *Recreation and Tourism*). Cumulative impacts on environmental justice populations from noise would likely be negligible to minor, of which the Proposed Action would contribute a noticeable increment, based on the potential impacts of pile driving noise on boating, fisheries, and marine mammals.

Ports to be utilized for the Proposed Action may also be used for other ongoing and planned activities. Combined port utilization impacts on environmental justice populations from ongoing and planned activities, including the Proposed Action, would likely be minor due to air emissions and noise. Port activity would also have minor beneficial impacts on environmental justice communities, due to increased employment opportunities and business activity.

The Proposed Action in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas. The presence of structures for the Proposed Action in combination with other planned offshore wind would result in adverse cumulative impacts on marine businesses supporting commercial fishing, adverse and beneficial cumulative impacts on marine businesses supporting for-hire recreational fishing, and adverse cumulative impacts on scenic and visual resources, similar to impacts of the Proposed Action but more notable due to the greater number of cumulative structures.

Other offshore wind projects may install onshore project components in the geographic analysis area. Onshore export cables and substations for other offshore wind development are anticipated to use cable routes and substation locations that comply with local land use regulations, and these improvements are not likely to be close enough to the Proposed Action to affect the same neighboring land uses. Therefore, the cumulative impacts from the Proposed Action in combination with other ongoing and planned activities would likely be negligible.

Conclusions

Impacts of the Proposed Action: During both construction and operations of the Proposed Action, the impacts on low-income and minority employees of marine industries and supporting businesses (commercial fishing, support industries, marine recreation, and tourism) from most IPFs would range from negligible to minor with minor beneficial impacts. The Proposed Action would result in negligible to minor impacts on environmental justice communities due to air emissions, noise at ports, land disturbance at onshore construction sites, and disruption of marine activities during offshore cable installation and the impacts on commercial and for-hire fishing resulting from the long-term presence of offshore structures. Damage to ASLFs in or near the defined Nantucket Sound TCP resulting from offshore construction would result in major disproportionate impacts on Native American tribal nations that trace their ancestry to the TCP. Visual impacts on both the Nantucket Sound TCP and Chappaquiddick Island TCP would also contribute to impacts on tribal nations, but, because views of WTGs would be sustained from many coastal communities along the shore, these impacts would not disproportionately affect tribal nations. Potentially beneficial impacts on environmental justice populations would result from port utilization and the resulting employment and economic activity. Beneficial impacts could also result if the Proposed Action displaces fossil fuel energy generation in locations that improve air quality and health outcomes for environmental justice populations.

In summary, BOEM anticipates that the Proposed Action would have overall **negligible** to **minor** impacts, with the exception of **major** impacts related to tribally important TCPs, and **minor beneficial** impacts on all environmental justice populations. Except for the TCP impacts, BOEM determined that impacts of the Proposed Action on low-income and minority populations would not be disproportionately high and adverse. The installation of cables intersecting the Nantucket Sound TCP would result in disproportionally high and adverse impacts on environmental justice populations due to the unique cultural importance of the landforms to the tribes residing within, or maintaining cultural associations to, the analysis area.

Cumulative Impacts of the Proposed Action: The Proposed Action in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas, and additional onshore construction and port utilization within the geographic analysis area. In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with the Proposed Action when combined with impacts from ongoing and planned activities including future offshore wind would be **moderate**.

3.6.4.7 Impacts of Alternatives C and F on Environmental Justice

Impacts of Alternatives C and F: The impacts of Alternatives C-1, C-2, and F on environmental justice communities would be the same as those of the Proposed Action except for impacts of land disturbance and cable emplacement and maintenance. To avoid sensitive fish habitat in the Sakonnet River, the export cable route to Brayton Point under Alternatives C-1 and C-2 would be re-routed onshore. The longer onshore cable routes under Alternatives C-1 and C-2 would result in increased air emissions, traffic, and noise associated with onshore construction. However, the location of the onshore cables would not occur in areas with environmental justice populations and would not bisect environmental justice communities in Fall River (Figure 3.6.4-11); therefore, there would be no additional adverse impacts on environmental justice communities compared to the Proposed Action. Limiting the number of Falmouth offshore export cables to three under Alternative F and adding one more HVDC converter OSP would not meaningfully change the impacts on recreational and commercial fishing businesses that are a source of employment for low-income and minority populations. The impacts of Alternatives C and F would be the same as those of the Proposed Action for environmental justice populations.

Cumulative Impacts of Alternatives C and F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives C and F would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternatives C and F: Impacts of Alternatives C-1, C-2, and F would be the same as those of the Proposed Action for environmental justice populations and would range from **negligible** to **major** adverse and **minor beneficial**.

Cumulative Impacts of Alternatives C and F: In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives C -1, C-2, and F would be the same as the Proposed Action, which are anticipated to be **moderate**.

3.6.4.8 Impacts of Alternatives D (Preferred Alternative) and E on Environmental Justice

Impacts of Alternatives D and E: The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternative D and Alternative E would be similar to those described under the Proposed Action. Under Alternative D, the removal of six WTGs near Nantucket Shoals would slightly reduce vessel activity at port locations with environmental justice communities and reduce impacts on commercial and for-hire fishing operations by providing more structure-free areas compared to the Proposed Action. Under Alternative E, use of all piled foundations (Alternative E-1) would have the same impacts as the Proposed Action by affecting fishing and other marine-based businesses from operating during pile-driving activity. Use of gravity-based (Alternative E-2) or suction-bucket foundations (Alternative E-3) for WTGs and OSPs would slightly reduce impacts on businesses in environmental justice communities that rely on fishing or tourism by reducing the noise associated with foundation installation, which may be a deterrent to these operations, as compared to pile driving.

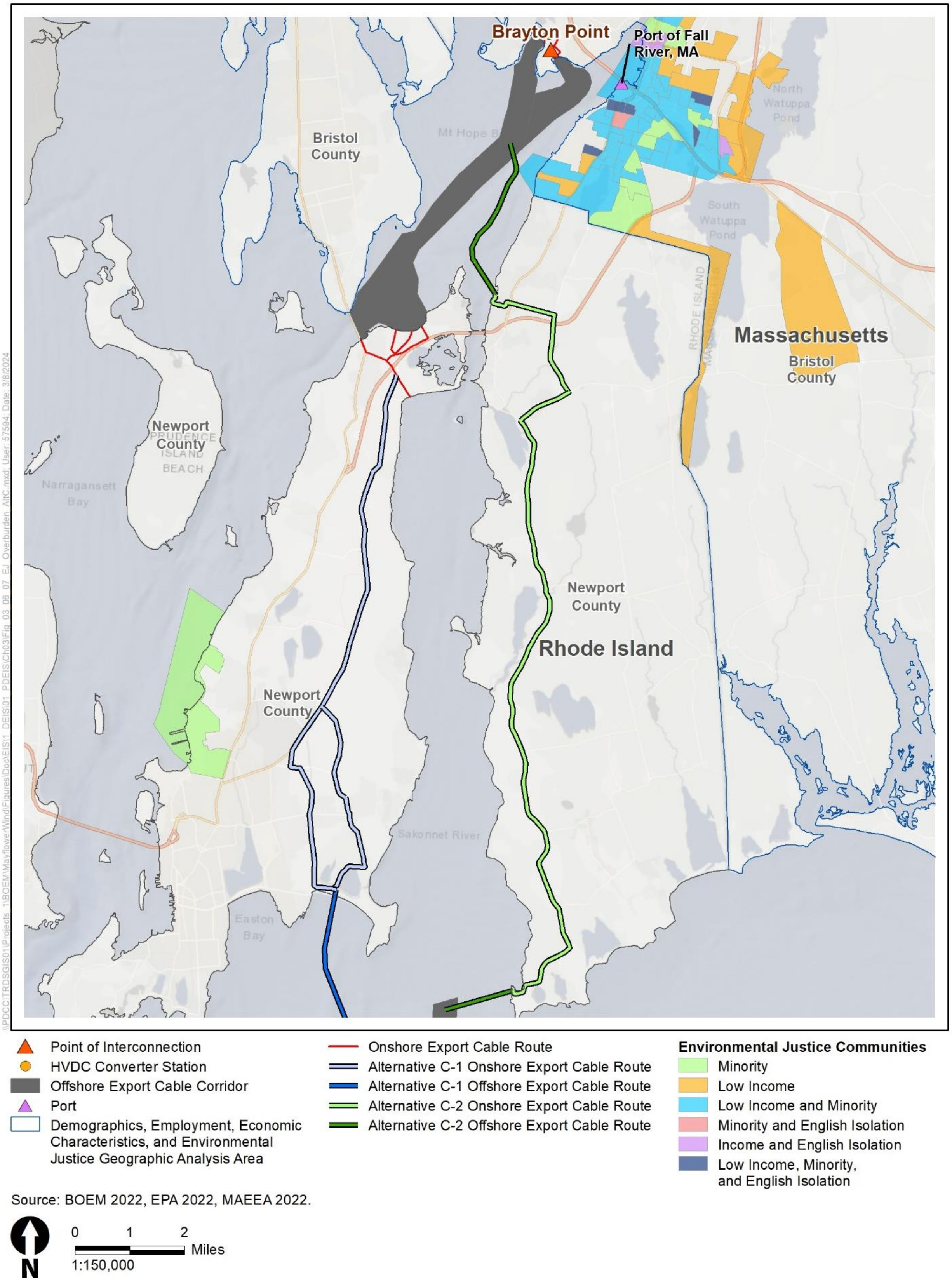


Figure 3.6.4-11. Environmental justice communities near Alternative C cable corridors

Under both Alternatives D and E, localized long-term, negligible to minor impacts are still anticipated and would not change the impacts on business that are the source of employment for low-income populations significantly from the Proposed Action. Alternative D would not meaningfully change onshore visual resource impacts or adverse impacts from the presence of WTGs on the local coastal economy compared to the Proposed Action. The impacts resulting from individual IPFs under both Alternatives D and E would be similar to the impacts described for the Proposed Action.

Cumulative Impacts of Alternatives D and E: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives D and E would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternatives D and E: Impacts of Alternative D and Alternative E would be similar as those of the Proposed Action for environmental justice populations and would range from **negligible** to **major** adverse and **minor beneficial**. While impacts from individual IPFs may be slightly reduced due to the reduction in the number of WTGs (Alternative D) or avoidance of pile driving (Alternatives E-2 and E-3), there would not be a meaningful difference in impacts on fishing and marine businesses that may employ low-income and minority workers or to the overall coastal economy.

Cumulative Impacts of Alternatives D and E: In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives D and E would be the same as the Proposed Action, which are anticipated to be **moderate**.

3.6.4.9 Comparison of Alternatives

Because any onshore differences in Alternatives C and F would not meaningfully change the impact of the Proposed Action on nearby environmental justice communities, and because Alternatives D and E involve modifications only to offshore components, impacts on environmental justice populations from these alternatives would be the same as under the Proposed Action and are expected to be **negligible** to **major** adverse and **minor beneficial.**

In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives C, D, E, and F compared to the overall impacts from ongoing and planned activities would be the same as that of the Proposed Action—**moderate**.

3.6.4.10 Proposed Mitigation Measures

No measures to mitigate impacts on environmental justice have been proposed for analysis.

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.

3.6.6 Navigation and Vessel Traffic

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 navigation and vessel traffic from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)

This section discusses potential impacts on other uses not addressed in other portions of the EIS, including marine minerals, military use, aviation, search and rescue (SAR), cables and pipelines, radar systems, and scientific research and surveys that would result from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis areas for other uses (marine minerals, military use, aviation, SAR, scientific research, and surveys) are described below and shown on Figure 3.6.7-1.

- Aviation and air traffic, military and national security, and radar systems: Areas within 10 miles (16.1 kilometers) of the SouthCoast Wind export cable corridors and Lease Area and the nearby Massachusetts and Rhode Island lease areas, as well as Nantucket Memorial Airport on Nantucket; Katama Airfield, Trade Wind Airport, and Martha's Vineyard Airports on Martha's Vineyard; Newport State Airport on Aquidneck Island, Rhode Island; Quonset State Airport in Rhode Island; Falmouth Airport, New Bedford Regional Airport, and Westport Airport in Massachusetts (Figure 3.6.7-1).
- Cables and pipelines: Areas within 1 mile (1.6 kilometers) of the export cable corridors and Lease Area that could affect future siting or operation of cables and pipelines (Figure 3.6.7-1).
- Scientific research and surveys: Same analysis area as finfish, invertebrates, and essential fish habitat (Section 3.5.5, Figure 3.5.5-1).
- Marine minerals: Areas within 0.25 mile (0.4 kilometer) of the export cable corridors and Lease Area that could affect marine minerals extraction (Figure 3.6.7-1).
- SAR: Areas within 10 miles (16.1 kilometers) of the export cable route and Lease Area (Figure 3.6.7-1)

3.6.7.1 Description of the Affected Environment

Marine Mineral Extraction

BOEM's Marine Mineral Program manages non-energy minerals, primarily sand and gravel, on the OCS and leases access to these resources to target shoreline erosion, beach renourishment, and restoration projects. At this time, there are no active or requested BOEM marine mineral leases offshore Massachusetts or Rhode Island (BOEM 2022). The closest active lease is offshore New Jersey, approximately 170 miles (273.6 kilometers) east of the Massachusetts Wind Energy Area (BOEM 2022).

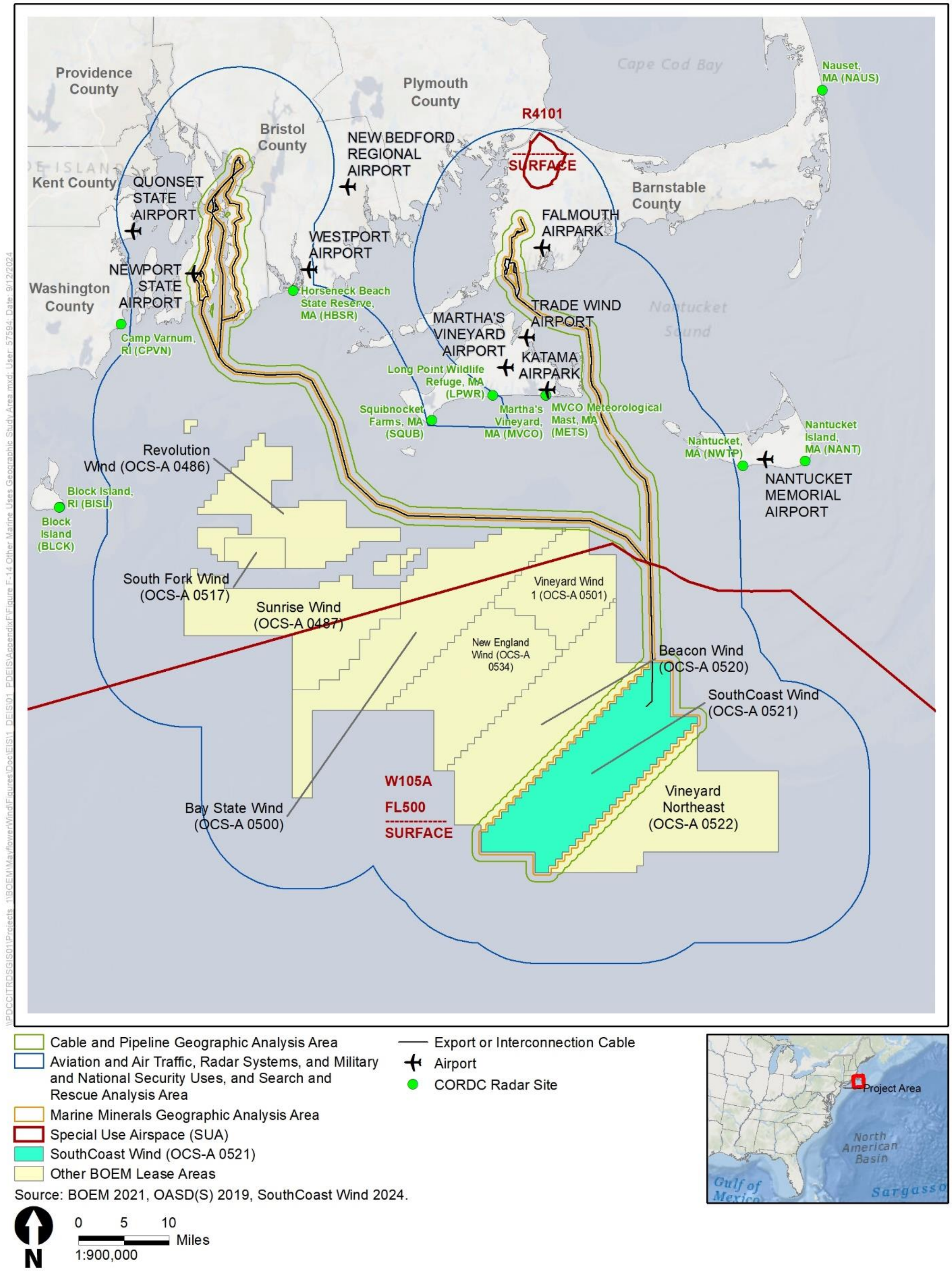


Figure 3.6.7-1. Other uses geographic analysis area

USEPA Region 1 is responsible for designating and managing ocean disposal sites in the region of the Project. While there are active and permitted dredged disposal sites in the region, there are no ocean dredged disposal sites in the geographic analysis area (USACE 2022). See Appendix D, *Planned Activities Scenario*, for more information on planned marine mineral use and ocean dredged material disposal in the vicinity of the Project but outside the geographic analysis area. BOEM would coordinate with USEPA Region 1 should ocean disposal for any material be required to determine if it is permissible to dispose of at an ocean disposal site.

National Security and Military Uses

Major onshore military uses in the region revolve around several naval bases, including Naval Station Newport in Rhode Island, which hosts U.S. Marine Corps, USCG, and U.S. Army Reserve commands and activities, such as research, development, test and evaluation, engineering, and fleet support for submarines, autonomous underwater systems, and offensive and defensive weapons systems for undersea warfare (CRMC 2010). Other military bases in the region include Naval Submarine Base New London, Connecticut; Portsmouth Naval Shipyard, Maine/New Hampshire; Naval Weapons Station Earle, New Jersey; Joint Base Cape Cod, Massachusetts; and Newport Naval Undersea Warfare Center, Rhode Island. USCG District 1 is responsible for responding to SAR incidents for both air and sea assets in the Lease Area in proximity to the Sector Southeastern New England area of responsibility, including Air Station Cape Cod and applicable Sector Command centers in the Northeast region.

The U.S. Atlantic Fleet conducts training and testing exercises in the Northeast Range Complex for the Navy. The Northeast Range Complex includes the Boston, Atlantic City, and Narraganset Bay Operating Areas. The Lease Area and a section of the offshore export cable corridors overlap with the Narraganset Bay Operating Area, which extends approximately 180 nautical miles (333 kilometers) from the coasts of Massachusetts, Rhode Island, and New York. Additionally, the Lease Area overlaps with the Navy Undersea Test and Evaluation Center, an area used for research, development, testing, and evaluation of undersea warfare systems to support Navy and Department of Defense (DoD) operations. Naval vessels occasionally transit in the vicinity of the Lease Area; however, they are not involved in range activity in proximity to the Lease Area (SouthCoast Wind 2024). Offshore, special use airspace warning area W-105A overlies the Lease Area. Onshore, restricted area R-4101 overlies a portion of Joint Base Cape Cod, Massachusetts called Camp Edwards and extends from the surface level to 9,000 feet MSL.

Two danger zone/restricted areas, areas used for munitions testing where public access is prohibited or limited due to use by the U.S. government, are within the geographic analysis area in waters surrounding Norman's Land Island. Danger Zone 33.4.80(a) is located approximately 4.2 nautical miles (7.8 kilometers) southeast of the Brayton Point export cable corridor and Danger Zone 167.103 is located approximately 3.3 nautical miles (6.11 kilometers) east of the Brayton Point export cable corridor. Activities in the danger zones or restricted areas are not expected to have regular interaction with the Project area. Additionally, the Brayton Point export cable corridor intersects with a land-based formerly used defense site that extends into the Sakonnet River. The formerly used defense site status is listed as complete and closed out (USACE 2019).

Military activities are anticipated to continue to use onshore and offshore areas in the vicinity of the Project area into the future and may involve routine and non-routine activities.

Aviation and Air Traffic

Multiple public and private-use airports serve the region surrounding the Project area including the Nantucket Memorial Airport on Nantucket; Katama Airfield, Trade Wind Airport, and Martha's Vineyard Airports on Martha's Vineyard; Newport State Airport on Aquidneck Island, Rhode Island; Quonset State Airport in Rhode Island; Falmouth Airport, Westport Airport, and New Bedford Regional Airport in Massachusetts.

The Obstruction Evaluation and Airspace Analysis completed for the Project indicates there are no visual flight rules for traffic pattern airspace, expected visual flight rules routes, instrument departure procedure obstacle clearance surfaces, or low altitude enroute airway obstacle clearance surfaces overlying the Lease Area (COP Appendix Y1; SouthCoast Wind 2024). Air traffic is expected to continue at current levels in and around the Wind Farm Area.

Cables and Pipelines

No existing cables or submarine pipelines were identified in the Lease Area. In the Falmouth export cable corridor, there are up to two expected crossings of existing cables and up to seven anticipated crossings of planned cables. Cables would intersect with the Falmouth export cable corridor at two crossing locations: one south of the Muskeget Channel and one between Martha's Vineyard and Falmouth. For the Brayton Point export cable corridor, up to seven planned cables are expected to be crossed south of the Muskeget channel, up to four planned cables are anticipated to be crossed south of Nomans Island, and up to two planned cables are expected to be crossed south of the Sakonnet River, for a total of up to 13 crossings of planned cables. Additionally, the Brayton Point export cable corridor would cross three existing pipelines in the Sakonnet River.[1]

Beyond the planned cables identified above and cables for other offshore wind projects, 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. The following six DOD national defense and FAA air traffic control radar sites are in the vicinity of the Project area.

- Boston Airport Surveillance Radar-9 (ASR-9) and co-located Boston Air Traffic Control Beacon Interrogator-6.

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

- Falmouth Airport Surveillance Radar-8 (ASR-8)
- Nantucket ASR-9
- North Truro Air Route Surveillance Radar-4 (ARSR-4)
- Providence ASR-9
- Riverhead ARSR-4

Five high-frequency radar sites used by NOAA and other agencies are in the vicinity of the Project area.

- Amagansett High Frequency radar
- Block Island High Frequency radar
- Martha's Vineyard High Frequency radar
- Nantucket High Frequency radar
- Nauset High Frequency radar

Two omnidirectional range (VOR) NAVAIDS and co-located distance measuring equipment (DME) are in the vicinity of the Project area.

- Martha's Vineyard VOR/DME
- Nantucket VOR/DME

Additionally, two Next Generation Weather radar sites are in the vicinity of the Project area.

- Boston Weather Surveillance Radar 1988 Doppler (WSR-88D)
- Brookhaven WSR-88D

Most of the Lease Area is within the line of sight of long-range radar systems used by the DoD and Department of Homeland Security for air defense and homeland security, including the Early Warning Radars at Cape Cod Air Force Station, Massachusetts, used for ballistic missile defense and space surveillance.

The high-frequency radars are used by the NOAA Integrated Ocean Observing System (IOOS) as part of its Surface Currents Program. Surface current data collected is used by the Coast Guard's Search and Rescue Optimal Planning System (SAROPS), a decision-support tool that uses ocean observations to narrow search areas.

Existing radar systems will continue to provide weather, navigational, and national security support to the region. The number of radars and their coverage area are anticipated to remain at current levels for the foreseeable future.

Scientific Research and Surveys

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 Wind Farm Area and surrounding waters.

The following current fisheries management and ecosystem monitoring surveys conducted by or in coordination with the NMFS NEFSC will overlap with offshore wind lease areas in the Mid-Atlantic region.

- NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock-assessment tool using a bottom trawl.
- NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock-assessment and habitat-characterization tool, using a bottom dredge and camera tow.
- NEFSC Surfclam/Ocean Quahog Survey, a stock-assessment tool for both species using a bottom dredge.
- NEFSC Ecosystem Monitoring Program, a more than 40-year shelf-ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units.
- Atlantic Marine Assessment Program for Protected Species shipboard and aerial surveys.
- North Atlantic Right Whale Sighting Advisory System aerial survey (BOEM 2021).

These surveys support management of more than 40 fisheries in the region, more than 30 marine mammal species, and 14 threatened and endangered species (Hare et al. 2022). Additionally, these surveys support numerous other science products produced by NOAA Fisheries, including ecosystem and climate assessments.

Multiple surveys are conducted by state agencies in the geographic analysis area to monitor fish and invertebrate abundance including the following in the Sakonnet River and Mount Hope Bay.

- RIDEM Division of Marine Fisheries Coastal Trawl Survey, a year-round survey that has been in operation for over 38 years and has collected data on 132 species with sampling at both fixed stations and seasonal random sampling.
- RIDEM Division of Marine Fisheries Narragansett Bay Seine, a monthly survey at fixed stations focusing on monitoring juvenile finfish abundance and distribution for commercial and recreationally species.
- RIDEM Division of Marine Fisheries Rhode Island Lobster Ventless Trap Survey, a stock-assessment tool to record juvenile lobster abundances.

As offshore wind development continues, alternative platforms, sampling designs, and sampling methodologies could be needed to maintain surveys conducted in or near the Project area.

Search and Rescue

SAR activities occur on an as-needed basis and, thus, could be considered non-routine. USCG and other entities conduct regular SAR training and perform active SAR missions frequently enough in or near the geographic analysis area so that SAR is evaluated here as a routine activity. The installation of foundations within the geographic analysis area could attract interest for recreational fishing or sightseeing, resulting in vessels that may travel farther offshore than typically occurs. Recreational fishing vessel traffic would be additive to vessel traffic that already transits the leased areas and could increase demand for USCG SAR operations near the WTGs, with the structures themselves additionally complicating SAR operations. Airborne and maritime SAR in the geographic analysis area is primarily provided by USCG. Mission data taken from the USCG MARIPARS report indicate that an average of 9.5 SAR cases per year occurred in an area approximately equivalent to the Massachusetts and Rhode Island lease areas, of which 0.14 case occurred in the Project area (USCG 2021; SouthCoast Wind 2024). The largest percentage of incidents were disabled vessels, distress/medivac, and other incidents; there were no recorded allisions, collisions, or groundings in the Project area (COP Appendix X, Figure 12-3; SouthCoast Wind 2024). An increase in commercial and recreational vessels in and around offshore wind projects could increase the risk of vessel collisions with military and national security vessels and may lead to an increased demand for USCG SAR operations.

3.6.7.2 Impact Level Definitions for Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)

Impact level definitions for other uses are provided in Table 3.6.7-1.

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, Scientific Research and Surveys, and Search and Rescue)

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, *Planned Activities Scenario.*

Impacts of the No Action Alternative

Under the No Action Alternative, marine minerals, military and national security uses, aviation and air traffic, SAR, offshore cables and pipelines, radar systems, and scientific research and surveys would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities in the geographic analysis area that would contribute to impacts on other uses would generally be associated with offshore developments and climate change. The ongoing offshore wind activities in the geographic analysis area for marine minerals, military and national security uses, aviation and air traffic, SAR, cables and pipelines, and radar systems include the Vineyard Wind 1 project in lease area OCS-A 0501, South Fork Wind Farm in lease area OCS-A 0517, and the Revolution Wind project in lease area OCS-A 0486. Impacts from ongoing construction of these projects would be similar to those described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity. The geographic analysis area for scientific research and surveys includes the constructed Block Island Wind Farm offshore Rhode Island and CVOW Pilot Project offshore Virginia, in addition to the ongoing construction of the Vineyard Wind 1, South Fork Wind Farm, Revolution Wind, CVOW Commercial, and Ocean Wind 1 projects.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative 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 (see Appendix D, Section D.2, for a complete description of planned activities). Ongoing and planned offshore wind activities in the geographic analysis area for other uses include the construction, O&M, and decommissioning of the Vineyard Wind 1 project in lease area OCS-A 0501, South Fork Wind Farm in lease area OCS-A 0517, Revolution Wind project in lease area OCS-A 0488, Sunrise Wind in lease area OCS-A 0487, Bay State Wind in lease area OCS-A 0500, New England Wind in lease area OCS-A 0534, Beacon Wind in lease area OCS-A 0520, and Vineyard Wind Northeast in lease area OCS-A 0522. The following sections summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on other uses during construction, O&M, and decommissioning of the projects.

BOEM expects other offshore wind development in the geographic analysis area to primarily affect other uses through the following IPFs.

Marine Mineral Extraction

Presence of structures: The demands for sand and gravel resources is expected to grow with increasing trends in coastal erosion, storm events, and sea level rise. There are no mineral leases, sand resource areas, borrow sites, or ocean disposal sites in the geographic analysis area. Offshore wind project infrastructure, including WTGs and transmission cables, could prevent future marine mineral extraction activities where the Project area overlaps with the extraction area. Marine mineral extraction typically occurs within 8 miles of the shoreline, limiting adverse impacts on the offshore export cable routes. Additionally, other offshore wind projects may be able to minimize impacts on existing and proposed borrow areas through consultation with the BOEM Marine Minerals Program and USACE before an offshore wind cable route is approved. The adverse impacts on sand and marine mineral extraction of offshore wind activities without the Proposed Action are anticipated to be negligible.

National Security and Military Uses

The offshore wind lease area geographic boundaries were developed through coordination with stakeholders to address concerns surrounding overlapping military and security uses. BOEM continues to coordinate with stakeholders to minimize these concerns, as needed.

Presence of structures: Existing stationary facilities that present allision risks are limited in the open waters of the geographic analysis area and include the meteorological buoys operated for offshore wind farm site assessment. Dock facilities and other structures are concentrated along the coastline. Installation of up to 901 WTGs as part of other offshore wind projects in the geographic analysis area would affect military and national security, primarily through increased risk in transiting the Lease Area due to the risk of allision with foundations and other stationary structures (USCG 2021). Military vessels moving within or near the offshore wind facilities would have a higher risk of allision with the offshore wind structures. However, wind energy 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 incrementally change navigational patterns and would increase navigational complexity for military vessels and military aircraft operating in the region around the wind energy projects. The structures associated with offshore wind energy may necessitate route changes to navigate around the offshore wind lease areas and vessels associated with the construction of a project. Military and national security aircraft would be affected by the presence of tall equipment necessary for offshore wind facility construction, such as stationary lift vessels and cranes, which would increase navigational complexity in the area. Additionally, military and national security operations conducted within the Northeast Range Complex, Narraganset Bay Operating Area, Navy Undersea Test and Evaluation Center, and special use airspace warning area W-105A 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 on 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.

Potential measures mitigating risks that offshore wind projects could include implementation of FAA- and BOEM-recommended navigational lighting and marking to reduce the risk of aircraft collisions. Wind energy structures would be visible on military and national security vessel and aircraft radar.

Navigational hazards would be eliminated as structures are removed during decommissioning. Due to anticipated coordination with agencies and the mitigation measures described above, the overall impacts on military and national security uses from offshore wind energy activities are anticipated to be minor.

Traffic: Impacts on military operations from vessel traffic related to the construction and operation of offshore wind activities on the OCS are expected to be short term, localized, and minor. Vessel traffic is expected to increase during construction. Construction periods for the planned offshore wind energy projects in the geographic analysis area are expected to overlap in 2025 to 2030, 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 vessels associated with offshore wind.

Aviation and Air Traffic

Presence of structures: Other offshore wind development could add up to 901 WTGs to the offshore environment in the nearby OCS. WTGs could have a maximum blade tip height of 1,171 feet (357 meters) AMSL. As these structures are built, aircraft navigational patterns and complexity would incrementally increase in the region around the offshore wind lease areas, along transit routes between ports and construction sites, and locally around ports. These changes could compress lower-altitude aviation activity into more limited airspace in these areas, leading to airspace conflicts or congestion and increasing collision risks for low-flying aircraft. After all foreseeable offshore wind energy projects are built, there would still be open airspace available over the open ocean. Navigational hazards and collision risks in transit routes would be reduced as construction is completed and would be gradually eliminated during decommissioning as offshore WTGs are removed.

All stationary structures would have aviation and navigational marking and lighting in accordance with FAA, USCG, and BOEM requirements and guidelines to minimize and mitigate impacts on air traffic. BOEM assumes that offshore wind projects would coordinate with aviation interests through the planning, construction, operation, and conceptual decommissioning processes to avoid or minimize impacts on aviation and air traffic. For this reason, the adverse impacts on aviation and airports are anticipated to be minor.

Cables and Pipelines

Presence of structures: Two existing submarine cables were identified between Martha's Vineyard and Falmouth, and three existing submarine pipelines have been identified in the Sakonnet River. The majority of the cables identified in the geographic analysis area are planned offshore export cables associated with other offshore wind projects. Up to 3,520 statute miles (5,667 kilometers) of submarine cables are expected to be installed for the projects in the geographic analysis area. The installation of WTGs and OSPs could preclude future submarine cable placement within the foundation footprint, which would cause future cables to route around these areas. In the majority of circumstances, the presence of existing submarine cables from these projects would not prohibit the placement of additional cables and pipelines. Following standard industry procedures, cables and pipelines can be crossed without adverse impact to existing cables or pipelines.

However, in locations where there are many existing and planned cables and pipelines, there reaches a saturation point where there is not sufficient accommodation space within possible offshore routes or at the shore approach where limited landfall locations exist. 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.

Installed WTGs and OSPs, and the stationary lift vessels used during construction of offshore wind energy project infrastructure, may pose allision or 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, BOEM, and USCG requirements and guidelines. Risk of allision by cable maintenance vessels would decrease to zero after project decommissioning as structures are removed.

Radar Systems

Presence of structures: WTGs that are near to or in the direct line of sight of land-based radar systems can interfere with the radar signal, causing shadows or clutter in the received signal. Construction of other wind energy projects would add up to 901 WTGs with a maximum blade tip height of up to 1,171 feet (357 meters) AMSL in the geographic analysis area. The presence of wind energy infrastructure could lead to localized, long-term, moderate impacts on radar systems. Development of offshore wind projects could incrementally decrease the effectiveness of individual radar systems if the field of WTGs expands within the radar system's coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded radar coverage that could affect multiple radars. Most offshore wind structures would be sited at such a distance from existing and proposed land-based radar systems to minimize interference to most radar systems, but some impacts are anticipated.

For radar structures with a co-located secondary surveillance radar systems (including Falmouth ASR-8, North Truro ARSR-4, Riverhead ARSR-4, Boston ASR-9, Nantucket ASR-9, and Providence ASR-9), the secondary surveillance radar is the main source of aircraft identification and positional data for air traffic control. A Department of Homeland Security–funded study found that secondary radar tracks were rarely affected by wind turbines (JASON 2008). Additional flight trials by the Department of Energy, Department of Homeland Security, DoD, and FAA found that while primary surveillance radars were affected by wind turbines, beacon transponder-based secondary surveillance radars were not affected (Sandia National Laboratories, MIT Lincoln Laboratory 2014).

BOEM assumes that Project proponents would conduct an independent radar analysis and coordinate with FAA, NOAA, and DoD to identify potential impacts and any mitigation measures specific to aeronautical, military, oceanographic, and weather radar systems. BOEM would continue to coordinate with the Military Aviation and Installation Assurance Siting Clearinghouse to review each proposed offshore wind project on a project-by-project basis and would attempt to resolve project concerns identified through such consultation related to military and national security radar systems with COP approval conditions. Refer to Section 3.6.6, *Navigation and Vessel Traffic*, for a discussion of impacts on marine vessel radar.

Scientific Research and Surveys

Presence of structures: Construction of other wind energy projects between 2023 and 2030 in the geographic analysis area for scientific research and surveys would add up to 2,945 offshore wind structures, associated cable systems, and associated vessel activity that would present additional navigational obstructions for sea- and air-based scientific studies. Collectively, these developments would prevent NOAA from continuing scientific research surveys or protected species surveys under current vessel capacities, would affect monitoring protocols in the geographic analysis area, could conflict with state and nearshore surveys, and may reduce opportunities for other NOAA scientific research studies in the area. This EIS incorporates by reference the detailed summary of and potential impacts on NOAA’s scientific research provided in the *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement* (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 by precluding NOAA survey vessels and aircraft from sampling, impacts on the random-stratified statistical design that is the basis for assessments; alter 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 reduce sampling productivity through navigation impacts of wind energy infrastructure on aerial and vessel surveys. NOAA has determined that survey activities in 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 in the offshore wind lease areas but cannot be observed as part of surveys, resulting survey indices could be biased and unsuitable for monitoring stock status. Offshore wind facilities will disrupt survey sampling statistical designs, such as random-stratified sampling. Impacts on the statistical design of region-wide surveys violate the assumptions of probabilistic sampling methods. Development of new survey technologies, changes in survey methodologies, and required calibrations could help to mitigate losses in accuracy and precision of current practices caused by the impacts of wind development on survey strata.

Other offshore wind projects could also require implementation of mitigation and monitoring measures identified in their associated records of decision. 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.

Search and Rescue

Presence of structures: Offshore wind development within the geographic analysis area is expected to result in 149 foundations (147 WTGs and up to 5 OSPs) by 2030 (Appendix D, *Planned Activities Scenario*, Table D2-1) which would affect USCG SAR operations, primarily through increased risk of allision with foundations and other stationary structures.

Potential mitigation measures that offshore wind projects could implement include operational protocols to stop WTG rotation during SAR aircraft operations and implementation of FAA- and BOEM-recommended navigational lighting and marking to reduce the risk of aircraft collisions. Even if these mitigation measures were implemented, the presence and layout of large numbers of WTGs could make it more difficult for SAR aircrafts and USCG to perform operations, leading to less effective search patterns or earlier abandonment of searches. This could result in otherwise avoidable loss of life due to maritime incidents.

Navigational hazards would be eliminated as structures are removed during decommissioning. Due to anticipated coordination with agencies and the mitigation measures described previously, the overall impacts on SAR operations from offshore wind energy activities are anticipated to be moderate adverse.

Conclusions

Impacts of the No Action Alternative: BOEM expects ongoing activities, including offshore wind development, to have continuing impacts on marine mineral extraction, military and national security uses, aviation and air traffic, SAR, offshore cables and pipelines, radar systems, and scientific research and surveys, primarily through the presence of structures that introduce navigational complexities and vessel traffic.

BOEM anticipates that the impacts of ongoing activities on other uses would be **negligible** for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and radar systems and **moderate** for SAR. 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 **major** for scientific research and surveys due to the impacts from ongoing offshore wind activity (e.g., Block Island Wind Farm).

Cumulative Impacts of the No Action Alternative: In addition to ongoing activities, BOEM anticipates that planned activities would contribute to impacts on other uses from increasing vessel traffic; residential, commercial, and industrial development onshore and along the shoreline; and development of FAA-regulated structures including cell towers and onshore wind turbines. BOEM anticipates that any issues with aviation routes or radar systems would be resolved through coordination with DoD or FAA, as well as through implementation of aviation and navigational marking and lighting of structures according to FAA, USCG, and BOEM requirements and guidelines. There are no planned offshore activities anticipated to affect marine mineral extraction or cable and pipeline infrastructure.

BOEM anticipates that the cumulative impact of the No Action Alternative would result in **negligible** impacts for marine mineral extraction; **minor** impacts for aviation and air traffic, military and national security uses, and cables and pipelines; **moderate** for radar systems due to WTG interference; **moderate** for SAR operations due to the possible loss of life; and **major** for scientific research and surveys. 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 in 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.

3.6.7.4 Relevant Design Parameters and Potential Variances in Impacts

This 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.
- Timing of offshore construction and installation activities.
- Location and route of offshore export cable corridor.

Variability of the proposed Project design exists as outlined in Appendix C. The following summarizes the potential variances in impacts.

- WTG size and location: Larger turbines closer to shore could increase impacts on land-based radar systems, movements of civilian and military aircraft, and military vessels.
- WTG spacing: Removal of groups of WTGs, creating spacing of greater than 1 nautical mile, could allow for scientific research and surveys in those areas, decreasing the impact.
- Timing of construction: Construction could affect submarine or surface military vessel activity during typical operations and training exercises.
- Offshore cable route options: The route chosen (including variants in the general route) could conflict with marine mineral extraction or cables and pipelines.

SouthCoast Wind has committed to measures to minimize impacts on other uses, which include, but are not limited to, complying with USCG, BOEM, and FAA marking and lighting guidelines, avoiding, minimizing, or mitigating effects on navigation by equipping all Project-related vessels and relevant infrastructure with the required navigation marking and lighting and day shapes, use of established standard techniques for adequately protecting existing and newly installed cables, and liaising with the military and national security stakeholders to reduce potential conflicts (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.6.7.5 Impacts of Alternative B – Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)

Marine Mineral Extraction

Presence of structures: Offshore wind project infrastructure, including WTGs and transmission cables, has the potential to prevent future marine mineral extraction activities where the footprint of the structures and cable corridors overlaps with the extraction area. Because there are no borrow areas, sand resource areas, or ocean disposal sites located in the vicinity of the Project, negligible impacts associated with construction, O&M, and decommissioning are anticipated.

National Security and Military Uses

Presence of structures: The addition of up to 149 substructures, supporting a combination of WTGs and OSPs, would increase the risk of allisions for military vessels during Project O&M, particularly during bad weather or low visibility, resulting in minor impacts on most national security and military uses. Project structures would be marked as a navigational hazard per FAA, BOEM, and USCG guidelines, and WTGs would be visible on military and national security vessel and aircraft radar, minimizing the potential for allision and increased navigational complexity. Additional navigational complexity would increase the risk of collision and allisions for military and national security vessels or aircraft in the Project area.

While warning Area W-105A overlies the entire Lease Area, it does not overlap any submarine transit lanes, torpedo exercise areas, danger zones or restricted areas (SouthCoast Wind 2024). WTGs in this portion of the Lease Area may create conflicts with the U.S. Air Force and Navy Fleet Area Control and Surveillance Facility, Virginia Capes, or other units that use the airspace. SouthCoast Wind has submitted an informal review request to the DoD in May 2020 and has agreed to continue to engage with the DoD and relevant agencies as the Project progresses. These coordination activities would ensure the Project is designed and operated in a manner that would minimize impacts on military use in the Project area to the extent feasible. Potential impacts on military operations from the permanent placement of structures within the water column and above the sea surface in the Wind Farm Area are expected to be long term and localized.

Additionally, construction of the Proposed Action would add up to 149 substructures 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: Though the Lease Area overlaps with a portion of the W-105A warning area within the Narraganset Bay Operating Area, military traffic in the MA Wind Energy Area is relatively low, with four vessels recorded between 2016 and 2017 (BOEM 2021). Increased vessel traffic in the Project area during construction, operations, and decommissioning could result in an increased risk of vessel collision with military and national security vessels, could cause military and national security vessels to change routes, and could result in congestion and delays in ports. Impacts are anticipated to be minor and would be greatest during construction when vessel traffic is greatest and would be reduced during operations. Vessel traffic and navigation impacts are summarized in Section 3.6.6, *Navigation and Vessel Traffic*.

Aviation and Air Traffic

Presence of structures: The Proposed Action would install up to 147 WTGs with a maximum blade tip height of 1,066.3 feet (325 meters) AMSL in the Wind Farm Area. The addition of these structures would increase navigational complexity and change aircraft navigational patterns around the Wind Farm Area.

The Boston Consolidated (A90) Terminal Radar Approach Control (TRACON) overlaps with the northern portion of the Lease Area and has a minimum vectoring altitude of 2,000 feet (610 meters). With the maximum design scenario WTG height of 1,066.3 feet (325 meters), there would be a vertical distance of 933.7 feet (284.6 meters) between the maximum WTG blade tip height and the minimum vectoring altitude. Due to their height, the WTGs proposed in the northern portion of the Lease Area would be considered obstructions to air navigation. An increase to the minimum vectoring altitude would likely be required, pending coordination with the FAA (COP Volume 2, Section 14.2.3.1.1; SouthCoast Wind 2024).

WTGs and OSPs would comply with lighting and marking regulations and be marked per FAA and USCG rules to minimize and mitigate impacts on air traffic. Due to their size, WTGs would also be visible on aircraft radars. 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. Adverse impacts on air traffic are anticipated to be localized, long term, and minor.

Cables and Pipelines

Presence of structures: It is anticipated that there would be several potential crossing areas along the Falmouth export cable corridor, if Falmouth is selected as the POI for Project 2. Between Martha's Vineyard and Falmouth, Massachusetts, the export cable corridor for the Proposed Action would cross up to two existing cables. South of the Muskeget Channel, the export cable corridor would cross up to seven planned cables associated with the Vineyard Wind 1 offshore wind project. In the Muskeget Channel and in the Nantucket Sound, the Falmouth ECC also has the potential to cross planned cables associated with the New England Wind project.

The Brayton Point export cable corridor is anticipated to have five potential crossing areas. The Proposed Action would cross up to seven planned cables associated with the Vineyard Wind offshore wind project. Up to four planned cables would be crossed south of Nomans Land. The Brayton Point export cable corridor would cross three existing pipelines at the Sakonnet River (COP Volume 2, Section 14.1.4; SouthCoast Wind 2024).

Where cable or pipeline crossings along the offshore export cable corridor are necessary, SouthCoast Wind would use well-established standard techniques for adequately avoiding, minimizing, or mitigating the impacts on existing cables and the newly installed Project offshore export cables. Additionally, SouthCoast Wind would coordinate with the owners of existing and planned cables and pipelines to coordinate crossing design, installation, and maintenance requirements. The presence of offshore wind energy structures, such as WTG foundations, could preclude future submarine cable placement within the foundation footprint, requiring future cables to route around these areas. In most situations, 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 and impacts would be negligible. However, in locations where there are many existing and planned cables and pipelines, there reaches a saturation point where there is not sufficient accommodation space within possible offshore routes or at the shore approach where limited landfall locations exist. It is expected that this saturation will be reached along the Falmouth offshore export cable corridor within the Muskeget Channel where technically feasible routes are limited and multiple offshore wind project cables in the same location are planned. In these situations, additional coordination with cable operators and additional cable protection systems may be required. Impacts on submarine cables and pipelines would be eliminated during decommissioning of the projects as the foundations and export and interarray cables are removed.

Project structures including WTGs and OSPs, 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 telecommunications cables. However, FAA, USCG, and BOEM navigational hazard marking, as well as the relative infrequency of cable maintenance activities would minimize the risk of allision. Risk of vessel collisions between cable maintenance vessels and vessels associated with the projects would be limited to the construction and installation phase and during planned maintenance activities during the operational phase.

Radar Systems

Presence of structures: Air traffic control, national defense, weather, and oceanographic radar in the line of sight of the offshore infrastructure associated with the Proposed Action may be affected by the O&M phase of the projects. Potential impacts for radar operations over and in the immediate vicinity of the Project area include unwanted radar returns (clutter) resulting in a partial loss of primary target detection and a number of false primary targets, and a partial loss of weather detection including false weather indications.

A review of the radar line of sight found that the proposed WTGs at a maximum height of 1,066.3 feet (325 meters) would be either partially or fully in the line of sight for the following radar systems: Falmouth (ASR-8), Nantucket (ASR-9), North Truro (ARSR-4), Riverhead (ARSR-4), Martha’s Vineyard High Frequency Radar, Block Island High Frequency Radar, and Nantucket High Frequency Radar. The Project may also affect additional high-frequency radars, as these instruments measure areas over-the-horizon, beyond line of sight. Radar effects may include unwanted radar returns resulting in a partial loss of primary target detection and a number of false primary targets over and in the immediate vicinity of the WTGs in the line of sight. Other possible radar effects include a partial loss of weather detection, including false weather indications. For oceanographic high-frequency radars, anticipated impacts include a loss of ocean surface current and wave measurements in an area extending within and substantially beyond the Project area. In addition, the following FAA radar sites for air traffic control would be in the line of sight: Boston Consolidated A90 TRACON, Nantucket Air Traffic Control Tower, and the Providence TRACON. WTGs in the northern half of the Lease Area would be in the line of sight of the Cape Cod Air Force Station Early Warning Radar used for ballistic missile defense and space surveillance, which could have impacts on the radar system. SouthCoast Wind has committed to working with the DoD Siting Clearinghouse to identify and implement appropriate mitigation measures for military and national security radar systems—and with NOAA IOOS per Table 3.6.7-2 for oceanographic high-frequency radars—and, therefore, impacts are anticipated to be minor.

Scientific Research and Surveys

Presence of structures: Scientific research and surveys, particularly for NOAA surveys supporting commercial fisheries and protected-species research programs, could be affected during construction and operations of the Proposed Action; however, research activities may continue in the proposed Project area, as permissible by survey operators. The Proposed Action would affect survey operations by excluding certain portions of the Lease Area occupied by Project components from sampling, affecting the statistical design of surveys, reducing survey efficiency, and causing habitat alteration in the Wind Farm Area that cannot be monitored.

This Final EIS incorporates by reference the detailed analysis of potential impacts on scientific research and surveys provided in the Vineyard Wind 1 Final EIS (BOEM 2021). The analysis in the Vineyard Wind 1 Final EIS is summarized in Section 3.6.7.3.

The Proposed Action would install up to 147 WTGs with a maximum blade tip of 1,066.3 feet (325 meters) AMSL. Aerial survey track lines for cetacean and sea turtle abundance surveys could not continue at the current altitude (600 feet AMSL) in the Project area because the planned maximum-case scenario for WTG blade tip height would exceed the survey altitude. The increased altitude necessary for safe survey operations could result in lower chances of detecting marine mammals and sea turtles, especially smaller species. Agencies would need to expend resources to update scientific survey methodologies due to construction and operation of the Proposed Action, as well as to evaluate these changes on stock assessments and fisheries management, resulting in major impacts for scientific research and surveys.

Search and Rescue

Presence of structures: The presence of structures could change navigational patterns and add to the navigational complexity for USCG SAR vessels and aircraft operating in the Project area during construction and operation of the Proposed Action. Construction activities associated with the Proposed Action would include the use of stationary lift vessels in the Lease Area and cranes in ports. The presence of these structures and vessels could affect the demand for resources associated with USCG SAR operations by changing vessel traffic patterns and densities. Due to WTG spacing of 1.0 nm, USCG marine assets could safely navigate and maneuver within the Lease Area. However, the presence of the WTGs would affect USCG's ability to conduct standardized/grided search patterns. Depending on weather conditions such as low visibility, sea state, strong winds, etc., some USCG vessels may choose not to enter the Lease Area because of heightened risk caused by the presence of the WTGs. USCG aviation assets conducting SAR missions over the Lease Area would need to maneuver around WTGs, OSPs, and the Met Tower. The layout and density of Proposed Action structures could complicate SAR activities during operations and lead to abandoned SAR missions and resultant increased fatalities. The NSRA estimates there would be a slight increase of 0.4 SAR mission per year in the Project area. Because the Proposed Action would adhere to a uniform 1-nm-by-1-nm grid pattern and the markings/lightings on structures would assist with position reporting for SAR responders, impacts on SAR missions would be long term and moderate.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considers the impacts of the Proposed Action in combination with the other ongoing and planned non-offshore wind activities and other ongoing and planned offshore wind activities. BOEM anticipates that the other offshore wind projects could be designed to avoid existing and proposed marine mineral extraction areas through consultation with USACE, BOEM, and relevant state and local agencies; therefore, there would be negligible impacts on future marine mineral extraction activity.

The Proposed Action would contribute to the combined impacts on military use from ongoing and planned activities, including offshore wind, through the construction and operation of offshore structures. The Proposed Action and ongoing and planned activities would contribute to localized and temporary impacts on military and national security related traffic, which are most likely to occur during the construction and decommissioning timeframes.

While open airspace around the offshore wind lease areas in the geographic analysis area would still exist after all foreseeable future offshore wind energy projects are built, the WTGs for the Proposed Action and other offshore wind projects would contribute to the increased navigational complexity for aviation and air traffic, resulting in minor cumulative impacts. 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 contribution of the Proposed Action to the impacts on cables and pipelines from ongoing and planned activities could result in some localized and long-term impacts. However, these impacts are not anticipated to appreciably contribute to cumulative impacts because they can be avoided by standard protection techniques.

The Proposed Action would contribute to the impacts on radar systems from ongoing and planned activities, primarily due to the presence of WTGs in the line of sight causing interference with radar systems. Development of offshore wind projects could incrementally decrease the effectiveness of individual radar systems if the field of WTGs expands within the radar system's coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded radar coverage that could affect multiple radars, resulting in moderate cumulative impacts.

The cumulative impacts of the Proposed Action would result in long-term and major impacts on scientific research and surveys, particularly for NOAA surveys that support commercial fisheries and protected-species research programs. The entities conducting scientific research and surveys would have to make significant investments to change methodologies to account for areas occupied by offshore energy components, such as WTGs and cable routes, that are no longer able to be sampled.

The installation of WTGs throughout the geographic analysis area would hinder USCG SAR operations across a larger area, resulting in moderate impacts and potentially leading to less-optimized search patterns.

Conclusions

Impacts of the Proposed Action: Under the Proposed Action, up to 147 WTGs with a maximum blade tip of 1,066.3 feet (325 meters) AMSL would be installed, operate, and eventually be decommissioned in the Project area. The presence of these structures would introduce navigational complexity and increased vessel traffic in the area that would continue to have temporary to long-term impacts that range from **negligible** to **major** on marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar systems, scientific research and surveys, and SAR.

- Marine mineral extraction: The Wind Farm Area and offshore export cable routes for the Proposed Action would avoid sand resource, borrow, and ocean disposal areas, resulting in **negligible** potential impacts.
- Military and national security uses: The installation of WTGs in the Project area would result in increased navigational complexity and increased allision risk, creating potential **minor** adverse impacts on military and national security uses.
- Aviation and air traffic: Potential **minor** impacts on low-level flights would occur, primarily due to the installation of WTGs in the Project area and changes in navigation patterns.
- Cables and pipelines: Potential impacts on cables and pipelines would be **negligible** due to the use of standard protection techniques to avoid impacts.
- Radar: Potential **minor** adverse impacts on radar systems would primarily be caused by the presence of WTGs in the line of sight causing interference with radar systems. Options are available to minimize or mitigate impacts and SouthCoast Wind would continue to coordinate with FAA, DoD, and NOAA on impacts.
- Scientific research and surveys: Potential impacts on scientific research and surveys would generally be **major**, particularly for NOAA surveys supporting commercial fisheries and protected-species research programs. The presence of structures would exclude certain areas occupied by Project components (e.g., WTG foundations, cable routes) from potential vessel and aerial sampling, and could affect survey gear performance, efficiency, and availability.
- SAR: The installation of WTGs in the Project area would result in increased navigational complexity, allision risk, and vessel traffic. USCG SAR activities could be hindered in the Wind Farm Area due to navigational complexity and safety concerns of operating among WTGs. Changing navigational patterns could also concentrate vessels within and around 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.

Cumulative Impacts of the Proposed Action: In context of reasonably foreseeable environmental trends, the cumulative impacts on other uses from the Proposed Action in combination with ongoing and planned activities would range from **negligible** to **major**. Considering all of the IPFs together, BOEM anticipates that the cumulative impacts associated with the Proposed Action when combined with ongoing and planned activities would be **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic and military and national security uses; **moderate** for USCG SAR operations; **moderate** for radar systems; and **major** for NOAA's 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 NOAA scientific research and surveys would qualify as major because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected species research as a whole, as well as on the commercial fisheries community. There could be impacts on other types of surveys, and increased opportunities to study impacts of offshore wind development on a variety of resources.

3.6.7.6 Impacts of Alternative C on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)

Impacts of Alternative C: Under Alternative C, a portion of the Brayton Point offshore export cables would be routed onshore to avoid placing cables in the Sakonnet River. Routing the export cables onshore would avoid the planned crossing of three existing pipelines in the Sakonnet River, which would reduce localized impacts on cables and pipelines. However, the overall impact on cables and pipelines would remain the same as described under the Proposed Action. Under Alternative C-2, the Brayton Point export cable corridor would intersect with the Fort Church formerly used defense site property. All projects at this property have been completed. The Fort Church formerly used defense site property was transferred from DoD control in 1960 (USACE 2019). Impacts on military and national security uses would remain the same as described under the Proposed Action.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative C would be the same as under the Proposed Action.

Conclusions

Impacts of Alternative C: The implementation of Alternative C would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action. The impact of the alternative alone resulting from individual IPFs would be **negligible** for marine mineral extraction and for cables and pipelines; **minor** for aviation and air traffic, radar systems, and military and national security uses; **moderate for** SAR operations; and **major** for scientific research and surveys.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative C would be the same as the Proposed Action: **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic and military and national security uses; **moderate** for SAR operations; **moderate** for radar systems; and **major** for scientific research and surveys.

3.6.7.7 Impacts of Alternative D (Preferred Alternative) on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)

Impacts of Alternative D: Impacts of Alternative D would be similar to those of the Proposed Action on marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. Alternative D could potentially decrease impacts on radar systems on Nantucket Island by removing six WTG positions closest to shore in the northeastern portion of the Lease Area. While this could reduce line-of-sight impacts for the three radar systems on

Nantucket Island, localized, long-term, minor impacts on the other radar systems in the geographic analysis area are still anticipated.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative D would be the same as under the Proposed Action.

Conclusions

Impacts of Alternative D: The implementation of Alternative D would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action. The impact of the alternative alone resulting from individual IPFs would be **negligible** for marine mineral extraction and for cables and pipelines; **minor** for aviation and air traffic, radar systems, and military and national security uses; **moderate** for SAR operations; and **major** for scientific research and surveys.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative D would be the same as the Proposed Action: **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic, military and national security uses; **moderate** for SAR operations; **moderate** for radar systems; and **major** for scientific research and surveys.

3.6.7.8 Impacts of Alternatives E and F on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research and Surveys, and Search and Rescue)

Impacts of Alternatives E and F: 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, radar systems, and scientific research and surveys. The presence of WTG and OSP foundations would preclude future submarine cables and pipelines placement within the footprint of the foundation. Due to their structure, the suction bucket and GBS foundations proposed under Alternative E-2 and Alternative E-3, respectively, would have a larger footprint on the seabed and would exclude more area from future submarine cable and pipeline placement as compared to the piled foundations proposed under Alternative E-1. Impacts on cables and pipelines would remain the same as described under the Proposed Action because no publicly noticed plans for additional submarine cables or pipelines in the geographic analysis area were identified and future submarine cables and pipelines would have the option to route around foundations.

Impacts of Alternative F would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, radar systems, and scientific research and surveys. Under Alternative F, up to three HVDC cables would be used for the Falmouth offshore export cable, as opposed to the maximum of five as proposed under the Proposed Action. Reducing the number of cables within the Falmouth offshore export cable corridor has the potential to reduce impacts on existing and planned cables in the Muskeget Channel east of Martha’s Vineyard because it would reduce the number of crossings required and associated cable protection. However, because crossings would still be required at this location, the overall impact on cables and pipelines would remain the same as described under the Proposed Action.

Cumulative Impacts of Alternatives E and F: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives E and F would be the same as under the Proposed Action.

Conclusions

Impacts of Alternatives E and F: The implementation of Alternative E and Alternative F would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action. The impact of the alternatives alone would be **negligible** for marine mineral extraction and for cables and pipelines; **minor** for aviation and air traffic, radar systems, and military and national security uses; **moderate** for USCG SAR operations; and **major** for scientific research and surveys.

Cumulative Impacts of Alternatives E and F: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative E and Alternative F would be the same as the Proposed Action: **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic and military and national security uses; **moderate** for SAR operations; **moderate** for radar systems; and **major** for scientific research and surveys.

3.6.7.9 Comparison of Alternatives

Alternatives C and F modify aspects of the offshore export cable corridor, which has the potential to reduce localized impacts on cables and pipelines. Alternative C would reroute portions of the Brayton Point offshore ECC to avoid placing cables in the Sakonnet River, which would avoid the planned crossing of three existing pipelines. Under Alternative F, up to three HVDC cables would be used for the Falmouth offshore export cable, as opposed to the maximum of five HVAC cables included as part of the Proposed Action, which has the potential to reduce impacts on existing and planned cables in the Muskeget Channel east of Martha's Vineyard. While the number of cable crossings would be reduced under Alternatives C and F, overall impacts on cables and pipelines would remain the same as described under the Proposed Action because crossings would still be required in the Muskeget Channel and along the Brayton Point offshore ECC. Alternative D would remove six WTG positions in the northeastern portion of the Lease Area closest to Nantucket Island. Alternative E would limit which foundation structure is selected and assumes the maximum use of either piled (monopile and piled jacket), suction bucket, or GBS foundation structures.

While Alternatives D and E would modify components of the PDE or restrict what aspects of the PDE are approved, the modifications would not materially change the analysis of any IPF for any resource analyzed under other uses when compared to the Proposed Action. Under Alternatives C, D, E, and F the overall impact on other uses would be the same as under the Proposed Action: **negligible** for marine mineral extraction and for cables and pipelines; **minor** for aviation and air traffic, radar systems, and military and national security uses; **moderate** for SAR operations; and **major** for scientific research and surveys.

In the context of reasonably foreseeable environmental trends, the contribution of Alternatives C, D, E, and F to cumulative impacts on other uses would be the same as described under the Proposed Action: **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic and military and national security uses, including SAR operations; **moderate** for SAR operations; **moderate** for radar systems; and **major** for scientific research and surveys.

3.6.7.10 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 3.6.7-2. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on other uses (marine minerals, military use, aviation, SAR operations, and scientific research and surveys) could be further reduced.

Table 3.6.7-2. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): other uses (marine minerals, military use, aviation, scientific research and surveys, and search and rescue)

Measure	Description	Effect
NORAD notification and Radar Adverse-impact Management	1) The Lessee will notify NORAD 30-60 days ahead of project completion and when the project is complete and operational for Radar Adverse-impact Management scheduling. 2) The Lessee will contribute funds ($80,000) toward the execution of the Radar Adverse-impact Management. 3) The Lessee will curtail when necessary for National Security or Defense Purposes as described in the agreement executed between BOEM and the Lessee for lease of the Project site.	This measure would ensure adequate coordination and development of mitigation strategies to mitigate radar impacts.
Distributed optical fiber sensing	BOEM will require that the Lessee provide information regarding deployment of distributed fiber-optic sensing technology to facilitate a Department of the Navy risk assessment and will require the Lessee to mitigate risk to national security, if identified.	The mitigation measure would ensure that DOD activities could continue within the Lease Area, as possible while avoiding structures, without the risk of distributed optical fiber sensing inadvertently capturing sensitive information from DOD activities. However, the overall Project impact on military and national security uses would remain minor, as the primary cause of the impact level is the presence of WTG structures in the Lease Area.

Table 3.6.7-3. BOEM or agency-proposed measures (also identified in Appendix G, Table G-2): other uses (marine minerals, military use, aviation, scientific research and surveys, and search and rescue)

Measure	Description	Effect
Federal survey mitigation implementation strategy for the Northeast U.S. region	BOEM is committed to working with NOAA toward a long-term regional solution to account for changes in survey methodologies because of offshore wind farms. NOAA Fisheries and BOEM published (December 2022) a Federal Survey Mitigation Strategy for the Northeast U.S. Region to address anticipated impacts of offshore wind energy development on NOAA Fisheries' scientific surveys. This strategy also defines stakeholders, partners, and other ocean users that will be engaged throughout the process and identifies potential resources for successful implementation. Activities described in the strategy are designed to mitigate the effect of offshore wind energy development on NOAA Fisheries surveys and is referred to as the Federal Survey Mitigation Program. The mitigation program will include survey-specific mitigation plans for each affected survey including both vessel and aerial surveys. The strategy is intended to guide the implementation of the mitigation program through the duration of wind energy development in the Northeast U.S. region.	The mitigation measure would reduce some of the impacts of the Project of NOAA research and survey activities and would allow NOAA to continue to meet its mission objectives. Survey-specific mitigation plans have the potential to allow survey activities to continue in some capacity; however, individual survey mitigation plans have not been developed and funding is not currently available to support survey mitigation plans to date.
High-frequency radar system mitigation	The Lessee's Project has the potential to interfere with oceanographic high-frequency (HF) radar systems in the U.S. Integrated Ocean Observing System (IOOS®), which is managed by the IOOS Office within the National Oceanic and Atmospheric Administration (NOAA) pursuant to the Integrated Coastal and Ocean Observation System Act of 2009 (Pub. L. No. 111-11), as amended by the Coordinated Ocean Observation and Research Act of 2020 (Pub. L. No. 116-271, Title I), codified at 33 U.S.C. 3601–3610 (referred to herein as "IOOS HF-radar"). IOOS HF-radar measures the sea state, including ocean surface current velocity and waves in near real time. These data have many vital uses ("mission objectives"), including tracking and predicting the movement of spills of hazardous materials or other pollutants, monitoring water quality, and predicting sea state for safe marine navigation. The U.S. Coast Guard also integrates IOOS HF-radar data into its Search and Rescue systems. The Lessee's Project is within the measurement range of one IOOS HF-radar system operated by University of Massachusetts Dartmouth in Nauset, MA (NAUS), two IOOS HF-radar system operated by Woods Hole Oceanographic Institute (WHOI) and four IOOS HF-radar systems operated by Rutgers University in Amagansett, New York (AMAG), Block Island, RI Long-range SeaSonde (BLCK), Martha's Vineyard, MA (MVCO), and Nantucket, MA SeaSonde (NANT). 1.1 Mitigation Requirement 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 Project. The Lessee must mitigate interference before	The mitigation measure would reduce some of the impacts of the Project on oceanographic high-frequency radars and would ensure that the Surface Currents Program could continue to meet its mission objectives. Some impacts would remain as the mitigation measures are not able to fully eliminate the potential line-of-sight impacts of the WTGs on radar systems.

Measure	Description	Effect
	commissioning the first WTG or before 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. 1.2 Mitigation Review The Lessee must submit to BOEM documentation demonstrating how it will mitigate unacceptable interference with IOOS HF-radar systems in accordance with Section 1.1. The Lessee must submit this documentation to BOEM at least 120 days prior to commissioning the first WTG or the start of blades 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 NOAA IOOS Office, BOEM deems the mitigation unacceptable, the Lessee must resolve all comments on the documentation to BOEM's satisfaction. 1.3 Mitigation Agreement 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. The point of contact for the development of a Mitigation Agreement with the NOAA IOOS Office is the Surface Currents Program Manager, whose contact information is available at https://ioos.noaa.gov/about/meet-the-ioos-program-office/ and upon request from BOEM. If the parties reach a mitigation agreement, the Lessee must submit the agreement to BOEM. The Lessee may satisfy its obligations under Section 1.2 by providing BOEM with an executed Mitigation Agreement between the Lessee and NOAA IOOS. If there is any discrepancy between Section 1.2 and the terms of a Mitigation Agreement, the terms of the Mitigation Agreement will prevail. 1.4 Mitigation Data Requirements Mitigation required under Section 1.2 must address the following: 1.4.1 Before commissioning the first WTG or before blades start spinning, whichever is earlier, and continuing throughout the life of the Lessee's Project until the point of decommissioning when all rotor blades are removed, the Lessee must make publicly available via NOAA IOOS near real-time, accurate numerical telemetry of surface current velocity, wave height, wave period, wave direction, and other oceanographic data measured at the Lessee's Project locations selected by the Lessee in coordination with the NOAA IOOS Office.	

Measure	Description	Effect
	1.4.2 If requested by the NOAA IOOS Office, the Lessee must share with IOOS accurate numerical time-series data of blade rotation rates, nacelle bearing angles, and other information about the operational state of each WTG in the Lease Area to aid interference mitigation. 1.5 Additional Notification and Mitigation 1.5.1 If at any time the NOAA IOOS Office or an HF-radar operator informs the Lessee that the Lessee's Project will cause unacceptable interference to an HF-radar system, the Lessee must notify BOEM of the determination and propose new or modified mitigation pursuant to Section 1.5.2 as soon as possible and no later than 30 days from the date on which the determination was communicated. 1.5.2 If a mitigation measure other than that identified in Section 1.2 is proposed, then the Lessee must submit information on the proposed mitigation measure to BOEM for its review and concurrence. If, after consultation with the NOAA IOOS Office, BOEM deems the mitigation acceptable, the Lessee must conduct activities in accordance with the proposed mitigations. The Lessee must resolve all comments on the documentation to BOEM's satisfaction, in consultation with the NOAA IOOS Office, prior to implementation of the mitigation.	

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.6.7-2 and Table 3.6.7-3 and Appendix G, Table G-2 and Table G-3 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 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.

3.6.8 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.

3.6.9 Scenic and Visual Resources

This section discusses potential impacts on seascape, open ocean, 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 Assessmen*t (3rd Edition) (Landscape Institute and Institute of Environmental Management and Assessment 2016). The geographic analysis area, as shown on Figure 3.6.9-1, includes an earth curvature-based 42.8-mile (68.9-kilometer) buffer around the Lease Area, a 3-mile (4.8-kilometer) buffer around the onshore Brayton Point converter station and Falmouth substation sites,[1] and a 0.5-mile (0.8-kilometer) buffer around the export cables. The geographic analysis area includes the full extent of the Offshore and Onshore Project areas and the coastlines from western Aquinnah, Martha's Vineyard to eastern Nantucket, the Sakonnet River to Portsmouth, Rhode Island and Somerset, Massachusetts, inland to north Falmouth, Massachusetts, including Upper Cape Cod, and associated smaller islands, including Nomans Land, Esther, Tuckernuck, and Muskeget, as well as the Elizabeth Islands off Cape Cod (COP Appendix T; SouthCoast Wind 2024). Appendix H, *Seascape, Landscape, and Visual Impact Assessment*, contains additional analysis of the seascape, open ocean, and landscape character units, and viewer experiences that would be affected by the Proposed Action and alternatives, and visual simulations of the Proposed Action alone and in combination with other planned offshore wind projects.

3.6.9.1 Description of the Affected Environment

This section summarizes the seascape, open ocean, landscape, and viewer baseline conditions as described in COP Appendix T, *Visual Impact Assessment* (VIA) (SouthCoast Wind 2024). The demarcation line between seascape and open ocean is the U.S. state jurisdictional boundary, 3 nm (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 is based on the juxtaposition of apparent seacoast and landward landscape elements, including topography, water (bays and estuaries), vegetation, and structures.

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[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

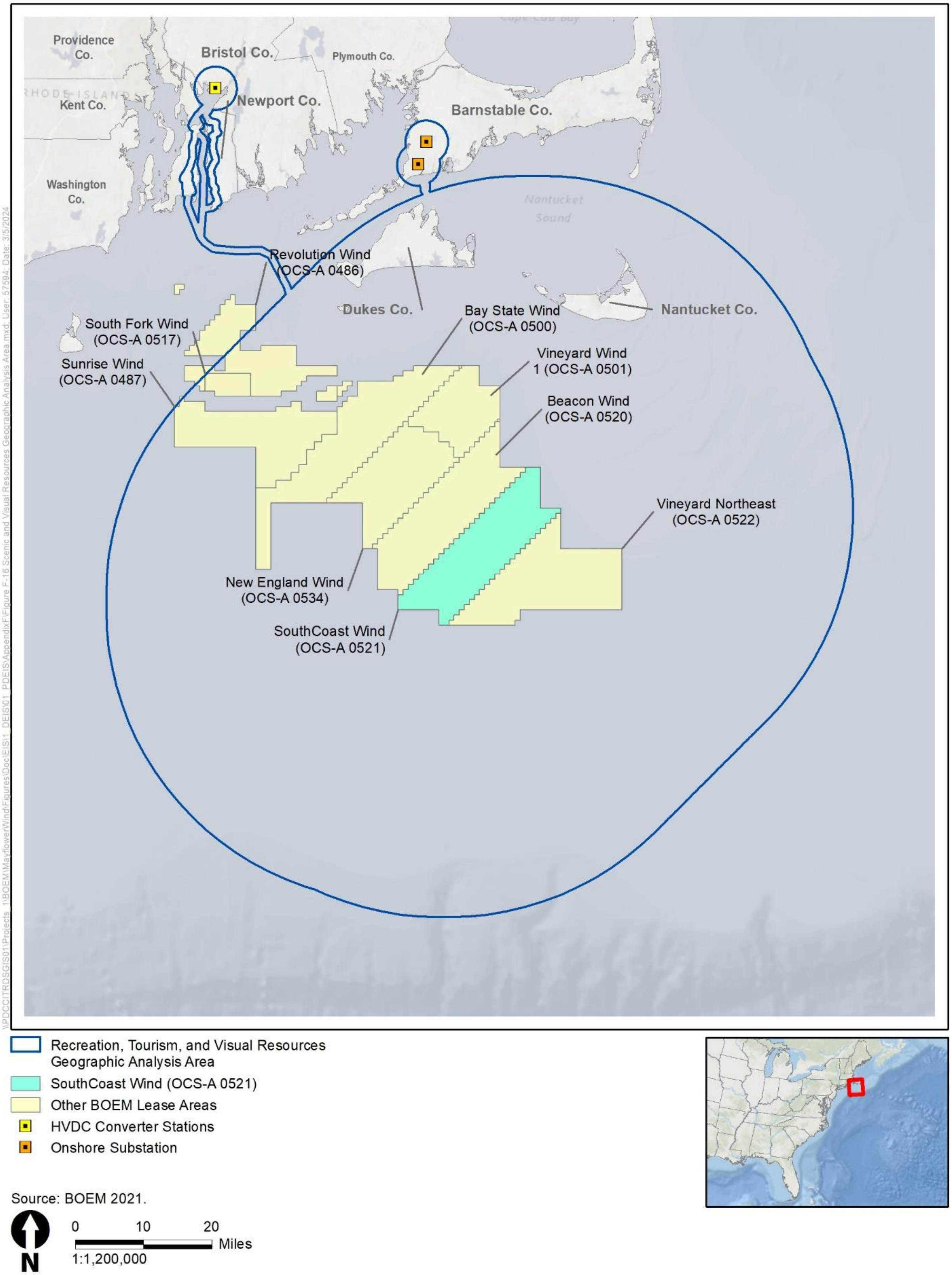


Figure 3.6.9-1. Scenic and visual resources geographic analysis area

The geographic analysis area is classified by broadly defined land and water areas and more specific seascape, open ocean, and landscape character areas. These discrete areas are based on major features and elements 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. Seascape, open ocean, and landscape character areas provide a framework to analyze potential visual effects throughout the geographic analysis area. The character areas identified in this analysis are summarized in Table 3.6.9-1.

Table 3.6.9-1. Seascape, open ocean, and landscape character areas

Areas	Character Areas [a]
Open Ocean	Ocean Character
Seascape Areas	Seascape Character Areas: • Ocean • Sound • Beachfront • Coastal Bluff • Coastal Dune • Boardwalk • Coastal Scrub • Commercial • Forests/Woodlands • Institutional • Park • Preserve • Residential • Salt Pond • Transportation • Village/Town
Landscape Areas	Landscape Character Areas: • Agriculture • Coastal Scrub • Commercial • Estuary • Forests/Woodlands • Institutional • Light Industrial • Marshland • Park • Preserve • Residential • Salt Pond • Pond Shoreline • Transportation • Village/Town

[a] Seascape, Open Ocean, and Landscape Character Areas are consistent with the seascape/landscape and visual impact assessment (SLVIA) and seascape/landscape impact assessment (SLIA) terminology and purpose (BOEM 2021).

Figure 3.6.9-2 provides an overview of seascape and landscape in the geographic analysis area, including the maximum extent of visibility of WTGs and key observation point (KOP) locations. Figure 3.6.9-3 and Figure 3.6.9-4 display existing landscape character, KOPs, and WTG viewshed on Martha's Vineyard and Nantucket. Figure 3.6.9-5 displays the areas in view of the Gay Head Lighthouse. Figure 3.6.9-6 displays the area in view of the Sankaty Head Lighthouse. Figure 3.6.9-7 and Figure 3.6.9-8 show existing landscape character and KOPs around the Brayton Point Onshore Project area and Falmouth Onshore Project area.

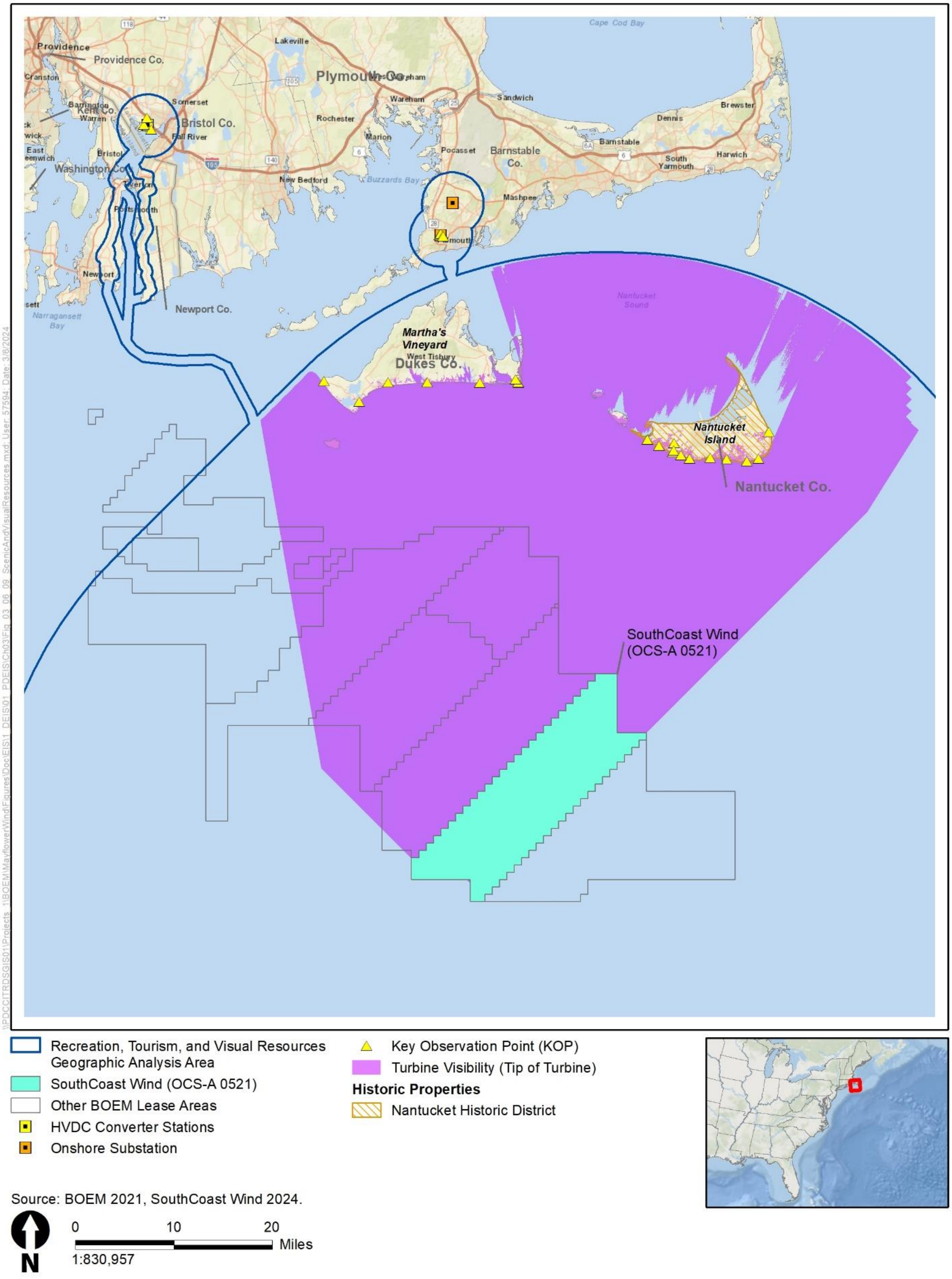


Figure 3.6.9-2. Scenic resources, offshore lease area viewshed, and KOP overview

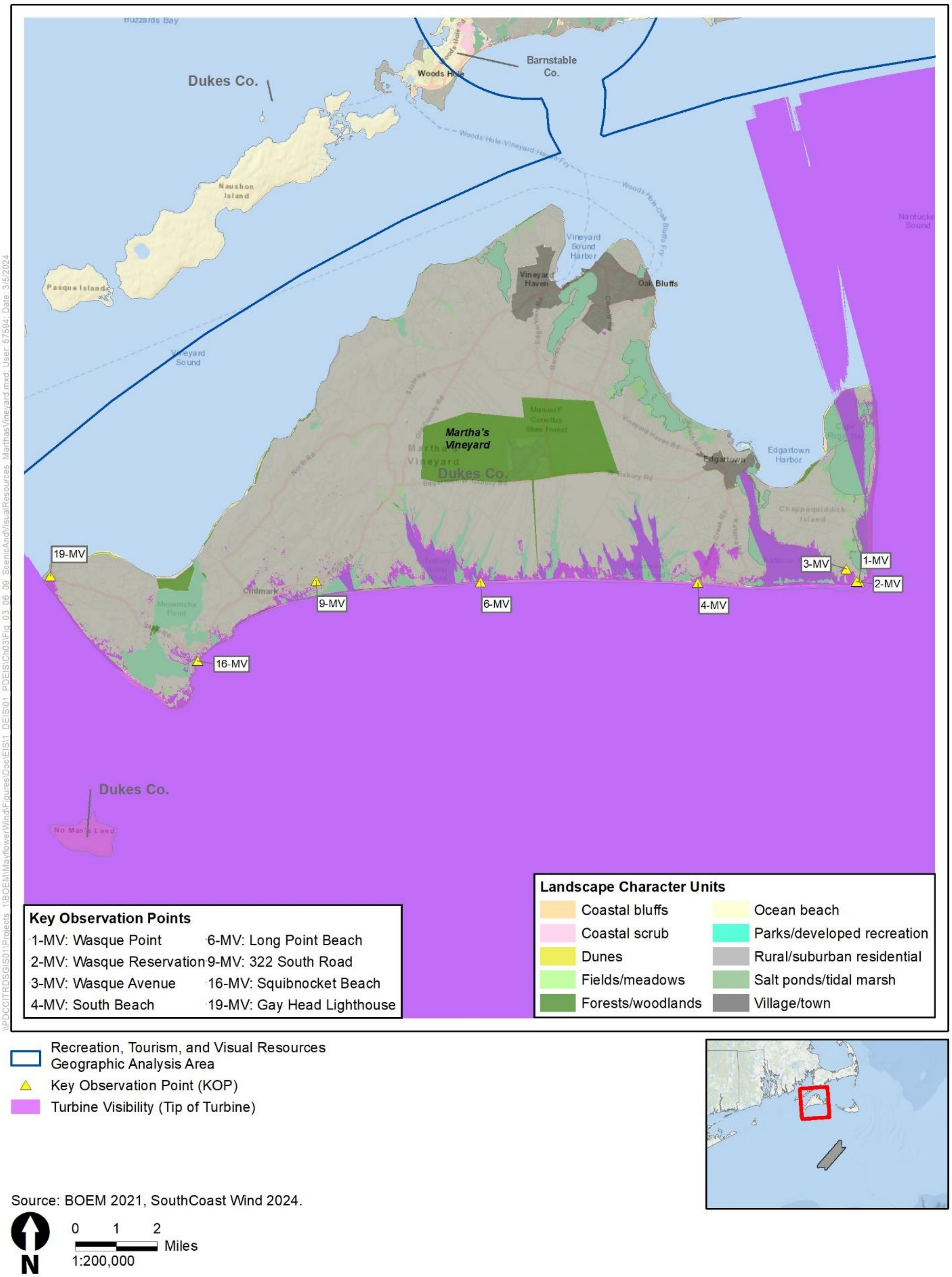


Figure 3.6.9-3. Landscape character, KOPs, and WTG viewshed – Martha's Vineyard

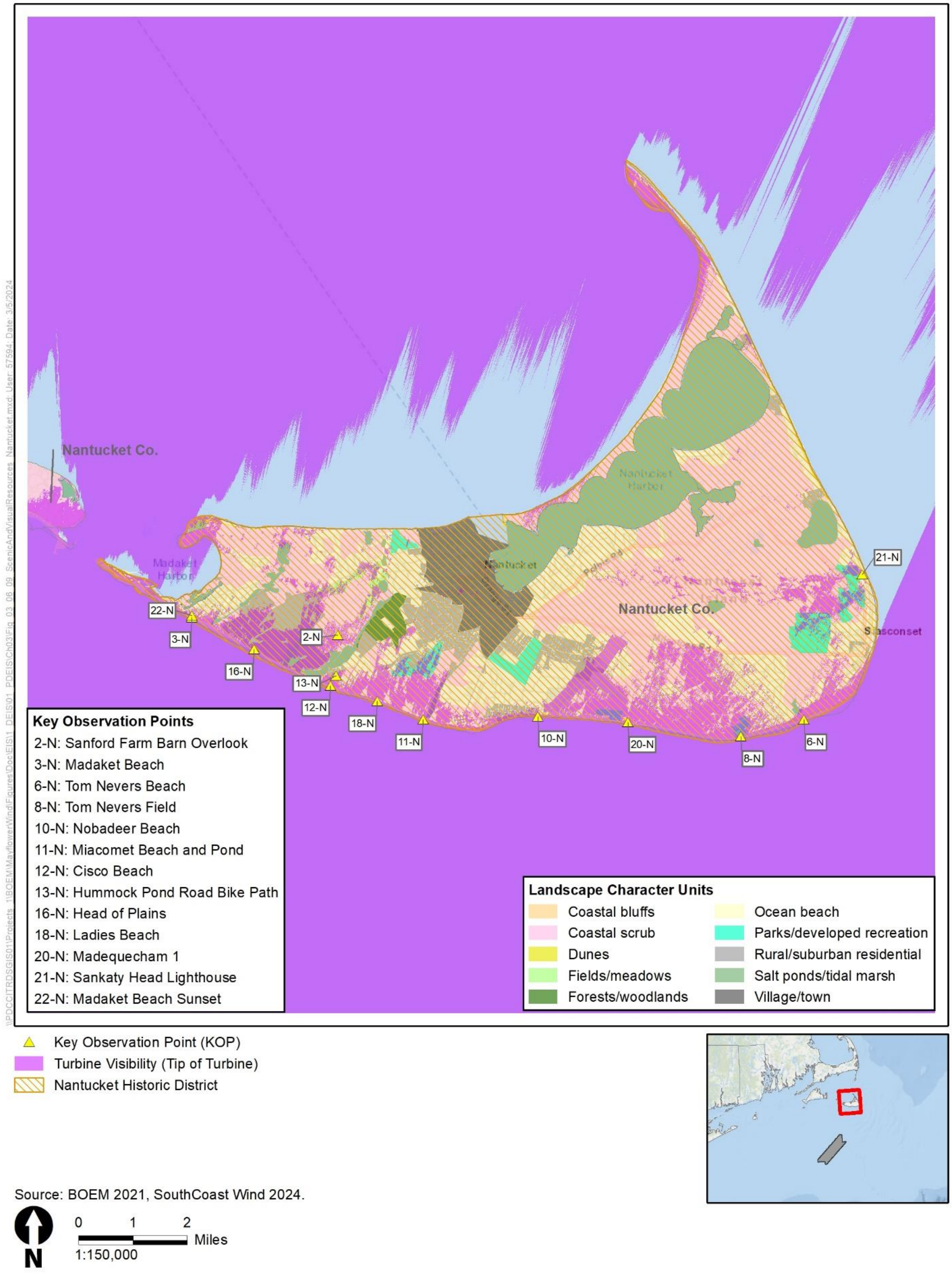


Figure 3.6.9-4. Landscape character, KOPs, and WTG viewshed – Nantucket

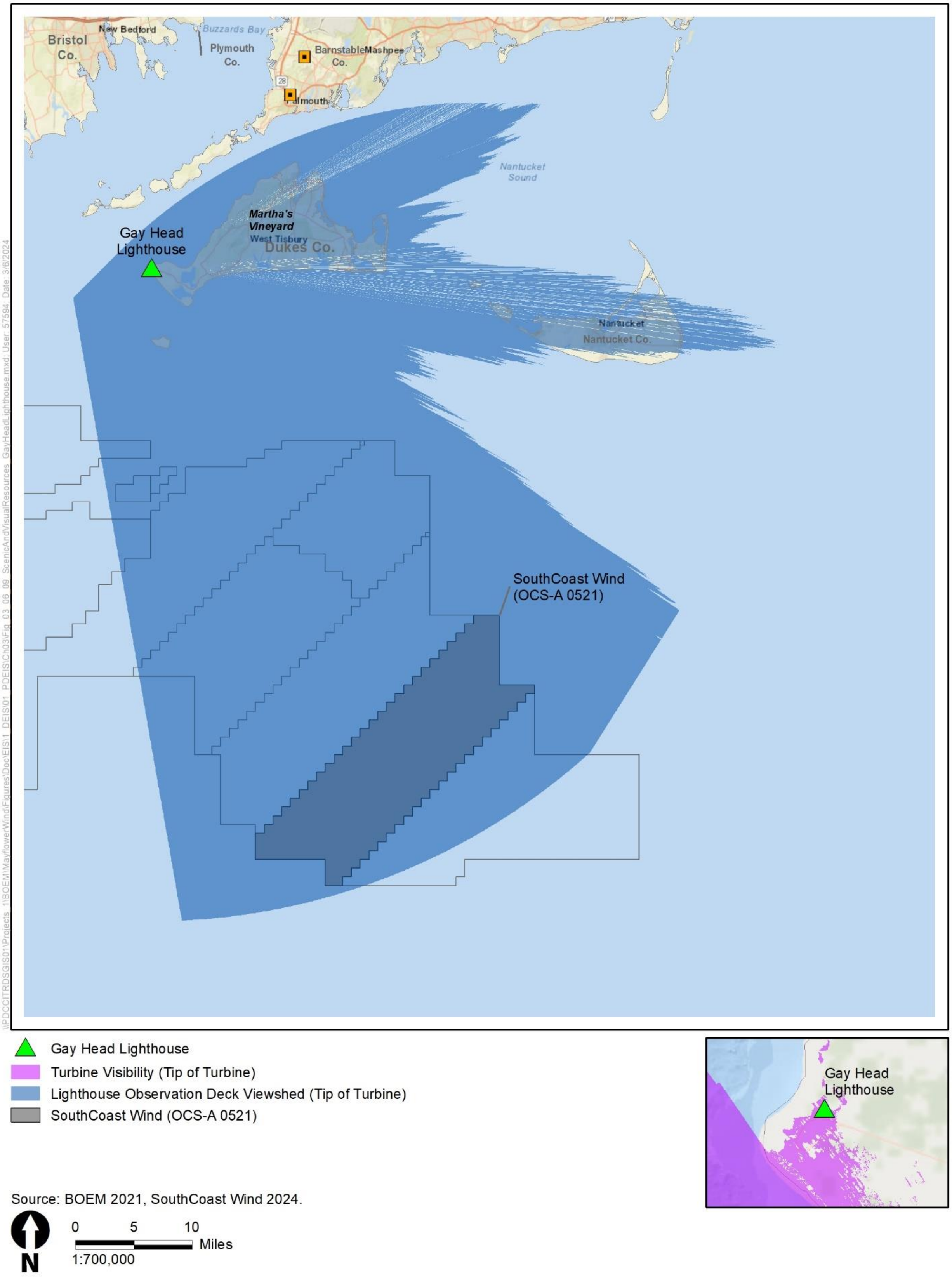


Figure 3.6.9-5. Gay Head Lighthouse viewshed

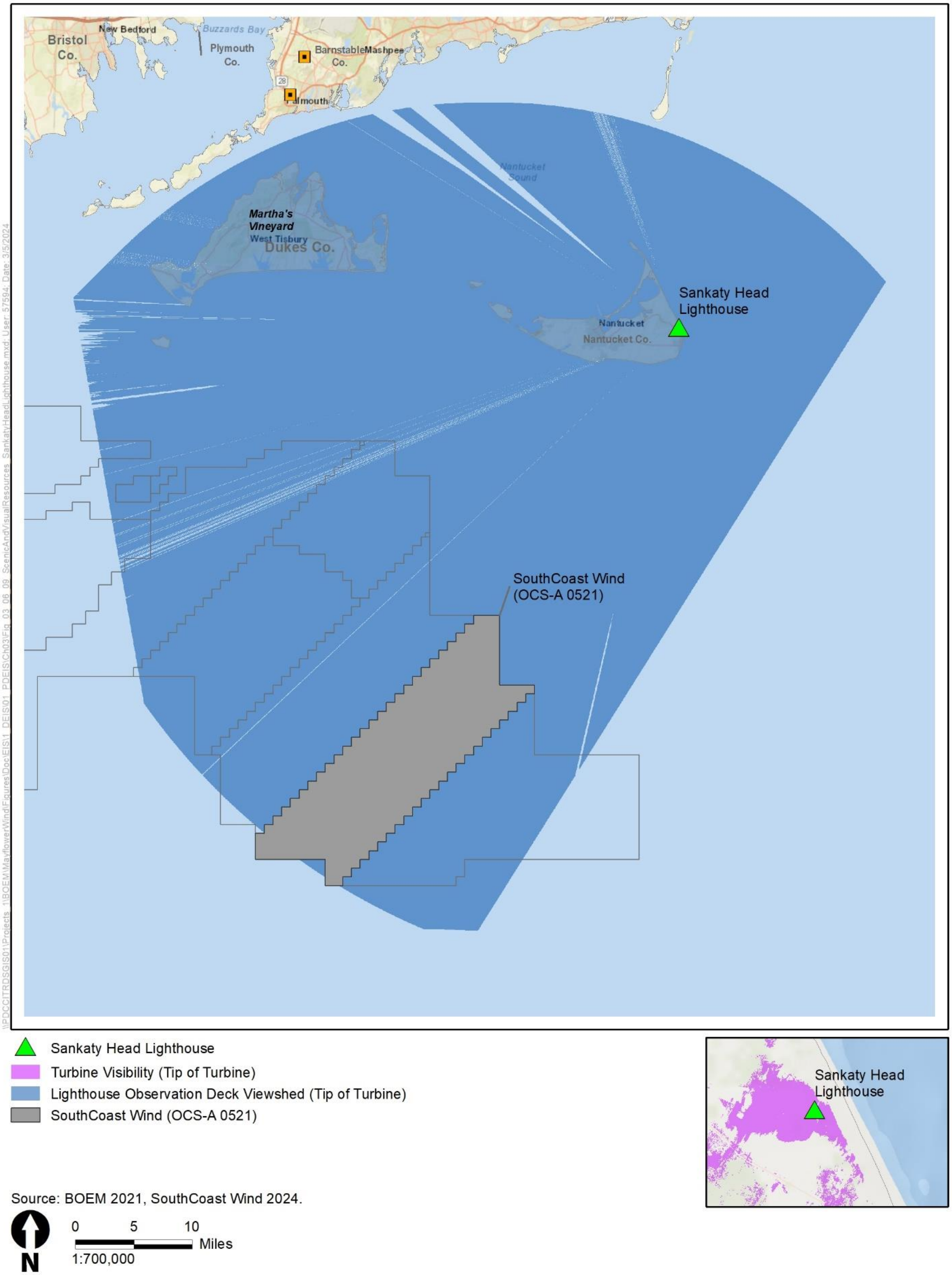
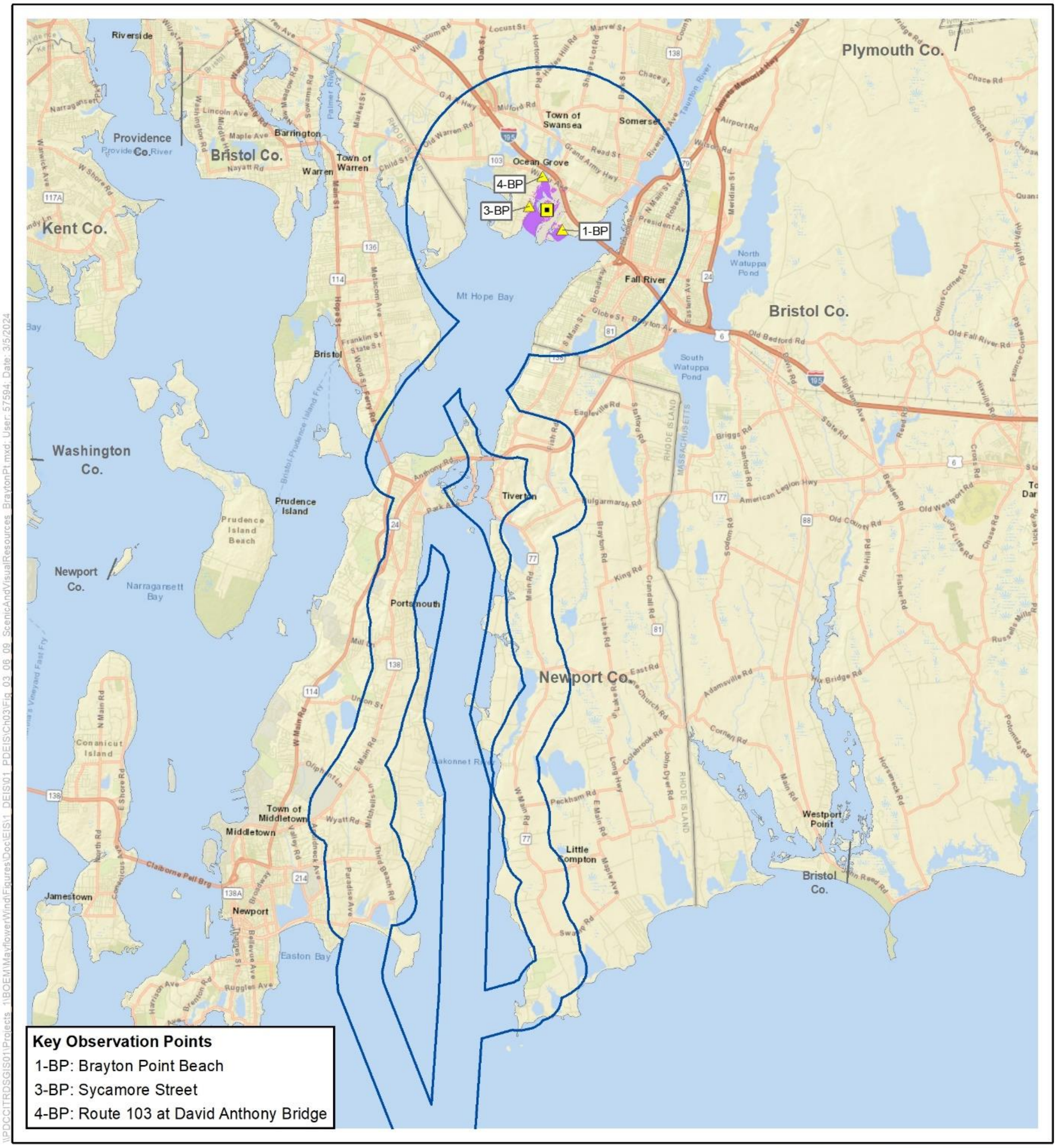


Figure 3.6.9-6. Sankaty Head Lighthouse viewshed

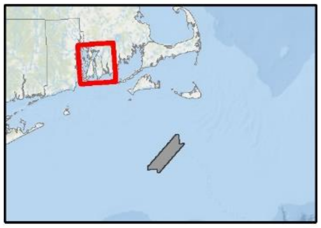


Recreation, Tourism, and Visual Resources Geographic Analysis Area

HVDC Converter Stations

Key Observation Point (KOP)

Substation Visibility



Source: BOEM 2021, SouthCoast Wind 2024.

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1:200,000

N

Figure 3.6.9-7. Scenic resources – Brayton Point

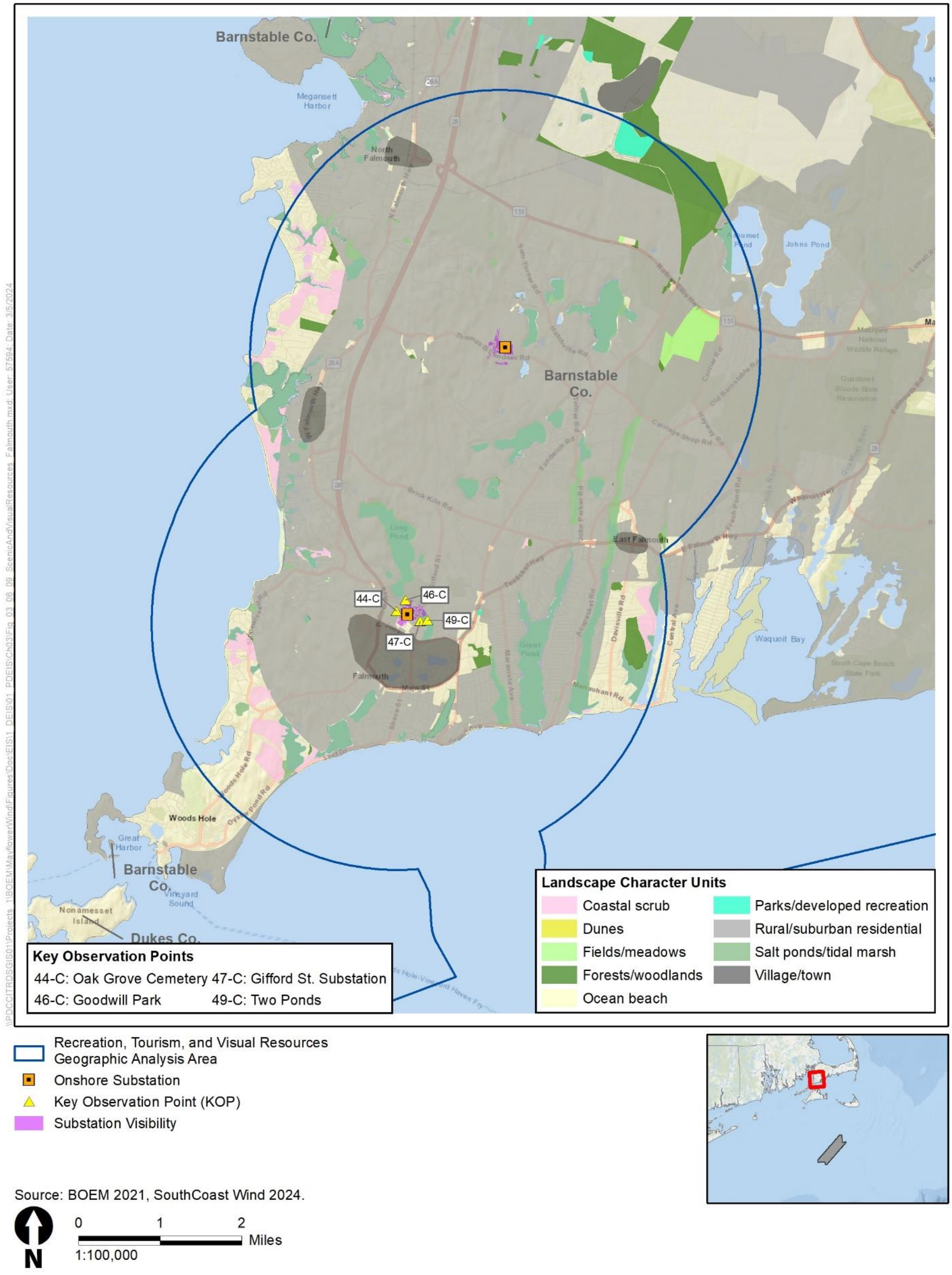

Figure 3.6.9-8. Scenic resources – Falmouth

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, cliffs, dunes, islands, and inland topography.
Water	Ocean, estuary, river and stream water patterns.
Vegetation	Tidal salt marshes and estuarine biomes, beach grass, bogs, heaths, meadows, and maritime forests. Vegetation community tree and shrub species include American beach (*Fagus grandifolia*), black oak (*Quercus velutina*), eastern red cedar (*Juniperus virginiana*), Japanese pine (*Pinus thunbergii)*, pitch pine (*Pinus rigida*), and white oak (*Quercus alba*), bayberry (*Morella caroliniensis*), beach plum (*Prunus maritime*), hazelnut (*Corylus americana*), highbush blueberry (*Viburnum trilobum*), huckleberry (*Vaccinium myrtillus*), inkberry (*Ilex glabra*), and wintergreen (*Pyrola minor*).
Structures	Buildings, plazas, signage, walks, parking, roads, trails, seawalls, and infrastructure.

The visual characteristics of the seascape, open ocean, and landscape conditions in the geographic analysis area, including surroundings of the Wind Farm Area, landfall sites, offshore and onshore export cable corridors, and onshore substation and 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. Seascape, open ocean, and landscape conditions

Category	Seascape, Open Ocean, and Landscape Conditions
Seascape	Intervisibility by pedestrians and boaters within coastal and adjacent marine areas (3.45 miles [5.5 kilometers]) in the 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, and whitecaps.
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 within the open ocean (beyond the 3.45-mile [5.5-kilometer] seascape area) in the geographic analysis area from seagoing vessels, including recreational cruising, fishing, sailing vessels, commercial "cruise ship" routes, commercial fishing activities, tankers and cargo vessels and air traffic over and near the WTG array and cable routes.
Open Ocean Features	Physical features range from flat water to ripples, waves, swells, surf, foam, chop, and whitecaps.

Category	Seascape, Open Ocean, and Landscape Conditions
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 commercial, recreational, and residential 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 islands, bays, marshlands, shorelines, vegetation, flat to moderately inclined topography, and natural areas. Built elements: boardwalks, bridges, buildings, gardens, landscapes, life-saving stations, umbrellas, lighthouses, parks, piers, roads, seawalls, skylines, trails, single-family residences, commercial corridors, village centers, mid-rise motels, and low to moderate -density residences.
Landscape Character	Tranquil and pristine natural, to vibrant and ordered, to chaotic and disordered.
Designated National, State, and Local Parks, Preserves, and Parkways	Adams Lookout Cemetery, Cape Pogue Wildlife Refuge, Chilmark Cemetery, Coatue Wildlife Refuge, Correllus State Forest, Coskata-Coatue Wildlife Refuge, Felix Neck Wildlife Sanctuary, Francis Newhall Woods Nature and Wildlife Preserve, Gay Head Lighthouse, Holdgate Trails, Lily Pond Park, Long Point Wildlife Refuge, Main Street and Fair Street Park, Miacomet Pond Trail, Mill Hill Cemetery, Mill Hill Park, Mill Square Park, Moshup Trail, Municipal Cemetery, Nantucket National Historic District, Nantucket State Forest, Nashawena Park, Naushon Park, New North Cemetery, New Westside Cemetery, Newtown Cemetery, Niantic Park, Nomans Land Island National Wildlife Refuge, Ocean Park, Old North Cemetery, Penacook Park, Plymouth Park, Prospect Hill Cemetery, Sankaty Head Lighthouse, Saratoga Park, Sea View Hill Cemetery, Sesachacha Heathlands Wildlife Sanctuary, Shawkemo Hills Trail, Siasconset Park, South Beach State Park, Saint Mary Catholic Cemetery, Summerfield Park, Tower Hill Cemetery, Trinity Park, Veira Park, Waban Park, Washing Pond, Washington Park, Wesleyan Park, Westside Cemetery, and Winter Park.

The sensitivity of the geographic analysis area's seascape character is defined by its innate features, elements, and value to residents and visitors. Seascape sensitivity ratings include the following.

- **High**: Seascape character is highly distinctive and highly valued by residents and visitors.
- **Medium**: Seascape character is moderately distinctive and moderately valued by residents and visitors.
- **Low**: Seascape character is common, and unimportant to residents and visitors.

The sensitivity of the open ocean is defined by the activities of viewers, innate character, and susceptibility to the type of change proposed by the Project. Open ocean sensitivity ratings include the following.

- **High**: Open ocean characteristics are pristine, highly distinctive, and highly valued by residents and visitors.

- **Medium**: Open ocean characteristics are moderately distinctive and moderately valued by residents and visitors.
- **Low**: Open ocean characteristics are common or with minimal scenic value.

The sensitivity of the geographic analysis area's landscape character is defined by its innate features, elements, and value to residents and visitors. Landscape sensitivity ratings include the following.

- **High**: Landscape characteristics are highly distinctive, highly valued by residents and visitors, or within a designated scenic or historic landscape.
- **Medium**: Landscape characteristics are moderately distinctive and moderately valued by residents and visitors.
- **Low**: Landscape characteristics are common or within a landscape of minimal scenic value.

Table 3.6.9-4 summarizes the conditions within seascape, open ocean, and landscape settings with high, medium, and low innate sensitivity.

Table 3.6.9-4. Seascape, open ocean, and landscape sensitivity

Settings	Conditions
High-Sensitivity Seascape	Ocean shoreline, beach, and dune areas, and ocean areas within 3.45 statute miles (5.5 kilometers) of the shoreline Seascapes with national, state, or local designations: Gay Head Lighthouse, Sankaty Head Lighthouse, and Tom Nevers Field Beaches, boardwalks, and piers
High-Sensitivity Open Ocean	Ocean areas in the geographic analysis area
High-Sensitivity Landscape	Scenic and medium to high resident and visitor use volume coastal areas and bays, islands, sounds, and adjoining estuaries. Cemeteries, churches, historic sites, lighthouses, scenic overlooks, schools, town halls, and residential areas in the geographic analysis area Landscapes with national, state, or local designations: Adams Lookout Cemetery, Cape Pogue Wildlife Refuge, Chilmark Cemetery, Coatue Wildlife Refuge, Correllus State Forest, Coskata-Coatue Wildlife Refuge, Felix Neck Wildlife Sanctuary, Francis Newhall Woods Nature and Wildlife Preserve, Gay Head Lighthouse, Holdgate Trails, Lily Pond Park, Long Point Wildlife Refuge, Main Street and Fair Street Park, Miacomet Pond Trail, Mill Hill Cemetery, Mill Hill Park, Mill Square Park, Moshup Trail, Municipal Cemetery, Nantucket National Historic District, Nantucket State Forest, Nashawena Park, Naushon Park, New North Cemetery, New Westside Cemetery, Newtown Cemetery, Niantic Park, Nomans Land Island National Wildlife Refuge, Ocean Park, Old North Cemetery, Penacook Park, Plymouth Park, Prospect Hill Cemetery, Sankaty Head Lighthouse, Saratoga Park, Sea View Hill Cemetery, Sesachacha Heathlands Wildlife Sanctuary, Shawkemo Hills Trail, Siasconset Park; South Beach State Park, Saint Mary Catholic Cemetery, Summerfield Park, Tower Hill Cemetery, Trinity Park, Veira Park, Waban Park, Washing Pond, Washington Park, Wesleyan Park, Westside Cemetery, and Winter Park (including 517 private and public reserves [Appendix H])
Medium-Sensitivity Landscape	Moderately distinctive areas of medium scenic value and/or low resident or visitor use volume beaches, coastal areas and bays, sounds, adjoining estuaries, and inland areas
Low-Sensitivity Landscape	Indistinctive areas with low scenic value and limited to absent resident or visitor use volume

The susceptibility of the geographic analysis area's seascape character is defined by both the susceptibility to impacts from the Project and its visual resources' rarity and scenic value. Seascape susceptibility rating criteria include the following.

- **High**: Seascape character is highly vulnerable to the type of change proposed, distinctive, and highly valued by residents and visitors.
- **Medium**: Seascape character is reasonably resilient to the type of change proposed, moderately distinctive, and moderately valued by residents and visitors.
- **Low**: Seascape character is unlikely to be affected by the type of change proposed, common, and unimportant to residents and visitors.

The susceptibility of the geographic analysis area's seascape, open ocean, and landscape character is defined by both the susceptibility to impacts from the Project and its visual resources' rarity and scenic value. Open ocean susceptibility rating criteria include the following.

- **High**: The character is highly vulnerable to the type of change proposed, distinctive, and highly valued by residents and visitors.
- **Medium**: The character is reasonably resilient to the type of change proposed, moderately distinctive, and moderately valued by residents and visitors.
- **Low**: The character is unlikely to be affected by the type of change proposed, common, and unimportant to residents and visitors.

Table 3.6.9-5 summarizes the conditions in seascape, open ocean, and landscape settings with high, medium, and low susceptibility.

Table 3.6.9-5. Seascape, open ocean, and landscape susceptibility

Susceptibility	Settings
High-Susceptibility Seascape	Ocean shoreline portion of the seascape and ocean within the 3.45-mile (kilometer) seascape area (The geographic analysis area is classified by broadly defined land and water areas and more specific seascape, open ocean, and landscape character areas. These discrete areas are based on major features and elements 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. Seascape, open ocean, and landscape character areas provide a framework to analyze potential visual effects throughout the geographic analysis area. The character areas identified in this analysis are summarized in Table 3.6.9-1. Table 3.6.9-1). Seascapes with national, state, or local designations: Cisco Beach, Dionis Beach, Eel Point, Jackson Point, Jetties Beach Recreation Area, Low Beach, Madaket Beach, Madaquecham Beach, Nobadeer Beach, Siasconset Beach, Surfside Beach, and Tom Nevers Beach.
High-Susceptibility Open Ocean	Ocean areas in the geographic analysis area.

Susceptibility	Settings
High-Susceptibility Landscape	Landscapes with scenic or historic designations: Adams Lookout Cemetery, Alter Rock, Brant Point CA, Capsum Pond CA, Cato Lane CA, Chilmark Cemetery, Cliff Road Nantucket Conservation Foundation, Fishers Landing, Gay Head Lighthouse, Goose Pond CA, Gosnold Road CA, Grove Lane CA, Head of Hummock Pond CA, Head of the Plains CA, Hither Creek CA, Holdgate Trails, Hummock Pond CA, Hydrangea Way CA, Indian Burial Ground, Kings Way CA, Larsen Sanford Center, Laurel Brooke Farm CA, Lily Pond CA, Little Neck, Long Pond, Madaket, Madaket CA, Maddequet CA, Maddequet Road CA, Madequecham Valley, Massasoit Bridge Road CA, Maxcy Pond, Miacomet Moors, Miacomet Park, Miacomet Pond Trail, Miacomet Road CA, Middle Moors, Mill Hill Cemetery, Mill Hill Park, Monomoy Creek CA, Moors End Farm, Nantucket Municipal Cemetery, Municipal Cemetery, Nantucket National Historic District, New North Cemetery, New Westside Cemetery, Newtown Cemetery, New South Road CA, Newtown Cemetery, No Bottom Pond CA, Nobadeer Farm, North Beach Street CA, Old North Cemetery, Pesthouse Pond, Phillips Run, Pilot Whale Drive CA, Prospect Hill Cemetery, Ram Pasture, Ruddick Commons, Sanford Farm, Sankaty Head Lighthouse, Sesachacha Headlands Wildlife Sanctuary, Shawkemo, Shawkemo Hills Trail, Shimmo CA, Smooth Hummocks Coastal Preserve, South Pasture CA, South Pasture Road CA, Saint Mary Cemetery, Station Street CA, Sturgis Pines, Surfside CA, The Creeks, The Greenbelt, The Plains CA, Tom Nevers, Tom Nevers CA, Tower Hill Cemetery, Trotts Hills CA, Vesper Lane CA, Veterans of Foreign Wars Post 8608, Warrens Landing Road CA, Washerman's Island CA, West Chester Street CA, Westside Cemetery, Wildlife Sanctuary, Willfeld, and Winter Park.
Medium-Susceptibility Landscape	Landscape of locally valued scenic quality that are reasonably resilient: Backus Lane CA, Beach Avenue CA, Cape Pogue Wildlife Refuge, Coatue Wildlife Refuge, Correllus State Forest, Coskata-Coatue Wildlife Refuge, Felix Neck Wildlife Sanctuary, Francis Newhall Woods Nature and Wildlife Preserve, Holdgate Trails, Lily Pond Park, Long Point Wildlife Refuge, Main Street and Fair Street Park, Miacomet Golf Course, Miacomet Heath Wildlife Management Area, Miacomet Pond Trail, Milestone Cranberry Bog, Mill Hill Park, Mill Square Park, Moshup Trail, Nantucket Elementary School Playground, Nantucket Golf Club, Nantucket High School Fields, Nantucket State Forest, Nantucket Girl Scout Camp, Nashawena Park, Naushon Park, Niantic Park, Nomans Land Island National Wildlife Refuge, Ocean Park, Old North Cemetery, Penacook Park, Plymouth Park, Polpis Road, Radio Monitor Site Recreational Area, Saratoga Park, Sea View Hill Cemetery, Sesachacha Heathlands Wildlife Sanctuary, Shawkemo Hills Trail, Siasconset Park, Siasconset Golf Course, South Beach State Park, Saint Mary Catholic Cemetery, Summerfield Park, Trinity Park, Veira Park, UMass Field Station, Waban Park, Washing Pond, Washington Park, Wesleyan Park, and Winter Park
Low-Susceptibility Landscape	Landscapes in the geographic analysis area that are neither high nor medium susceptibility.

CA = Conservation Area

Geographic analysis area seascape and landscape jurisdictions with ocean views are listed in Table 3.6.9-6. The nearest and most distant beaches, Nantucket shoreline and Chilmark shoreline (Squibnocket Beach), respectively, are portrayed in Figure 3.6.9-9 and Figure 3.6.9-10, respectively.

Table 3.6.9-6. Jurisdictions with ocean views

Ocean View	Jurisdiction
Ocean view from a seascape beach	Aquinnah Chilmark Edgartown Nantucket West Tisbury
Ocean view from an inland landscape	Aquinnah Chilmark Edgartown Nantucket Tisbury West Tisbury

Typical views in the geographic analysis area are represented by photographs presented in Figure 3.6.9-9, Figure 3.6.9-11, Figure 3.6.9-11, and Figure 3.6.9-12. View conditions at the Falmouth substation are represented by photographic Figure 3.6.9-13 and Figure 3.6.9-14 (COP Appendix T; SouthCoast Wind 2024). View conditions at the Brayton Point Power Station converter stations are represented by photographic Figure 3.6.9-15 (COP Appendix T.1; SouthCoast Wind 2024).

Figure 3.6.9-9. Miacomet Beach Seascape, Nantucket

Figure 3.6.9-10. Squibnocket Beach Seascape, Martha's Vineyard

Figure 3.6.9-11. Hummock Pond Road Bike Path Landscape, Nantucket

Figure 3.6.9-12. 322 South Road Landscape, Martha’s Vineyard

Figure 3.6.9-13. Falmouth Youth Baseball Fields Landscape, Trotting Park, Falmouth

Figure 3.6.9-14. Oak Grove Cemetery Landscape, Falmouth

Figure 3.6.9-15. Brayton Point Landscape, Somerset

The range of sensitivity of view receptors and people viewing the Projects is determined by their engagement and view expectations. Table 3.6.9-7 lists the sensitivity issues identified for the SLIA and VIA and the indicators and criteria used to assess impacts for the EIS.

Table 3.6.9-7. View receptor sensitivity ranking criteria

Sensitivity	Sensitivity Criteria
High	Residents with views of the proposed Projects 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 seascape, open ocean, 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; people at their places of livelihood, commerce, and personal needs (inside or outside) whose attention is generally focused on that engagement, not on scenery, and where the seascape and landscape setting is not important to the quality of their activity; and, generally, those commuters and other travelers traversing routes that are dominated by non-scenic developments.
Low	People who regard the visual environment as an unvalued asset.

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, 24 designated KOPs (Table 3.6.9-8) provide the locational bases for detailed analyses of the geographic analysis area's seascape, open ocean, landscape, and viewer experiences as shown on Figure 3.6.9-2 (COP Appendix T; SouthCoast Wind 2024).

Table 3.6.9-8. Representative offshore analysis area view receptor contexts and key observation points

Context	Key Observation Points
Vantage Point	KOP-1-MV [a] Wasque Point KOP-19-MV Gay Head Lighthouse KOP-2-N [b] Nantucket Conservation Foundation Sanford Farm Barn Overlook KOP-17-N Bartlett's Farm KOP-21-N Sankaty Head Lighthouse
Linear Receptor	KOP-3-MV Wasque Avenue KOP-4-MV South Beach KOP-6-MV Long Point Beach KOP-9-MV 322 South Road KOP-16-MV Squibnocket Beach KOP-3-N Madaket Beach KOP-6-N Tom Nevers Beach KOP-8-N Tom Nevers Field KOP-10-N Nobadeer Beach KOP-11-N Miacomet Beach and Pond KOP-12-N Cisco Beach KOP-13-N Hummock Pond Road Bike Path KOP-16-N Head of Plains

Context	Key Observation Points
	KOP-18-N Ladies Beach KOP-20-N Madequecham 1
Scenic Area	KOP-2-MV Wasque Point Reservation KOP-1-O [c] Recreational Fishing, Pleasure, and Tour Boat Area KOP-2-O Commercial and Cruise Ship Shipping Lanes

[a] MV = Martha's Vineyard
[b] N = Nantucket Island
[c] O = Ocean

KOPs selected for viewer analyses in the substation areas include seven locations with existing views of the substations (COP Appendix T, Table 6-3; and Appendix T.1, Table 3-2; SouthCoast Wind 2024). The four KOPs in the vicinity of the Falmouth onshore substation and three KOPs in the vicinity of Brayton Point onshore converter stations and their viewing contexts are shown in Table 3.6.9-9.

Table 3.6.9-9. Representative onshore analysis area view receptor contexts and key observation points

Context	Key Observation Points
Vantage Point	KOP-1-BP [a] Brayton Point Beach KOP-44-C [b] Oak Grove Cemetery KOP-46-C Goodwill Park KOP-49-C Two Ponds
Linear Receptor	KOP-3-BP Sycamore Street KOP-4-BP Route 103 at Anthony Bridge KOP-47-C Lawrence Lynch Site Road - Gifford Street Substation Road

[a] BP = Brayton Point
[b] C = Cape Cod

The sensitivity of KOP viewers is determined with reference to view location and activity: 1) review of relevant designations and the level of policy importance that they signify (such as landscapes designated at national, state, or local levels); and 2) application of criteria that indicate value (such as 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 Appendix T; SouthCoast Wind 2024). Table 3.6.9-10 lists offshore KOP viewer sensitivity ratings, and Table 3.6.9-11 lists onshore KOP viewer sensitivity ratings.

Table 3.6.9-10. Offshore Project area key observation point viewer sensitivity ratings

Context	Key Observation Points
High	KOP-1-MV [a] Wasque Point KOP-2-MV Wasque Point Reservation KOP-3-MV Wasque Avenue KOP-4-MV South Beach KOP-6-MV Long Point Beach KOP-9-MV 322 South Road KOP-16-MV Squibnocket Beach

Context	Key Observation Points
	KOP-19-MV Gay Head Lighthouse KOP-2-N [b] Nantucket Conservation Foundation Sanford Farm Barn Overlook KOP-3-N Madaket Beach KOP-6-N Tom Nevers Beach KOP-8-N Tom Nevers Field KOP-10-N Nobadeer Beach KOP-11-N Miacomet Beach and Pond KOP-12-N Cisco Beach KOP-13-N Hummock Pond Road Bike Path KOP-16-N Head of Plains KOP-17-N Bartlett's Farm (in the topo viewshed – coastal scrub vegetation) KOP-18-N Ladies Beach KOP-20-N Madequecham 1 KOP-22-N Madaket Beach at Sunset KOP-21-N Sankaty Head Lighthouse KOP-1-O [c] Recreational Fishing, Pleasure, and Tour Boat Area KOP-2-O Commercial and Cruise Ship Shipping Lanes
Medium	None
Low	None

[a] MV = Martha's Vineyard
[b] N = Nantucket Island
[c] O = Ocean

Table 3.6.9-11. Onshore Project area key observation point viewer sensitivity ratings

Context	Key Observation Points
High	KOP-1-BP [a] Brayton Point Beach KOP-3-BP Sycamore Street KOP-4-BP Route 103 at Anthony Bridge KOP-44-C [b] Oak Grove Cemetery KOP-46-C Goodwill Park KOP-49-C Two Ponds
Medium	KOP-47-C Lawrence Lynch Site Road
Low	None

[a] BP = Brayton Point
[b] C = Cape Cod

Offshore viewing receptors include the fishing boats, pleasure craft, and cruise ships that represent marine traffic in the area. Daytime and nighttime views range from immediate foreground (0-mile) (0-kilometer) to 42.8-mile (68.9-kilometer) distances.

Daytime and nighttime aircraft receptors, arriving and departing Martha's Vineyard Airport and Nantucket Memorial Airport flights, and en-route airport flights traversing the coast, range from foreground to background viewing situations. Aircraft receptors are more frequently affected by view-limiting atmospheric conditions than are land and water receptors.

Typical meteorological and atmospheric conditions limit visibility of the Wind Farm Area from the islands and their beaches on 50 percent of daylight hours on 78 percent of days and provide clear visibility on 50 percent of daylight hours on 22 percent of days (1 of every 4 to 5 days). The tables in COP Appendix T, Table 5-2, Table 5-3, and Table 5-4 (SouthCoast Wind 2024) list conditions at greater than 10 nm (11.5 statute miles) and greater than 20 nm (23.0 statute miles). The nearest Wind Farm Area WTG is offshore 20.2 nm (23.3 statute miles [37.5 kilometers]) from the Nantucket shoreline.

Views from nearer the shoreline are more limited by atmospheric conditions than views from interior island 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.

The new Falmouth onshore substation at the Lawrence Lynch Site and Brayton Point converter stations would occupy portions of previously developed industrial facilities.

3.6.9.2 Impact Level Definitions for Scenic and Visual Resources

Definitions of impact levels are provided in Table 3.6.9-12. There are no beneficial impacts on scenic and visual resources.

Table 3.6.9-12. 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 in 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 has a high level of viewer concern (combination of susceptibility/value) may justify adjusting to a moderate level of impact.

Impact Level	Impact Type	Definition
Moderate	Adverse	SLIA: The Project would introduce features that would have medium to large levels of visual prominence in 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 key 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; 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 in 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, and, 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*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for seascape, open ocean, 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 non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on seascape, open ocean, landscape, and viewers primarily involves onshore development and construction activities and offshore vessel traffic. Ongoing activities have the potential to affect seascape character, open ocean character, landscape character, and viewer experience through new structures, traffic congestion, and nighttime light impacts.

Ongoing offshore wind activities in the geographic analysis area that contribute to impacts on scenic and visual resources include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would have the same type of impacts on scenic and visual resources that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative 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 seascape, open ocean, landscape, and viewers include activities related to development of undersea transmission lines, gas pipelines, and submarine cables; dredging and port improvements; marine minerals extraction; military use; 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 seascape character, open ocean character, landscape character, and viewer experience through the introduction of structures, light, land disturbance, traffic, air emissions, and accidental releases to the landscape or seascape.

BOEM expects other offshore wind development activities to affect seascape character, open ocean character, landscape character, and viewer experience through the following primary IPFs. Appendix H Tables H-13 to H-16 consider effects on seascape, open ocean, landscape, and viewers of offshore wind development without the Proposed Action and in combination with the Proposed Action.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on scenic and visual resources during construction, O&M, and decommissioning of the projects. Offshore wind projects other than the Proposed Action that contribute to impacts on scenic and visual resources include projects within all or portions of the following lease areas: OCS-A-0486 (Revolution Wind), OCS-A-0487 (Sunrise Wind), OCS-A-0500 (Bay State Wind), OCS-A 0501 (Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A-0520 (Beacon Wind), OCS-A 0522 (Vineyard Wind Northeast), and OCS-A 0534 (New England Wind) (Table D2-1, Appendix D). These projects are estimated to collectively install 901 WTGs in the geographic analysis area between 2023 and 2030 (Appendix D, Table D2-1).

Presence of structures: The placement of 901 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 901 WTGs considered under the planned activities scenario. For example, 335 WTGs would be theoretically visible from KOP-16-MV Squibnocket Beach in Martha's Vineyard, and 577 WTGs would be theoretically visible from KOP-12-N Cisco Beach in Nantucket. The presence of structures associated with offshore wind development would affect seascape character, open ocean character, landscape character, and viewer experience, as simulated from sensitive onshore receptors (Appendix H, *Seascape, Landscape, and Visual Impact Assessment*). The seascape character and 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 would result in major impacts.

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 901 WTGs within the geographic analysis area (excluding the Proposed Action). The impact of vessel lighting on scenic and visual resources during construction would be localized and short term. Visual impacts of nighttime lighting on vessels would continue during O&M of planned offshore wind facilities and the impact on seascape character, open ocean character, nighttime viewer experience, and valued scenery from vessel lighting would be intermittent and long term.

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. FAA hazard lighting systems would be in use 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 aviation warning lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the seascape, open ocean, 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. Assuming ADLS for other offshore wind projects would be similar to the Proposed Action, ADLS would be activated for less than 5 hours per year, or 0.1 percent of nighttime hours, compared to standard continuous FAA hazard lighting (COP Appendix T, Section 5.1.3; SouthCoast Wind 2024). During the construction phase, aviation warning lights would be installed and remain on when the tower construction rises above 200 feet above sea level until the ADLS is installed, tested, and approved. It is anticipated that the FAA hazard lighting, when activated, would have major impacts on viewers.

Traffic (vessel): Other offshore wind project construction and decommissioning and, to a lesser extent, O&M would generate increased vessel traffic that could contribute to adverse moderate to major impacts on scenic and visual resources in the geographic analysis area. The impacts would occur primarily during construction along routes between ports and the offshore wind construction areas. Assuming vessel traffic of other projects is similar to that of the Proposed Action, each project would generate between 15 and 35 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time during the construction phase. 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 from visible vessel activity related to O&M of offshore wind facilities. Based on the estimates for the Proposed Action, each of the offshore wind projects in the geographic analysis area would generate an average of 1–3 vessel trips per day. 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.

Land disturbance: Other offshore wind development would require installation of onshore export cables, onshore substations, and transmission infrastructure to connect to the electric grid, which would result in localized, temporary visual impacts near construction sites due to land disturbance for vegetation clearing, site grading or trenching, and construction staging. These impacts would last through construction and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M. The exact extent of impacts would depend on the locations of project infrastructure for offshore wind energy projects; however, BOEM anticipates these projects would generally have localized, short-term negligible to minor impacts on scenic and visual resources during construction or O&M due to land disturbance.

Accidental releases: Accidental releases during construction, O&M, and decommissioning of offshore wind projects (excluding the Proposed Action) could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean area, and landscapes. The potential for accidental releases would be greatest during construction and decommissioning of offshore wind projects and would be lower but continuous during O&M. Accidental releases would cause short-term negligible to minor impacts.

Conclusions

Impacts of the No Action Alternative: Ongoing activities would have continuing short- and long-term impacts on seascape, open ocean, landscape, and viewer experience, primarily through 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 ongoing 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 offshore wind and non-offshore wind construction activities and vessel traffic, which lead to increased nighttime lighting, visible congestion, and the introduction of new structures. The primary impacts would be related to the ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects, which would add new offshore structures to the ocean where none previously existed. BOEM anticipates that the potential impacts of ongoing activities would be **major adverse**.

Cumulative Impacts of the No Action Alternative: Installation of planned offshore wind projects in combination with ongoing offshore wind projects in the geographic analysis area would change the surrounding marine environment from undeveloped ocean to wind farm character environment. Offshore wind projects other than the Proposed Action would lead to the construction of approximately 901 WTGs in areas where no offshore structures currently exist, leading to **major** impacts on seascape and landscape scenic and visual resources. The No Action Alternative (ongoing activities) combined with all other planned activities would result in **major** impacts on open ocean areas in 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 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 following sections. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of change (BOEM 2021) of the impacts on scenic and visual resources.

- The Project layout, including the number, size, and placement of the WTGs and OSPs, and the design of lighting systems for structures.
- The number and type of vessels involved in construction, O&M, and decommissioning, and time of day that construction, O&M, and decommissioning would occur.
- 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, O&M, and decommissioning activities that involve nighttime lighting would increase visibility at night.
- Location and scale of onshore Project components: Installation of larger-scale onshore Project components in closer proximity to sensitive receptors would have greater impacts.

SouthCoast Wind has committed to measures to minimize impacts on scenic and visual resources, which include, but are not limited to, proposing to design the substation and converter stations to minimize visual effects to the extent feasible, including height, location, and color; working with the Towns of Falmouth, Somerset, and Portsmouth to ensure the lighting scheme complies with town requirements; and ensuring the lighting on the onshore substation and converter stations will be kept to a minimum (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.6.9.5 Impacts of Alternative B – Proposed Action on Scenic and Visual Resources

This section addresses the impacts associated with construction, O&M, and decommissioning of the Proposed Action on seascape character, open ocean character, landscape character, and viewer experience in the geographic analysis area. The impact level is judged with reference to the sensitivity of the view receptor and the magnitude of 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 seascape, open ocean, and landscape. The degree of adverse effects is determined by 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 seascape, open ocean, 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 Wind Farm Area range from 23.3 miles (37.5 kilometers) to 42.8 miles (68.9 kilometers). At the 23.3 miles (37.5 kilometers) distance, the Project would occupy 22.8° (18 percent) of the typical human's 124° horizontal FOV and 0.4° (0.7 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 wind farm. At 42.8 miles (68.9 kilometers) distance to the southwest, the Project may appear 0.03° above the horizon and 34.4° (29.4 miles [47.3 kilometers]) along the horizon, 0.05 percent and 28 percent of the human vertical and horizontal FOV, respectively. WTG and OSP 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 and OSP would vary throughout daylight hours depending on whether the WTGs and OSPs 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 moderate visual effects, while at other times of day would have minor or negligible effects.

Atmospheric refraction of light rays causes fluctuations in the extents and appearances of offshore and onshore facilities. It results from the bending of light rays between viewers and objects due to current air temperature, water vapor, and barometric pressure (Bislins 2022). Based on the average sea level refraction calculation coefficient of 0.17 (Bislins 2022) applied to the turbine blade tip viewshed distance of 42.8 miles (68.9 kilometers), the 1,066.3-foot (325.0-meter) turbines may be projected upward to increased visibility from 0.0 feet (0.0 meters) to 192 feet (58.5 meters) above the horizon. The nearest beach viewers, located at 23.3 miles (37.5 kilometers) from the Lease Area, may see increased visibility of the 1,066.3-foot (325.0-meter) turbines from 790 feet (240.8 meters) to 844 feet (257.3 meters) above the horizon. Daytime and nighttime atmospheric refraction-based visibility varies with sea level's continuous increases and decreases in temperature, water vapor, and barometric pressure.

At distances of 12 miles or closer (boats and cruise ships), 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.

Presence of structures: The Proposed Action would install up to 147 WTGs extending up to 1,066.3 feet (325.0 meters) above MLLW and up to 5 OSPs extending up to 344.5 feet (105 meters) above MLLW in the Lease Area, for a maximum of 149 offshore structures. The WTGs would be painted white or light gray, no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey. 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 seascape character, open ocean character, landscape character, and viewer experience. The magnitude of WTG and OSP 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 Appendix T, Attachment 3, *Offshore Visual Analysis Forms and Photo Simulations for Martha's Vineyard* *and Nantucket* (SouthCoast Wind 2024) presents WTG and OSP visual simulations from onshore 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.

Appendix H provides an assessment of the Proposed Action's noticeable elements, distance effects, FOV effects, foreground elements and influence, scale effects, prominence effects, and contrast rating effects by seashore character unit, open ocean character unit, landscape character unit, and offshore and onshore KOP. 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-7), applicable distances (Appendix H, Table H-8), and FOV extents (Appendix H, Table H-9), open views versus view framing or intervening foregrounds (Appendix H, Table H-10), and form, line, color, and texture contrasts in the characteristic seascape, open ocean, and landscape (Appendix H, Table H-11). Higher impact significance stems from unique, extensive, and long-term appearance of strongly contrasting vertical structures in the otherwise horizontal open ocean environment, where structures are an unexpected element and viewer experience includes formerly open views of high-sensitivity seascape, open ocean, and landscape, and from high-sensitivity view receptors. Table 3.6.9-13 considers the totality of the Proposed Action's level of impact by seascape character unit, open ocean character unit, and landscape character unit.

Table 3.6.9-13. Proposed Action impact on seascape character, open ocean character, and landscape character

Level of Impact	Seascape Character Units, Open Ocean Character Unit, and Landscape Character Units
Major	SLIA: Open Ocean Character Unit
Moderate	SLIA: Seascape Character Units Ocean, Sound, Beachfront, Coastal Bluff, Coastal Dune, Boardwalk, Coastal Scrub, Commercial, Forests/Woodlands, Institutional, Park, Preserve, Residential, Salt Pond, Transportation, and Village/Town Landscape Character Units Agriculture, Coastal Scrub, Estuary, Forests/Woodlands, Institutional, Marshland, Park, Preserve, Residential, Salt Pond, and Shoreline
Minor	SLIA: Landscape Character Units Agriculture, Coastal Scrub, Commercial, Estuary, Forests/Woodlands, Institutional, Light Industrial, Marshland, Park, Preserve, Residential, Salt Pond, Shoreline, Transportation, and Village/Town
Negligible	SLIA: Landscape Character Units Agriculture, Commercial, Forests/Woodlands, Institutional, Light Industrial, Marshland, Park, Preserve, Residential, Salt Pond, Shoreline, Transportation, and Village/Town

Table 3.6.9-14 considers the totality of the Proposed Action's level of impact (the Sensitivity Level and Magnitude of Change, BOEM 2021) by offshore and onshore KOPs. All KOPs in the geographic analysis area are rated high sensitivity (COP Appendix T and T.1, SouthCoast Wind 2024). Appendix H, Table H-6 lists for each KOP the applicable impact level based on specific measures of distance, occupied field of view, noticeable facility elements, visual contrasts, scale of change, and prominence.

The major impact level results from:

1. Wind farm facilities located from 0.0 miles (0.0 kilometers) to 5 miles (8.0 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.
2. Extensive field of view occupied by the facilities.
3. Greater extents of noticeable facility elements in the view.
4. Strong-rated visual contrasts between facilities' forms, lines, colors, and textures and the existing viewing condition's forms, lines, colors, and textures.
5. Large-rated scale of change by facilities.
6. 5- or 6-rated prominence[2] in the view.

The moderate impact level results from:

1. Wind farm facilities located between 23.3 miles (37.5 kilometers) and 26.5 miles (42.6 kilometers) of the KOP's viewers and onshore facilities located at 0.3 mile (0.4 kilometer) of the KOP's viewers.
2. Moderate field of view occupied by the facilities.
3. Moderate extents of noticeable facility elements in the view.
4. Moderate-rated visual contrasts between facilities' forms, lines, colors, and textures and the existing viewing condition's forms, lines, colors, and textures.
5. Medium-rated scale of change by facilities.
6. 3- or 4-rated prominence in the view.

The minor impact level results from:

1. Wind farm facilities located between 29.4 miles (kilometers) and 41.2 miles (kilometers) of the KOP's viewers.
2. Minor field of view occupied by the facilities.
3. Minor extents of noticeable facility elements in the view.
4. Weak-rated visual contrasts between facilities' forms, lines, colors, and textures and the existing viewing condition's forms, lines, colors, and textures.
5. Small-rated scale of change by facilities.

[2] WTGs and OSP 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 (NAEP 2012)

6. 1- or 2-rated prominence in the view.

Table 3.6.9-14. Proposed Action impact on viewer experience

Level of Impact	Offshore and Onshore Key Observation Points
Major	KOP-1-O [a] Recreational Fishing, Pleasure, and Tour Boat Area KOP-2-O Commercial and Cruise Ship Shipping Lanes KOP-8-N [b] Tom Nevers Field-Nighttime [c] KOP-12-N Cisco Beach-Nighttime [c] KOP-44-C [d] Oak Grove Cemetery KOP-46-C Goodwill Park KOP-47-C Lawrence Lynch Site Road
Moderate	KOP-8-N Tom Nevers Field-Daytime KOP-10-N Nobadeer Beach KOP-11-N Miacomet Beach and Pond KOP-12-N Cisco Beach-Daytime KOP-13-N Hummock Pond Road Bike Path KOP-16-N Head of Plains KOP-17-N Bartlett's Farm KOP-18-N Ladies Beach KOP-20-N Madequecham 1 KOP-22-N Madaket Beach at Sunset KOP-49-C Two Ponds
Minor	KOP-1-MV [e] Wasque Point KOP-2-MV Wasque Point Reservation KOP-3-MV Wasque Avenue KOP-4-MV South Beach KOP-6-MV Long Point Beach KOP-9-MV 322 South Road KOP-16-MV Squibnocket Beach KOP-19-MV Gay Head Lighthouse KOP-2-N Nantucket Conservation Foundation Sanford Farm Barn Overlook KOP-3-N Madaket Beach KOP-6-N Tom Nevers Beach KOP-21-N Sankaty Head Lighthouse
Negligible	KOP-8-N [b] Tom Nevers Field-Nighttime [f] KOP-12-N Cisco Beach-Nighttime [f] KOP-1-BP [g] Brayton Point Beach KOP-3-BP Sycamore Street KOP-4-BP Route 103 at Anthony Bridge

[a] O = Ocean
[b] N = Nantucket Island
[c] Major impact when ADLS is activated.
[d] C = Cape Cod
[e] MV = Martha's Vineyard
[f] Negligible impact when ADLS is not activated.
[g] BP = Brayton Point

The Proposed Action would also add up to two onshore converter stations in the vicinity of Brayton Point Power Station, Somerset, Massachusetts and, if Falmouth is selected as the POI for Project 2, one substation in Falmouth, Massachusetts. COP Appendix T, Attachment 3, and Appendix T.1, *Onshore Visual Impact Assessment for Brayton Point* (SouthCoast Wind 2024) presents visual simulations of these onshore Project features. 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 and converter station sites and the surrounding landscape, and ability to screen the substation and converter station sites from public viewpoints, impacts of these Project features on scenic and visual resources would be negligible to major. 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.

Lighting: Nighttime vessel lighting could result from construction, 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 vessel lighting on scenic and visual resources during construction and decommissioning would be moderate to major, localized and short-term. 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 seascape character, open ocean character, nighttime viewer experience, and valued scenery. This impact would be localized and short-term during construction and decommissioning and intermittent and long term during O&M. In addition to vessels and associated equipment lighting (e.g., cranes), additional short-term nighttime lighting during construction and decommissioning would be present on the offshore structures themselves in conformance with applicable USCG and FAA requirements. The Proposed Action would also use aircraft to support construction, O&M, and decommissioning, which could contribute additional lighting within and near the Project area. Under normal operations, offshore flights, either with aircraft, drones, or helicopters, would be limited to daytime only. SouthCoast Wind would consider night flights only in the case of medical emergency to evacuate an injured or sick person to the nearest hospital, and any visual impacts would be negligible and of short duration.

Permanent aviation warning lighting on WTGs 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 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.

SouthCoast Wind has committed to installing ADLS on WTGs, which activates the hazard lighting system in response to detection of nearby aircraft (COP Volume 2, Table 16-1; SouthCoast Wind 2024). The synchronized flashing of the aviation warning lights occurs only when aircraft are present, resulting in shorter-duration night sky impacts on the seascape, open ocean, 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 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. During the construction phase, aviation warning lights would be installed and remain on when the tower construction rises above 200 feet above sea level until the ADLS is installed, tested, and approved.

Based on estimates from SouthCoast Wind, ADLS-controlled obstruction lights would be activated for less than 5 hours per year (COP Appendix T, Section 5.1.3; SouthCoast Wind 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 OSPs 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 OSPs would have nighttime lighting up to 344.5 feet (105 meters) above sea level. Due to EC, from eye levels of 5 feet (1.5 meters), these lights would become invisible above the ocean surface beyond approximately 25.5 miles (41.0 kilometers). Lights of the OSP, 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 42.8-mile (68.9-kilometer) geographic analysis area, depending on variable ocean surface, cloud, and atmospheric reflectivity.

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 along routes between ports and the offshore wind construction areas. Construction and installation of the Proposed Action is projected to generate on average 15 to 35 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time. O&M activities for the Proposed Action are anticipated to generate between 1 and 3 vessel trips per day between a port and the Wind Farm Area. Vessel traffic during O&M would result in long-term, intermittent contrasts to open ocean character and in the viewer experience of valued scenery. Vessel activity would increase again during decommissioning at the end of the operating period, with impacts similar to those described for construction. 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.

Land disturbance: The Proposed Action would require installation of onshore export cables, an onshore substation, 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 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.

Accidental releases: Accidental during construction, O&M, and decommissioning of the Proposed Action could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean, and landscapes. The potential for accidental releases would be greatest during construction and decommissioning and would be lower but continuous during O&M, resulting in overall negligible to minor impacts.

Cumulative Impacts of the 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-1).

The Proposed Action would contribute up to 147 of a combined total of 1,048 WTGs that would be installed in the geographic analysis area between 2023 and 2030, which accounts for approximately 14 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 1,048 WTGs considered under the planned activities scenario in combination with the Proposed Action. For example, 425 WTGs would be theoretically visible from KOP-16-MV Squibnocket Beach in Martha's Vineyard and 707 WTGs would be theoretically visible from KOP-12-N Cisco Beach in Nantucket (Appendix H, Attachment H-1). The presence of structures associated with offshore wind development in combination with the Proposed Action would have major seascape character, open ocean character, landscape character, and viewer experience impacts, as simulated from sensitive onshore receptors (Appendix H).

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. SouthCoast Wind's contribution to cumulative seascape character and landscape character impacts would range from 86 of 679 total WTGs visible on Martha's Vineyard, 13 percent of the total, to 142 of 771 total WTGs visible on Nantucket, 18 percent of the total (SouthCoast Wind 2024). The seascape, open ocean, and landscape are highly valued scenery and rated high susceptibility.

SouthCoast Wind's WTG contribution to cumulative impacts from KOPs are as follows (SouthCoast Wind 2024).

- KOP-1-MV Wasque Point – 86 of 679 total WTGs visible, 13 percent of the total.
- KOP-2-N Sanford Barn Overlook – 142 of 771 total WTGs visible, 18 percent of the total.
- KOP-22-N Madaket Beach at Sunset – 129 of 743 total WTGs visible, 17 percent of the total.

- KOP-6-N Tom Nevers Beach – 92 of 457 total WTGs visible, 20 percent of the total.
- KOP-12-N Cisco Beach – 130 of 707 total WTGs visible, 18 percent of the total.
- KOP-16-MV Squibnocket Beach – 90 of 425 total WTGs visible, 21 percent of the total.
- KOP-16-N Head of Plains – 132 of 746 total WTGs visible, 18 percent of the total.

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. Impacts from lighting would be reduced if ADLS is implemented across all offshore wind projects in the geographic analysis area and would be more adverse if other projects do not commit to using ADLS. During construction, nighttime lighting from vessels and offshore structures would increase when multiple projects are under construction at the same time between 2023 and 2030, resulting in moderate to major short-term impacts. Similar impacts would result during decommissioning. During O&M, visual impacts of nighttime lighting on vessels from offshore wind projects in the geographic analysis area would continue, but long-term impacts would be less due to the lower number of anticipated vessel trips.

Planned offshore wind project construction, 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, *Navigation and Vessel Traffic*, 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.

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 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 or O&M due to land disturbance.

Accidental releases during construction, O&M, and decommissioning of planned offshore wind projects including the Proposed Action could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments.

Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean, and landscapes. The potential for accidental releases would be greatest during construction and decommissioning of offshore wind projects, and would be lower but continuous during O&M. The combined accidental release impacts from the Proposed Action and other ongoing and planned activities would be negligible to minor.

Conclusions

Impacts of the Proposed Action: Proposed Action effects on high- and moderate-sensitivity seascape character units, open ocean character units, and landscape character units would be minor 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, 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 effects. Due to distance, extensive FOVs, strong contrasts, large scale of change, and level of prominence, and 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 OSPs, 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 OSPs. In clear weather, the WTGs and OSPs 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 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/converter station sites surrounding industrial elements, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be insubstantial as viewed from the KOPs. While the Project's visibility would be moderately prominent from the KOPs, the value of the view is low, having little or no effect on viewers' quality of visual experience. Impacts of the onshore facilities on scenic and visual resources would be **negligible** to **minor**.

Cumulative Impacts of the Proposed Action: In context of other reasonably foreseeable environmental trends, the cumulative impacts of the Proposed Action in combination with ongoing and planned activities would range from **negligible** to **major**. Cumulative impacts would be **major** for the open ocean character unit and offshore viewer experience and **moderate** for seascape and landscape character units and onshore viewer 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 Alternative C on Scenic and Visual Resources

Impacts of Alternative C: Installation of longer onshore export cables and infrastructure would result in localized, temporary visual impacts near construction sites due to land disturbance for vegetation clearing, site grading or trenching, and construction staging. These impacts would last through construction and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M. Landfall export cable infrastructure would be underground and would not contribute to impacts on scenic and visual resources through the presence of structures. The export cable routes would have localized, short-term negligible to minor impacts on scenic and visual resources during construction or O&M due to land disturbance.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative C: The **minor** to **major** impacts of Alternative C on seascape character, open ocean character, landscape character, and viewer experience would be approximately the same as those of the Proposed Action. Temporary **minor** effects would occur during construction and decommissioning of the landfalls and onshore export cables. Effects during O&M would involve temporary vehicular and personnel presence and would be **negligible**.

Cumulative Impacts of Alternative C: In context of other reasonably foreseeable environmental trends in the area, BOEM anticipates the cumulative impacts of Alternative C would be **major**.

3.6.9.7 Impacts of Alternative D (Preferred Alternative) on Scenic and Visual Resources

Impacts of Alternative D: Eliminating six WTGs in the northeastern portion of the Lease Area would not result in a meaningful difference in impacts on seascape character, open ocean character, and landscape character from the Proposed Action. There is the potential for a slight reduction in impacts, but the number of structures that could be removed would be small and it is unlikely these changes would be noticeable to the casual viewer. Therefore, impacts from Alternative D are anticipated to be approximately the same as the Proposed Action.

Differences between the horizontal and vertical FOV extents for Alternative D (Table 3.6.9-15 and Table 3.6.9-16) and the Proposed Action (Appendix H, Table H-4 and Table H-5) would not be noticeable to the casual viewer at applicable distances to the WTG array.

Table 3.6.9-15. Horizontal FOV occupied by Alternative D

Noticeable Element	Width miles (km)	Distance miles (km)	Horizontal FOV	Human FOV	Percent of FOV
D WTGs	12.3 (19.8)	23.6 (37.9)	26.2°	124°	21%

km = kilometers; FOV = field of view.

Table 3.6.9-16. Vertical FOV occupied by Alternative D

Noticeable Element	Height feet (m) MLLW	Distance miles (km)	Visible Height [a] feet (m)	Vertical FOV	Human FOV
D Rotor Blade Tip	1,066.3 (325.0)	23.6 (37.9)	779 (237)	0.3°	55°

[a] Based on intervening EC and clear-day conditions.
km = kilometers; m = meters; FOV = field of view.

For those shoreline viewers directly north of the wind farm, the distance to the nearest WTG under Alternative D would be 0.3 mile (0.5 kilometer) further than the distance to the Proposed Action, (23.6 miles [37.9 kilometers] compared with 23.3 miles [37.5 kilometers]). The change in character, prominence, and contrasts would be unnoticeable to viewers, particularly because the Proposed Action view would not be built (seen) for comparison.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative D: The **minor** to **major** impacts of Alternative D on seascape character, open ocean character, landscape character, and viewer experience would be approximately the same as those of the Proposed Action. The impacts from removal of six WTGs under Alternative D would be unnoticeable to the casual viewer and would not change the impact ratings.

Cumulative Impacts of Alternative D: In context of other reasonably foreseeable environmental trends in the area, BOEM anticipates the cumulative impacts of Alternative D would be **major**.

3.6.9.8 Impacts of Alternatives E and F on Scenic and Visual Resources

Impacts of Alternatives E and F: Installation of different foundation types under Alternatives E-1, E-2, and E-3 would not change the most prominent visible aspects of WTGs and OSPs (e.g., blade height, hub height) and, therefore, would have no meaningful difference in impacts on seascape, open ocean, and landscape character units and viewer experience compared to the Proposed Action. The reduction in the number of cables installed along the Falmouth offshore export cable route under Alternative F may reduce the number vessel trips required to install the cables, but this slight reduction in vessel activity would have no meaningful difference in impacts compared to the Proposed Action.

Cumulative Impacts of Alternatives E and F: In context of reasonably foreseeable environmental trends, the cumulative impact of Alternatives E and F would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternatives E and F: The **minor** to **major** impacts of Alternatives E and F on seascape character, open ocean character, landscape character, and viewer experience would be approximately the same as those of the Proposed Action.

Cumulative Impacts of Alternatives E and F: In context of other reasonably foreseeable environmental trends in the area, BOEM anticipates the cumulative impacts of Alternatives E and F would be **major**.

3.6.9.9 Comparison of Alternatives

Alternatives C, D, E, and F would have similar effects on seascape character, open ocean character, landscape character, and viewer experience, which would be similar to the impacts of the Proposed Action and would range from minor to major. Alternative C would have slightly greater temporary minor effects during construction and decommissioning of the onshore export cables associated with onshore construction/decommissioning activity due to the longer onshore cable length. The removal of six WTGs under Alternative D would not be noticeably different than the Proposed Action. Alternatives E and F would not result in meaningfully different impacts than the Proposed Action.

3.6.9.10 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 3.6.9-17. 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 3.6.9-17. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): scenic and visual resources

Measure	Description	Effect
Scenic and Visual Impact Monitoring Plan	In coordination with BOEM, SouthCoast Wind will prepare and implement a Scenic and Visual Resource Monitoring Plan that monitors and compares the visual effects of the wind farm during construction and O&M (daytime and nighttime) to the findings in the COP Visual Impact Assessment and verifies the accuracy of the visual simulations (photo and video). The monitoring plan should include monitoring and documenting the meteorological influences on actual wind turbine visibility over a duration of time from selected onshore key observation points, as determined by BOEM and the developer. In addition, SouthCoast Wind will include monitoring the operation of ADLS in the monitoring plan. SouthCoast Wind will monitor the frequency that the ADLS is operative documenting when (dates and time) the aviation warning lights are in the on position and the duration of each event. Details for monitoring and reporting procedures are to be included in the plan.	Implementation of this measure will improve accountability and provide a means to verify that impacts on scenic and visual resources during construction and O&M are consistent with the impacts disclosed in the COP Visual Impact Assessment and this EIS. While adoption of this measure would improve accountability, it would not alter the impact determination for scenic and visual resources.

Measures Incorporated in the Preferred Alternative

BOEM has identified the following additional measure in Table 3.6.9-17 as incorporated in the Preferred Alternative: scenic and visual resource monitoring plan. The effect of this measure, if adopted, is described in Table 3.6.9-17.

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 phase and would be temporary. Chapter 3, *Affected Environment and Environmental Consequences*, provides additional information on the potential impacts listed below.

All impacts from planned activities are still expected to occur as described in the No Action Alternative analysis in this 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 Impact of the Proposed Action
Air Quality	• Air quality impacts from emissions from engines associated with vessel traffic, construction activities, and equipment operation
Water Quality	• Increase in suspended sediments due to seafloor disturbance during construction, O&M, and decommissioning
Bats	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic
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/alteration, equipment activity and noise, and vessel traffic • Individual mortality due to construction activities
Birds	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic
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 collision with vehicles or equipment during clearing and grading activities, particularly species with limited mobility
Finfish, Invertebrates, and Essential Fish Habitat	• Suspension and re-settling of sediments due to seafloor disturbance • Displacement, disturbance, and avoidance behavior due to construction-related impacts, including noise, vessel traffic, increased turbidity, sediment deposition, and EMF • Individual mortality due to construction activities • Habitat quality impacts, including reduction in certain habitat types as a result of seafloor surface alterations • Conversion of soft-bottom habitat to new hard-bottom habitat

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
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, shipping and other vessel traffic, aircraft, geophysical surveys (HRG surveys and geotechnical drilling surveys), WTG operation, cable laying, and dredging during construction and operations • Increased risk of individual injury and mortality due to vessel strikes • Increased risk of individual injury and mortality associated with fisheries gear
Sea Turtles	• Increased risk of individual injury and mortality due to vessel strikes during construction, O&M, and decommissioning • Increased risk of individual injury and mortality associated with fisheries gear • Disturbance, displacement, and avoidance behavior due to habitat disturbance and underwater noise during construction
Wetlands	• Wetland and surface water alterations, including increased sediment deposition and removal of vegetation
Commercial Fisheries and For-Hire Recreational Fishing	• Disruption of access or temporary restriction in harvesting activities due to construction of offshore Project elements • Disruption of harvesting activities during operations of offshore wind facility • Changes in vessel transit and fishing operation patterns • Changes in risk of gear entanglement or availability of target species
Cultural Resources	• Visual impacts on viewsheds of historic properties • Physical impacts on known submerged archaeological resources • Physical impacts on known ancient submerged landforms
Demographics, Employment, and Economics	• Disruption of commercial fishing, for-hire recreational fishing, and marine recreational businesses during offshore construction and cable installation • Hindrances to ocean economy sectors due to the presence of the offshore wind facility, including commercial fishing, recreational fishing, sailing, sightseeing, and supporting businesses
Environmental Justice	• Compounded health issues of local environmental justice communities near ports as a result of air quality impacts from emissions from engines 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	• Land use disturbance due to construction as well as effects due to noise, vibration, and travel delays • Potential for accidental releases during construction

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Navigation and Vessel Traffic	• Congestion in port channels • Increased navigational complexity, vessel congestion, and allision risk within the offshore Wind Farm Area • 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 offshore Wind Farm Area
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 Wind Farm Area • Changes to aviation and air traffic navigational patterns
Recreation and Tourism	• Disruption of coastal recreation activities during onshore construction, such as beach access or traffic delays • 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 Area, vessel traffic, onshore landing sites, onshore export cable routes, onshore substation and converter station, and electrical connections with the power grid

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 here.

Table 4.2-1. Irreversible and irretrievable commitment of resources by resource area for the Proposed Action

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Air Quality	No	No	BOEM expects air pollutant emissions to comply with permits regulating compliance with air quality standards. Emissions would be temporary during construction activities and would be limited to the Project lifetime for O&M 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 temporary.
Bats	Yes	No	Irreversible impacts on bats could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bat displacement from foraging habitat.
Benthic Resources	No	No	Although local mortality of benthic fauna and habitat alteration is likely to 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 of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bird displacement from foraging habitat.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Coastal Habitat and Fauna	No	No	Although limited removal of habitat associated with clearing and grading for construction of the onshore landfalls, export cables, substation, and converter station 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 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 of high severity. With implementation of mitigation measures, developed in consultation with NMFS (e.g., timing windows, vessel speed restrictions, safety zones), the potential for an ESA-listed species to experience high-severity behavioral effects or be injured or killed would be reduced or eliminated. No irreversible high-severity behavioral effects from Project activities are anticipated; however, due to the uncertainties from lack of information, these effects are still possible. Irretrievable impacts could occur if individuals or populations grow more slowly 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 or eliminate the potential for impacts on listed species. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of injury or mortality due to vessel strikes or entanglement with fisheries gear 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.
Commercial Fisheries and For-Hire Recreational Fishing	No	Yes	Based on the anticipated duration of construction and O&M activities, BOEM does not anticipate irreversible impacts on commercial fisheries. The Project could alter habitat during construction and operations, limit access to fishing areas during construction, or reduce vessel maneuverability during operations. 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.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Cultural Resources	Yes	Yes	Although unlikely, unanticipated removal or disturbance of previously unidentified cultural resources onshore and offshore 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 operations would be irretrievable.
Land Use and Coastal Infrastructure	No	Yes	Land use required for construction and operational activities could result in a temporary impact on use of the land. Construction activities could result in a minor irretrievable impact due to the temporary loss of use of the land for otherwise typical activities. Other land uses could be restored upon Project decommissioning.
Navigation and Vessel Traffic	No	Yes	Based on the anticipated duration of construction and operations, 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, operations, and decommissioning activities.
Recreation and Tourism	No	Yes	Construction activities could result in a minor, temporary loss of use of land for recreation and tourism purposes, and temporary disruptions to fishing.
Scenic and Visual Resources	No	Yes	Long-term (until post-decommissioning) alterations to the seascape, open ocean, and landscape character units' character and effects on viewer experience due to construction, O&M, and decommissioning of the wind farm, onshore landing sites, onshore export cable routes, onshore substations, and electrical connections with the power grid would occur.

4.3 Relationship Between the Short-term Use of Man’s Environment and the Maintenance and Enhancement of Long-term Productivity

CEQ’s NEPA-implementing regulations (40 CFR 1502.16(a)(2)) 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 the following.

- 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 power to the Massachusetts (and broader northeastern United States) energy grid to contribute to the state’s renewable energy requirements.
- Increased habitat for certain fish species.

Based on the anticipated potential impacts evaluated in this 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.