US Wind

Fueling our future, naturally.

Construction and Operations Plan:
Maryland Offshore Wind Project

VOLUME II: Site Characterization & Impact Assessment

uswindinc.com

Construction and Operations Plan

Volume II. Site Characterization and Impact Assessment

Revised July 2024

Maryland Offshore Wind Project

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Glossary of Terms

Term	Definition
Barrier Beach Landfalls	Locations on land where the Offshore Export Cables may come ashore, specifically 3 R's Beach Parking Lot and Tower Road Parking Lot
Indian River Substation	Delmarva Power and Light (DPL) Substation adjacent to the NRG Indian River Power Plant
Inland Bays	Collection of inland bays in Delaware: Indian River Bay, Rehoboth Bay, Little Assawoman Bay
Inter-array Cables	Cables in the Lease area connecting WTGs in strings to OSSs
Interconnection Facilities	US Wind substations at Point of Interconnection
Lease	OCS-A 0490
Lease area	Area described in the Lease
Maryland WEA	The Wind Energy Area off Maryland that became US Wind's Lease area
Met Tower	Designed and fabricated structure proposed to be deployed in the Lease area, previously covered under an approved SAP
Metocean Buoy	Floating LiDAR buoy, including trawl-resistant bottom mount, deployed in Lease area under approved SAP
O&M Facility	Operations and maintenance facility (admin building and quayside) in the Ocean City, Maryland, region
Offshore Export Cable Corridors	Offshore export cable routes labelled 1 and 2
Offshore Export Cables	Up to 4 cables to be located in the selected Offshore Export Cable Corridor(s)
Onshore Export Cable Corridor 1	Area assessed as part of the routing within Indian River Bay, part of the Project Design Envelope
Onshore Export Cable Corridors	Potential onshore cable routes labelled 1, 1a, 1b, 1c, and 2
Onshore Export Cable South Corridor	"Onshore" cable corridor through Indian River Bay, proposed route from proposed landfall at 3R's Beach to proposed US Wind substations adjacent to Indian River Substation
Onshore Export Cables	Up to 4 cables to be located in the selected Onshore Export Cable Corridor(s)
Point of Interconnection	Where the Project interconnects to the regional electric grid (PJM)
The Project	Maryland Offshore Wind Project; encompasses all project facilities onshore and offshore

Term	Definition
Submarine Cables	All cables in water, proposed to be buried beneath the seabed or bay bottom (Indian River Bay)
US Wind Substations	The substation or substations that US Wind will build to connect to the Point of Interconnection

Acronyms and Abbreviations

Notation	Definition
°	Degrees
°C	Degrees Celsius
°F	Degrees Fahrenheit
3/C	Three Conductor
AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACPARS	Atlantic Coast Port Access Route Study
ADIZ	Air Defense Identification Zone
ADLS	Aircraft Detection Lighting System
AEP	Auditory Evoked Potential
AIS	Air Insulated Substation
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ANT	Aids to Navigation Team
AOR	Area of Responsibility
APE	Area of Potential Effect
ARPA	Automatic Radar Plotting Aid
ASL	Above Sea Level
ASLF	Ancient Submerged Landform
ASMFC	Atlantic States Marine Fisheries Commission
ATON	Aids to Navigation
BACI	Before-After-Control-Impact
BACT	Best Available Control Technology
BC	Black Carbon
BLM	Bureau of Land Management
BMPs	Best Management Practices
BOEM	Bureau of Ocean Energy Management
C & D Canal	Chesapeake & Delaware Canal
CAA	Clean Air Act
CBY	Chesapeake Bay Lowlands

Notation	Definition
CCTV	Closed-Circuit Television
CFR	Code of Federal Regulations
CH_4	Methane
cm	Centimeter
CMECS	Coastal and Marine Ecological Classification System
CMP	Coastal Management Program
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLREGS	International Regulations for Preventing Collisions at Sea 1972
COMAR	Code of Maryland Regulation
COP	Construction and Operations Plan
CP	Cathodic Protection
C-POD	Cetacean Pod
CPR	Cardiopulmonary Resuscitation
CPT	Cone Penetrometer Test
CPUE	Catch per Unit Effort
CTD	Conductivity, Temperature, And Depth
CTV	Crew Transport Vessel
CWB	Colonial Nesting Waterbird
dB	Decibels
dbh	Diameter at Breast Height
DC	Direct Current
DE	Delaware
DMA	Dynamic Management Area
DNR	Department of Natural Resources
DNREC	Department of Natural Resources and Environmental Control
DO	Dissolved Oxygen
DOE	Department of Energy
DOE	Determination of Eligibility
DP	Dynamic Positioning
DPL	Delmarva Power and Light

Notation	Definition
DPS	Distinct Population Segment
DRBA	Delaware River and Bay Authority
DSC	Digital Selective Calling
ECA	Emission Control Area
ECDIS	Electronic Chart Display and Information System
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
eGRID	Emissions and Generation Resource Integrated Database
ELMR	Estuarine Living Marine Resources
EMF	Electromagnetic Field
EMS	Ecological Marine Sediment
EPA	Environmental Protection Agency
ERES	Exceptional Recreational or Ecological Significance
ERL	Effects Range-Low
ESA	Endangered Species Act
ESP	Electric Service Platform
ESRI	Environmental Systems Research Institute
ETV	Emergency Towing Vehicle
FAA	Federal Aviation Administration
FACSFAC	United States Navy Fleet Area Control and Surveillance Facility
FDR	Facility Design Report
FIR	Fabrication and Installation Report
FFAESC	Fleet Forces Atlantic Exercise Coordination Center
FR	Federal Register
ft	Feet
ft^2	Square feet
FTE	Full-Time Equivalent
G&G	Geotechnical and Geophysical
GARFO	Greater Atlantic Regional Fisheries Office
GDP	Gross Domestic Product
GIS	Gas Insulated Substation

Notation	Definition
GIS	Geographic Information System
GOSBA	Governor’s Office of Small, Minority, & Women Business Affairs
GPS	Global Positioning System
HAPC	Habitat Area of Particular Concern
HD	High Definition
HAPs	Hazardous Air Pollutants
HDD	Horizontal Directional Drilling
HMS FMP	The 2006 Atlantic Highly Migratory Species Fishery Management Plan
HRG	High Resolution Geophysical
HURISK	National Hurricane Center Risk Analysis Program
HVDC	High Voltage Direct Current
Hz	Hertz
IHA	Incidental Harassment Authorization
IMO	International Maritime Organization
IMPLAN	Impact Analysis for Planning
in	Inches
IPaC	Information for Planning and Consultation
IWC	International Whaling Commission
km	Kilometers
km/h	Kilometers Per Hour
km^2	Square Kilometers
KOP	Key Observation Points
LOA	Length Overall
LOA	Letter of Authorization
Lpk	Peak Sound Pressure
LSZ	Landscape Similarity Zones
LTO	Landing and Takeoff
m	Meters
m^2	Square Meters
MABS	Mid-Atlantic Baseline Studies

Notation	Definition
MAC	Mariner's Advisory Committee
MAFMC	Mid-Atlantic Fisheries Management Council
Magnuson-Stevens Act	The Magnuson-Stevens Fishery Conservation and Management Act
MARUs	Marine Autonomous Recording Units
MBTA	Migratory Bird Treaty Act
MCA	British Maritime and Coastguard Agency
MD	Maryland
MD Project	Maryland Project
MD WEA	Maryland Wind Energy Area
MDAT	Marine-Life Data and Analysis Team
MDE	Maryland Department of Environment
MDNR	Maryland Department of Natural Resources
MEA	Maryland Energy Administration
MEC	Munitions of Explosive Concern
mG	Milligauss
mg/kg	Milligram Per Kilogram
mg/L	Milligrams Per Liter
MHHW	Mean Higher High Water
MIHP	Maryland Inventory of Historic Property
mi	Statute Miles
mi^2	Square Miles
MISLE	Marine Information for Safety and Law Enforcement
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MOA	Military Operating Areas
MPA	Marine Protected Area
MSL	Mean Sea Level
MTR	Military Training Routes
mV/m	Millivolts per meter
MW	Megawatt
N_2O	Nitrous Oxide

Notation	Definition
NAAQS	National Ambient Air Quality Standards
NARW	North Atlantic Right Whale
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NCR	National Capital Region
NDBC	National Data Buoy Center
NEFMC	New England Fisheries Management Council
NEFSC	Northeast Fisheries Science Center
NGO	Non-Governmental Agencies
NEPA	National Environmental Policy Act
NHC	National Hurricane Center
NHPA	National Historic Preservation Act
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NLCD	National Land Cover Dataset
NLEB	Northern Long-Eared Bat
NM	Nautical Miles
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NODE	Navy Operations Area Density Estimates
NOEP	National Ocean Economics Program
NO_x	Nitrogen Oxides
NP	Not Present
NRHP	National Register of Historic Places
NSRA	Navigational Safety Risk Assessment
NVIC	Navigation and Vessel Inspection Circular
O&M	Operations and Maintenance
O_3	Ozone
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OPAREA	Navy Operations Area
OREC	Offshore Wind Renewable Energy Credit

Notation	Definition
OREI	Offshore Renewable Energy Installation
OSP	Optimum Sustainable Population
OSS	Offshore Substations
PA	Pennsylvania
PA	Programmatic Agreement
PARS	Port Access Route Study
PAH	Polycyclic Aromatic Hydrocarbon
PATON	Private Aids to Navigation
Pb	Lead
PDE	Project Design Envelope
PEL	Probably Effect Level
PM_{10}	Particulate Matter Less Than or Equal To 10 Micrometers
$PM_{2.5}$	Particulate Matter Less Than or Equal To 2.5 Micrometers
POI	Point of Interconnection
ppb	Parts Per Billion
ppm	Parts Per Million
ppt	Parts per Thousand
psu	Practical Salinity Units
PTE	Potential to Emit
PTS	Permanent Threshold Shift
RACON	Radar Beacon
RCC	Rescue Coordination Center
RGC&A	R. Christopher Goodwin & Associates
RI	Rhode Island
RMS	Root Mean Square
RNA	Regulated Navigational Area
ROV	Remotely Operated Vehicle
ROW	Right-Of-Way
SADA	Shellfish Aquaculture Development Areas
SAP	Site Assessment Plan
SAR	Search and Rescue
SAV	Submerged Aquatic Vegetation

Notation	Definition
SC	South Carolina
SCADA	Supervisory Control and Data Acquisition
SCUBA	Self-Contained Underwater Breathing Apparatus
SEFSC	Southeast Fisheries Science Center
SELcum	Cumulative Sound Exposure
SGRE	Siemens Gamesa Renewable Energy
SHPO	State Historical Preservation Office
SMA	Seasonal Management Area
SMC	Coast Guard Search and Rescue Mission Coordinator
SO_2	Sulfur Dioxide
SOLAS	Safety of Life at Sea
SO_x	Sulfur Oxides
SPCC	Spill Prevention, Control, And Countermeasure
SWA	State Wildlife Areas
SWPPP	Stormwater Pollution Prevention Plan
TAP	Toxic Air Pollutant
TEL	Threshold Effect Level
TEU	Twenty-foot Equivalent Units
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TOC	Total Organic Carbon
TOY	Time-Of-Year
TRBM	Trawl Resistant Bottom Mount
TSS	Total Suspended Solids
TSS	Traffic Separation Scheme
TVAT	Traffic Vector Analysis Tool
UAV	Unmanned Aerial Vehicle
U.S.	United States
U.S.C.	United States Code
UHF	Ultra-High Frequency
UKC	Under Keep Clearance
UME	Unusual Mortality Event

Notation	Definition
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USCG	United States Coast Guard
USFF	United States Fleet Forces
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	Ultraviolet
UXO	Unexploded Ordnance
VA	Virginia
VACAPES	Virginia Capes
VAQF	Virginia Aquarium & Marine Science Center Foundation
VC	Vibracore
VHF	Very High Frequency
VMS	Vessel Monitoring System
VOC	Volatile Organic Compound
VOIP	Voice Over Internet Protocol
VSA	Visual Study Area
VTIS	Vessel Traffic Information Service
VTS	Vessel Traffic Service
WEA	Wind Energy Area
WFF	Wallops Flight Facility
WTG	Wind Turbine Generators
$\mu g/m^3$	Microgram per Cubic Meter
μm	Micrometer
μPa	Micropascal

Executive Summary

Volume II of the COP provides the Project site characterization and assessment of impact-producing factors associated with pertinent physical, biological, cultural, visual, and social resources. Volume II includes a description of the affected environment, an assessment of the potential Project impacts, and a listing of the methods being proposed by US Wind to mitigate and monitor for the potential impacts associated with each resource area.

The Project has been designed to meet all applicable regulatory requirements and to minimize impacts to physical, biological, cultural, visual, and social resources. US Wind will continue to coordinate with the appropriate regulatory agencies and other Project stakeholders to identify opportunities to implement additional mitigation and monitoring measures to further reduce Project impacts.

1.0 Introduction

1.1 Project Summary

US Wind is developing the Maryland Offshore Wind Project[1] (the Project), an offshore wind project of up to 2 gigawatts within OCS-A 0490 (the Lease), an area off the coast of Maryland on the Outer Continental Shelf. US Wind obtained the Lease in 2014 when the company won an auction for two leases from the Bureau of Ocean Energy Management (BOEM) which in 2018 were combined into the Lease. The Project will include as many as 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) Met Tower in the roughly 80,000-acre Lease area. The Project is proposed to be interconnected to the onshore electric grid by up to four new 230 kV export cables into a substation in Delaware. The proposed Project layout is provided in Figure 1-1. Figure 1-2 depicts the Project Design Envelope, as presented in Volume I.

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[1] The Project includes MarWin, a wind farm of approximately 300 MW for which US Wind was awarded Offshore Renewable Energy Credits (ORECs) in 2017 by the state of Maryland; Momentum Wind, a wind farm of approximately 808 MW for which US Wind was awarded ORECs in 2021 by the state of Maryland; and any subsequent development within the Lease area.

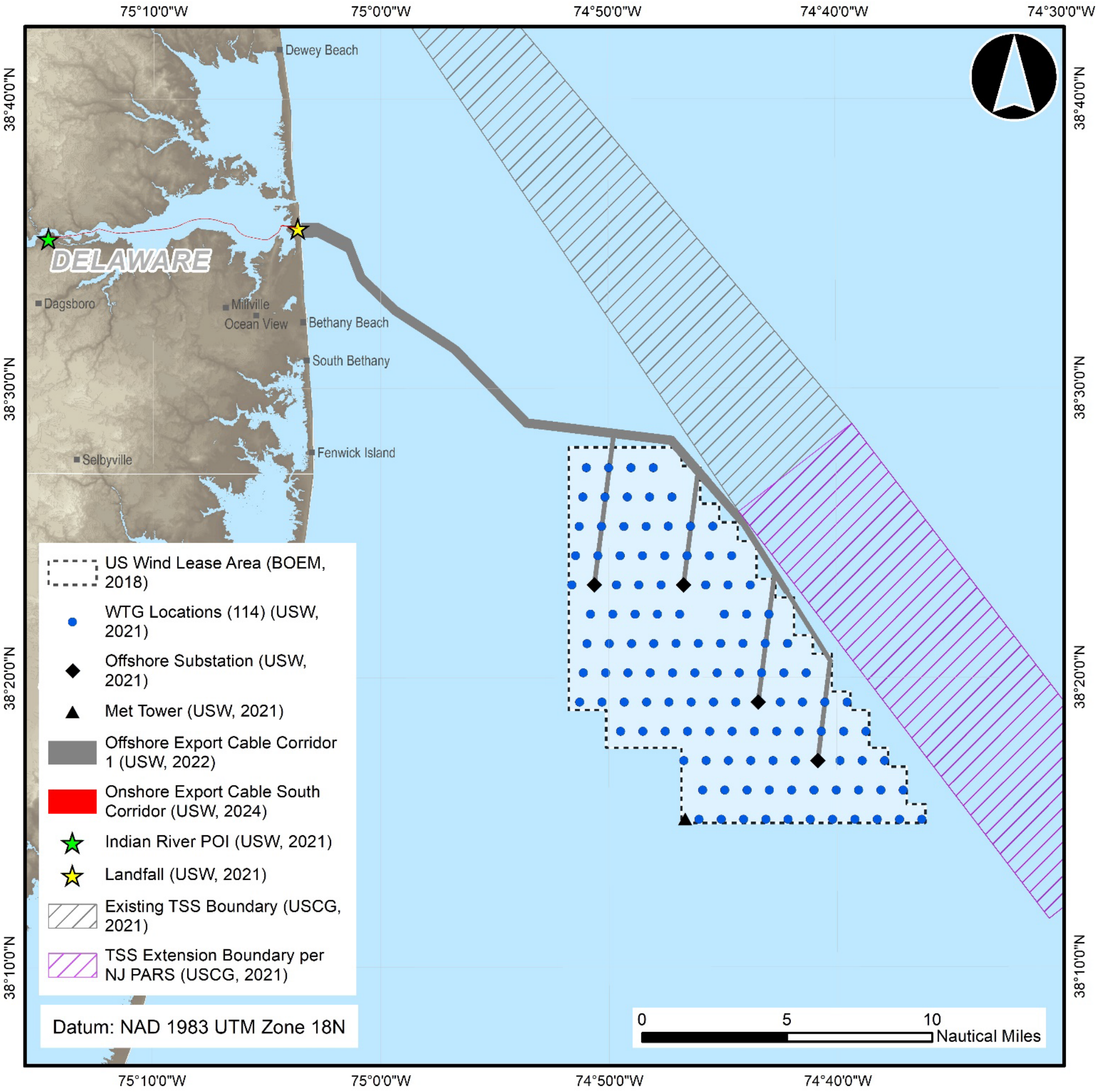

Figure 1-1. Proposed Project

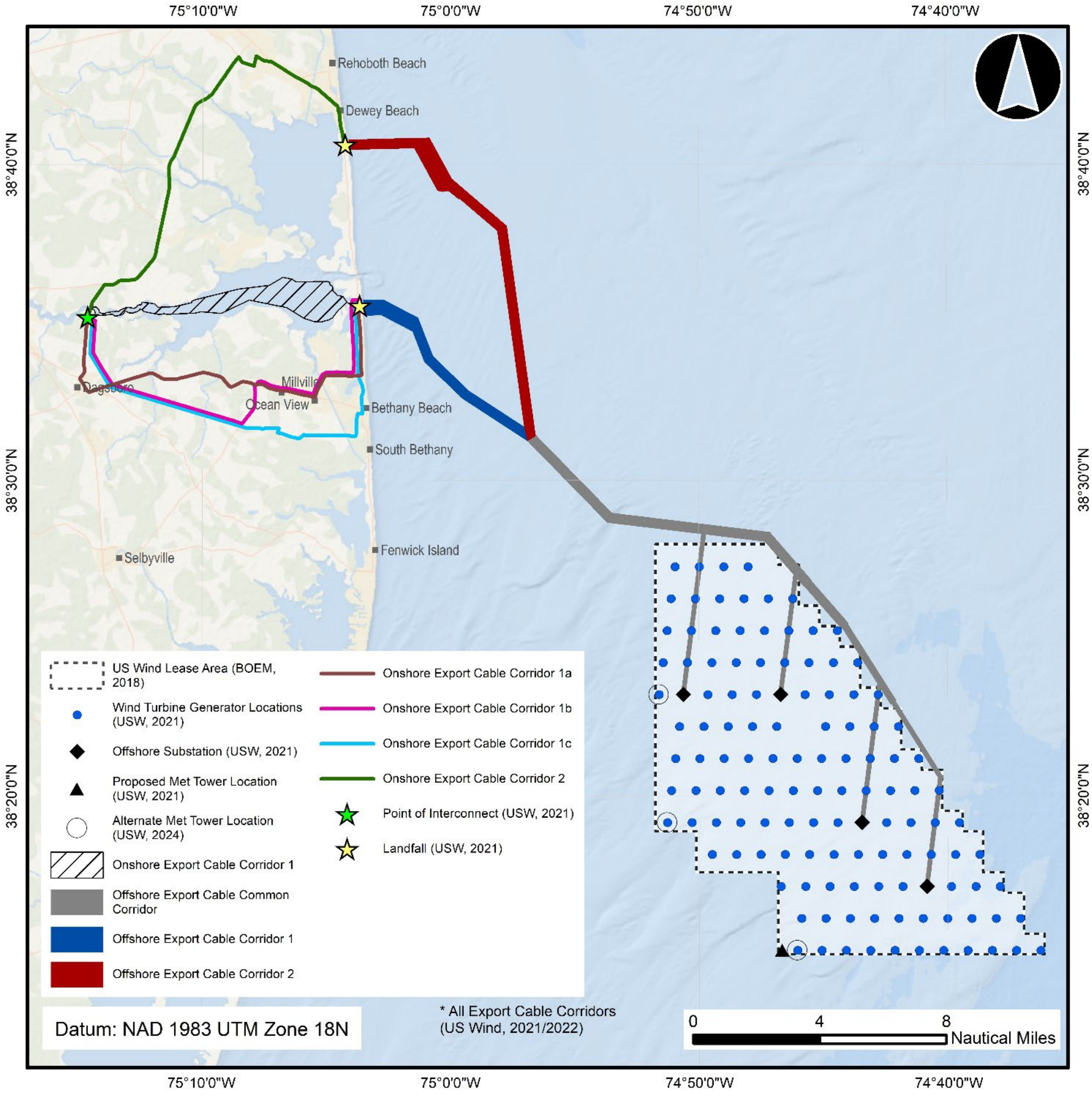

Figure 1-2. Project Design Envelope

1.2 Project Design Envelope

Parameter	Description
Project Layout	
Total Structures	Up to 126, including WTGs, OSSs, and Met Tower
Project Capacity	Up to 2.2 GW
Spacing	0.77 NM E-W (1.43 km, 0.89 mi) 1.02 NM N-S (1.89 km, 1.17 mi)
Water Depths	Approximately 14 – 41 m (46 – 135 ft)
WTG	
Total WTGs	Up to 121
WTG Size	Up to 18 MW
Foundation Type	Monopiles
Rotor Diameter	Up to 250 m (820 ft)
Hub Height	Up to 161 m (528 ft)
Height Tip of Blade	Up to 286 m (938 ft)
OSS	
Total OSS	Up to 4
Foundation Type	Monopiles, or jackets on piles or suction buckets
Met Tower	
Total Met Towers	1
Foundation Type	Braced Caisson
Cables	
Offshore Export Cables	4 – 230-275 kV AC submarine
Maximum Length of Offshore Export Cables (4 Total)	229.3 km (124 NM)
Inter-array Cables	66 kV AC submarine
Maximum Length of Inter-array Cable	202.2 km (127 mi)
Onshore Export Cables	Up to 4 – 3-phase 230-275 kV or 12 single phase
Maximum Length of Onshore Export Cables (4 Total)	68.1 km (42 mi)

Onshore Export Cable South Corridor was selected for the proposed Project. Please refer to Volume I Section 2.5.3.1 for a discussion of this selection.

1.3 Ocean/Bay Bottom/Soil Disturbance Summary

Bottom Disturbance Due to Rock or Structures (Permanent)

Foundations and Scour Protection		Maximum Number of Foundations	Maximum number of piles/buckets per Foundation	Max Area of Direct Disturbance Per pile/bucket (m^2)	Max area of scour protection per Foundation (m^2)	Total Area of disturbance per Foundation (m^2)	Total Area of Foundations and Scour Protection			
							m^2	ft^2	km^2	acres
WTGs	Monopile	121	1	95	760	855	103,491	1,113,968	0.10	25.57
OSSs	Monopile	4	2	95	760	1,711	6,842	73,651	0.01	1.69
	Jacket on Suction Bucket		8	177	0	1,414	5,655	60,868	0.01	1.40
	Jacket with Pin Piles		8	13	101	905	3,619	38,956	0.00	0.89
	Large-Pile Jacket		8	7	57	509	2,034	21,896	0.00	0.50
Meteorological Tower	IBGS Jacket	1	3	3	0	55	55	589	0.00	0.01

Cable Protection	Maximum Total Length of Cable (m)	Maximum Length of Cable to be Protected (m)	Width of Cable Protection (m)	Total Area of Cable Protection			
				m^2	ft^2	km^2	acres
Offshore Export Cables	229,294	22,929	6.0	137,577	1,480,860	0.14	34.00
Onshore Export Cables	68,096	6,810	6.0	40,858	439,787	0.04	10.10
Inter-array Cables	202,239	20,224	6.0	121,343	1,306,128	0.12	29.98

	Grand Total Foundations + Scour + Cable Protection			
	m^2	ft^2	km^2	acres
MAXIMUM TOTAL SEAFLOOR DISTURBANCE DUE TO FOUNDATIONS AND SCOUR PROTECTION (Worst Case Option - Monopile Foundations for OSSs)	110,388	1,188,208	0.11	27.28
MAXIMUM TOTAL CABLE PROTECTION ALONG THE ONSHORE, OFFSHORE AND INTERARRAY EXPORT CABLE CORRIDORS	299,777	3,226,775	0.30	74.08
TOTAL	410,166	4,414,983	0.41	101.35

Bottom Disturbance Due to Cable Installation, Jack-up Vessels, and Vessel Anchoring (Temporary)

Cable Installation	Maximum Total Length of Cable (m)	Width (m)	Total Area of Cable Installation Disturbance			
			m^2	ft^2	km^2	acres
Offshore Export Cables	229,294	0.6	137,577	1,480,860	0.14	34.00
Onshore Export Cables	68,096	10.0	680,959	7,329,776	0.68	168.27
Inter-array Cables	202,239	0.6	121,343	1,306,128	0.12	29.98
MAXIMUM TOTAL BOTTOM DISTURBANCE DUE TO CABLE INSTALLATION			939,879	10,116,765	0.94	232.25

Jack-up Vessels		Maximum Number of Foundations	Jack-ups Needed per Foundation	Jack-up Legs per Barge	Area Impacted by Each Leg (m^2)	Total Area of Jack-up Disturbance			
						m^2	ft^2	km^2	acres
WTG Installation	Monopile	121	2	4	250	242,000	2,604,864	0.24	59.80
OSS Installation	Monopile	4	2			8,000	86,111	0.01	1.98
	Jacket on Suction Bucket								
	Jacket with Pin Piles								
	Large-Pile Jacket								
Meteorological Tower	IBGS Jacket	1	2			2,000	21,528	0.00	0.49
MAXIMUM TOTAL DISTURBANCE DUE TO JACK-UP VESSELS						252,000	2,712,503	0.25	62.27

Vessel Anchoring	Maximum Number of Foundations	Maximum Area Impacted by Anchoring/Mooring per Foundation (m^2)	Total Area of Jack-up Disturbance			
			m^2	ft^2	km^2	acres
WTG Installation	121	500	60,500	651,216	0.06	14.95
OSS Installation	4	500	2,000	21,528	0.00	0.49
Meteorological Tower Installation	1	500	500	5,382	0.00	0.12
MAXIMUM TOTAL DISTURBANCE DUE TO VESSEL ANCHORING			63,000	678,126	0.06	15.57

Bottom Disturbance Due to Dredging (Temporary)

Dredging	Location	Maximum Number of Dredging Locations	Maximum Area of Dredging (m^2)	Total			
				m^2	ft^2	km^2	acres
Barge Access	Indian River Bay		157,884	157,884	1,699,468	0.16	39.01
HDD Gravity Cells	Barrier Beach Landfall	8	600	4,800	51,667	0.00	1.19
	Substation	4	600	2,400	25,833	0.00	0.59
MAXIMUM TOTAL DISTURBANCE CAUSED BY DREDGING				136,621	1,470,583	0.14	33.76

Land Disturbance (Temporary)

Component	Location	Quantity	Area disturbed Per Component (m^2)	Total			
				m^2	ft^2	km^2	acres
Construction Laydown Area	Indian River Substation	1	16,258	16,258	175,000	0.02	4.02
Temporary Access Road	Indian River Substation	1		3,076	33,106	0.00	0.76
Transition Vault Construction	Barrier Beach Landfall	4	372	1,486	16,000	0.00	0.37
MAXIMUM TOTAL TEMPORARY LAND DISTURBANCE				20,820	224,106	0.02	5.14

Land Disturbance (Permanent)

Component	Location	Quantity	Area disturbed Per Component (m^2)	Total			
				m^2	ft^2	km^2	acres
Project Substations	Indian River Substation	3		33,590	361,548	0.03	8.3
O & M Facility	Ocean City	1		5,787	62,291	0.01	1.43
MAXIMUM TOTAL PERMANENT LAND DISTURBANCE				39,377	423,839	0.04	9.73

1.4 Threatened and Endangered Species List

	Common Name	Federal Status	DE State Status	MD State Status	Location	Observed in Lease Area
Avian	Roseate Tern	E	-	X	Marine	Yes
	Bermuda Petrel	E	SC	-	Marine	No
	Common Tern^{BR}	-	E	E	Marine	Yes
	Forster’s Tern^{BR}	-	E	I	Marine	Yes
	Least Tern	-	E	T	Marine	Yes
	Royal Tern	-	-	E	Marine	Yes
	Black Skimmer	-	E	E	Marine	Yes
	Bald Eagle	-	E	-	Coastal	Yes
	Piping Plover	T	E	E	Coastal	No
	Rufa Red Knot	T	-	(T)	Coastal	No
	Eastern Black Rail	T	-	-	Coastal	No
Turtles	Loggerhead Turtle	T	E	T	Marine	Yes
	Green Turtle	T	E	T	Marine	Yes
	Kemp’s Ridley Turtle	E	E	E	Marine	Yes
	Hawksbill Turtle	E	-	E	Marine	Yes
	Leatherback Turtle	E	E	E	Marine	Yes
Marine Mammals	North Atlantic Right Whale	E	E	E	Marine	Yes
	Fin Whale	E	E	E	Marine	Yes
	Sei Whale	E	E	E	Marine	Yes
	Blue Whale	E	E	E	Marine	No

	Common Name	Federal Status	DE State Status	MD State Status	Location	Observed in Lease Area
	Sperm Whale	E	E	E	Marine	No
	West Indian Manatee	T	-	-	Marine	No
Fish	Atlantic Sturgeon	E	E	E	Marine	No
	Shortnose Sturgeon	E	E	E	Marine	No
	Giant Manta Ray	T	-	-	Marine	Yes
Terrestrial	Seabeach Amaranth	E	-	-	Coastal	No
	Evergreen Bayberry	-	-	E	Upland	No
	Swamp Pink	T	-	E	Wetland	No
	Bethany Beach Firefly	-	E	-	Coastal	No
	Northern Long-eared Bat	E	E	T	Upland	No

E = Endangered; T = Threatened; (T) = Appears likely to become endangered in MD;
X = Endangered/Extirpated (MD only); BR Breeding population only; SC= Special Concern;
I = In Need of Conservation

1.5 Master Mitigation and Monitoring Summary

Geology and Shallow Hazards

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Sediment disturbance/displacement	• Select suitable geological locations for the installation of the WTG, OSS and Met Tower foundations and design foundations appropriate to geological conditions. • To the greatest extent practicable, select areas with suitable seabed conditions for cable installation during cable route planning.
Surficial geology impacts	• Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable. • Minimize sediment disturbance by utilizing the best available technologies to achieve deep burial of submarine cable into a stable sediment layer (i.e. jet plow technology, HDD, gravity cells, etc.). • Minimize the amount of scour protection required.
Munitions of Explosive Concern (MEC)/ Unexploded Ordinance (UXO)	• Prior to construction, analyze survey data at installation locations to identify potential MEC/UXO and plan avoidance in line with industry best practices. US Wind would avoid MEC/UXO through micro-siting, and if avoidance is not possible, by lifting and shifting a MEC/UXO. US Wind is not proposing detonation or deflagration of UXO, or disposal at particular sites. • Prepare an MEC/UXO Emergency Risk Management Plan prior to construction. • Prior to construction activities, provide an MEC/UXO awareness briefing to vessel crews.
Operations	
Sediment disturbance/displacement	• Select suitable geological locations for the installation of the WTG, OSS and Met Tower foundations and design foundations appropriate to geological conditions. • To the greatest extent practicable, select areas with suitable seabed conditions for cable installation during cable route planning. • Minimize the amount of scour protection required.

Water Quality

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Turbidity/Total Suspended Solids (TSS)	• Based on feedback from DNREC, US Wind will implement the following time of year restrictions to minimize impacts of sediment disturbance: ○ No in-water work (e.g., cable installation, HDDs, dredging) in Indian River Bay March 1 through September 30. ○ No HDD in the Atlantic to the beach landfall April 1 through September 15 (inclusive of recreational period avoidance May 15 through September 15). • Sediment disturbance associated with submarine cable laying will be minimized by jet plowing, HDD techniques and the use of gravity cells where feasible. • Turbidity monitoring will be conducted during construction as required by the permitting authorities. Conduct TSS and water quality monitoring during cable installation activities and post installation as needed.
Frac-out from HDD activities	• A drilling fluid fracture contingency plan will be in place prior to the start of HDD activities. Operations will be shut down immediately in the event a frac-out occurs.
Routine and accidental discharges from vessels	• US Wind will monitor for and report any environmental release or fish kill to the appropriate authorities, e.g., in Delaware state waters, reports will be made via DNREC 24-hour hotline. • Project-specific SPCC Plan and Oil Spill Response Plan will be prepared prior to construction and for operations activities. • US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate. • Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 (“Marine Trash and Debris Awareness and Elimination”), per BOEM guidelines for marine trash and debris prevention. • Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.

Potential Impacts	Mitigation and Monitoring Measures
Operations	
Routine and accidental discharges from vessels	• US Wind will monitor for and report any environmental release or fish kill to the appropriate authorities, e.g., in Delaware state waters, reports will be made via DNREC 24-hour hotline. • Project-specific SPCC Plan and Oil Spill Response Plan will be prepared prior to construction and for operations activities. • US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate. • Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 (“Marine Trash and Debris Awareness and Elimination”), per BOEM guidelines for marine trash and debris prevention. • Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.

Air Quality

Potential Impacts	Mitigation and Monitoring Measures
Construction and Operations	
Emissions	• US Wind will obtain any necessary Clean Air Act permits under the state of Maryland's delegated program and comply with applicable permit conditions. • Vessel engines will meet the applicable EPA and International Maritime Organization (IMO) marine engine emission standards. • Engines will be operated and maintained in accordance with the manufacturer's recommendations and industry practices. • Diesel fuel for use in diesel engines will meet the per gallon fuel standards of 40 CFR 80.510(b) as applicable. • Land based engines that meet the EPA non-road engine standards will be used, as applicable. • Unnecessary idling of engines will be limited, where practicable. • Where practicable, engines with add-on emission controls will be used.

Coastal Habitat

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Habitat alteration	• US Wind will install cables using HDD to avoid impacts to coastal dunes and interdunal wetlands and to minimize bottom disturbance. • US Wind will minimize ground disturbance by confining cable infrastructure, such as transition vaults and HDD operations, to previously disturbed lands as much as practicable. Construction activities and ground disturbance at the Barrier Beach Landfall would occur in the previously disturbed parking lot. • Onshore construction activities will be scheduled to avoid impacting sensitive coastal habitats, where practicable. • Between May 1 and August 1, construction activities will not occur within 100 m (328 ft) of hummocks in Indian River Bay in order to avoid impacts to nesting terns. • Based on consultation with DNREC, the following habitat protection measures would be implemented to avoid and minimize impacts to species: ○ Installation of cables underneath tidal marshes will not be conducted during nesting season between April 1 through July 31. ○ Restrict nighttime artificial lighting restriction from June 1 through September 1 at Barrier Beach Landfall. ○ Avoid colonial waterbird nesting sites and avoid construction at the Barrier Beach Landfall and in-water work in Indian River Bay outside the nesting season. ○ US Wind would implement best practices such as diver surveys in Indian River for work between November 15 and March 1 to protect hibernating terrapins. ○ US Wind plans to install cables and conduct associated maintenance and monitoring outside of breeding season, April 1 to July 31, which would minimize impacts to marsh nesting birds. • US Wind will minimize impacts on submerged aquatic vegetation where practicable. No submerged aquatic vegetation has been identified in areas proposed for permanent or temporary disturbance. • US Wind will establish and maintain buffers around wetlands, implement best management practices (BMPs) to minimize erosion and control sediments and maintain natural surface drainage patterns, as practicable.

Potential Impacts	Mitigation and Monitoring Measures
	- US Wind will locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches, where feasible. The use of HDD for cable installation under the Barrier Beach Landfalls will avoid impacts on beaches. - Construction is anticipated to occur outside of turtle nesting season. Agency consultation and monitoring will be conducted as needed to mitigate disturbances. - Project-specific SPCC Plan will be prepared prior to construction and for operations activities. - US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate. - Agency consultation and monitoring regarding coastal habitats and species will be conducted as needed to mitigate disturbances, as practicable. - US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.

Benthic Resources

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Seabed and bay bottom disturbance	• Based on consultation with DNREC, the following habitat protection measures would be implemented to avoid and minimize impacts to species: ○ No in-water work (e.g., cable installation, HDDs, dredging) in Indian River Bay March 1 through September 30. ○ No HDD activities at the Atlantic beach landfall from April 15 through September 30 (inclusive of recreational period avoidance May 15 through September 15) to avoid impacts to spawning horseshoe crabs. • The Project has been sited to avoid sensitive or rare habitats (such as high-density clam beds) where feasible, and habitat disturbance will be minimized to the extent practicable. • Shellfish relocation/restoration in Onshore Export Cable Corridor 1 will be evaluated pre- and post-installation if warranted. • Cables will be installed using a jet plow to the greatest extent possible. Any dredging needed at HDD locations is expected to be limited to the gravity cells. • Horizontal Directional Drilling (HDD) will be used at landfall locations.
Vessel Anchoring	• Potential impacts from anchoring will be minimized by avoiding locations with sensitive habitats and utilizing mid-line anchor buoys.
Operations	
Electromagnetic Fields (EMF)	• Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable. • Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.

Finfish and Essential Finfish Habitat

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Habitat and migration	• Based on consultation with DNREC, the following protection measures would be implemented to avoid and minimize impacts to finfish and EFH: ○ No in-water work (cables, HDD, etc.) in Indian River Bay from March 1 through September 30 to avoid impacts to young of year summer flounder. ○ No in-water work in Indian River Bay from March 1 to May 15 to protect the American eel and allow passage of elvers upstream. ○ Landing Offshore Export Cables at 3R's Beach landfall location to avoid habitat sandbar and sand tiger sharks. • Conduct surveys and review existing data to identify important, sensitive, and unique marine habitats to be avoided. • Seafloor disturbance during construction will be minimized as practicable. • Impacts to summer flounder HAPC will be minimized by using dynamic positioning where feasible to minimize the need for construction vessels to anchor to the seafloor and using midline buoys to reduce seafloor scarring when construction vessels need to anchor. • Minimize construction activities as practicable in areas containing anadromous fish during migration periods.
Monitoring	• Fish monitoring equipment including nanotag antennas has been installed on the Metocean Buoy. • US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.
Turbidity/TSS impacts	• Sediment disturbance associated with submarine cable laying will be minimized by jet plowing, HDD techniques and the use of gravity cells where feasible.
Pile driving noise	• Soft-start procedures and sound attenuation will be used during foundation pile driving.

Potential Impacts	Mitigation and Monitoring Measures
Lighting	• Work lighting will be limited to the extent practicable to areas of active construction in coordination with USCG and other agencies as appropriate.
Routine and accidental discharges from vessels	• Project-specific SPCC Plan and Oil Spill Response Plan will be prepared prior to construction and for operations activities. • Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 (“Marine Trash and Debris Awareness and Elimination”), per BOEM guidelines for marine trash and debris prevention. • Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.
Operations	
Electromagnetic Fields (EMF)	• Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable. • Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.

Marine Mammals

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Pile Driving	- Prepare a pile driving monitoring plan, to include details about the measures listed below, prior to construction activities. Mitigation measures may be modified to reflect conditions set by NOAA Fisheries following the application for IHA or LOA associated with construction activities. - Consistent with the anticipated NMFS requirements for an LOA, US Wind will implement at least two functional noise abatement systems, such as double bubble curtains and nearfield attenuation devices, to reduce noise levels to the modeled harassment isopleths, assuming 10-dB attenuation, during all impact pile driving for monopile foundations. - Pile driving is planned between May 1 and November 30. Pile driving, if necessary, in November, may require additional mitigation measures such as larger clearance or exclusion zones. - Establish a clearance zone prior to pile driving using a combination of visual and acoustic monitoring for large whales. The clearance zone is to be monitored for a minimum of 60 minutes and the zone must be clear for 30 minutes before beginning soft-start procedure. - Once clearance zone is confirmed clear of marine mammals, pile driving will begin with minimum hammering at low energy for no less than 30 minutes (soft-start). - Additional restrictions on pile driving will include: no simultaneous pile driving; no more than one monopile driven per day; daylight pile driving only unless health and safety issues require completion of a pile; and initiation will not begin within 1.5 hours of civil sunset or in times of low visibility when the visual clearance zone and exclusion zone cannot be visually monitored, as determined by the lead PSO on duty. - Establish an exclusion zone using a combination of visual and acoustic monitoring for large whales. Pile driving will be halted if species enters defined exclusion zone, with exceptions for health and safety considerations as well as technical feasibility. - Visual clearance and exclusion zones will be monitored by PSOs which are individuals with a current NOAA Fisheries approval letter as a PSO.

Potential Impacts	Mitigation and Monitoring Measures
Vessel Strike Avoidance	• PSOs or trained observers will be present on crew vessels and other project vessels. • US Wind will ensure that from November 1 through April 30, vessel operators monitor NOAA Fisheries North Atlantic right whale (NARW) reporting systems (e.g., Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) for the presence of NARWs. • Vessels 19.8 m (65 ft) or larger will operate at 10 knots or less in NARW Seasonal Management Areas (SMAs). Additionally, all vessels would operate at speeds of 10 knots or less in Right Whale Slow Zones, identical to Dynamic Management Areas (DMAs), to protect visually or acoustically detected NARW. US Wind will incorporate the proposed revision to the NARW vessel speed rule for vessels 10.6-19.8 m (35-65 ft) in length upon implementation. • All vessels will maintain a minimum separation distance of 500 m (1,640 ft) or greater from any sighted NARW. If a NARW is sighted within this exclusion zone while underway, the vessel would steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m (1,640 ft) minimum separation distance has been established. If a NARW is sighted within 100 m (328 ft) of an underway vessel, the vessel operator would immediately reduce speed and promptly shift the engine to neutral. If the vessel is stationary, the operator would not engage engines until the NARW has moved beyond 100 m (328 ft). • All vessels will maintain a minimum separation distance of 100 m (328 ft) or greater from any sighted non-delphinid cetacean other than the NARW. If a non-delphinid cetacean sighted within this exclusion zone while underway, the vessel operator would immediately reduce speed and promptly shift the engine to neutral. The vessel operator would not engage the engines until the no-delphinid cetacean has moved beyond 100 m (328 ft). If the vessel is stationary, the operator would not engage engines until the non-delphinid cetacean has moved beyond 100 m (328 ft). • All vessels will maintain a minimum separation distance of 50 m (164 ft) or greater from any sighted delphinid cetacean or pinniped, except if the mammal approaches the vessel. If a delphinid cetacean or pinniped approaches an underway vessel, the vessel would avoid excessive speed or abrupt changes in direction to avoid injury to these organisms. Additionally, vessels underway may not divert to approach any delphinid cetacean or pinniped. • US Wind will continue to evaluate technologies that may increase the ability to detect marine mammals from vessels, such as thermal detection technologies.

Potential Impacts	Mitigation and Monitoring Measures
Routine/Accidental Releases from Vessels	• Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 (“Marine Trash and Debris Awareness and Elimination”), per BOEM guidelines for marine trash and debris prevention. • Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.
Monitoring	• The Metocean Buoy includes acoustic recorders to detect and identify marine mammal calls. • US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php. • Additional opportunities to support passive acoustic monitoring of marine mammals in and around the Lease area in conjunction with ongoing research efforts by others, such as the University of Maryland Center for Environmental Science, will continue to be explored.
Operations	
EMF	• Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable.
Monitoring	• US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php. • Additional opportunities to support passive acoustic monitoring of marine mammals in and around the Lease area in conjunction with ongoing research efforts by others will continue to be explored.

Sea Turtles

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Pile Driving	• Implement sound attenuation technologies such as double bubble curtains and nearfield attenuation devices to reduce underwater pile driving noise by 10 dB, with a target of 20 dB. • Establish a clearance zone prior to pile driving using visual monitoring for sea turtles. Once clearance zone is confirmed clear of protected species, pile driving will begin with minimum hammering at low energy for no less than 30 minutes (soft-start). • Additional restrictions on pile driving will include: no simultaneous pile driving; no more than one monopile driven per day; daylight pile driving only unless health and safety issues require completion of a pile; and initiation will not begin within 1.5 hours of civil sunset or in times of low visibility when the visual clearance zone and exclusion zone cannot be visually monitored, as determined by the lead PSO on duty. • Establish an exclusion zone using visual monitoring for sea turtles. Pile driving will be halted if species enters defined exclusion zone, with exceptions for health and safety considerations as well as technical feasibility. • Visual clearance and exclusion zones will be monitored by PSOs which are individuals with a current NOAA Fisheries approval letter as a PSO.
Vessel Strike Avoidance	• Vessels will observe NOAA Fisheries collision avoidance guidance, such as establishing minimum separation distances from sea turtles. • Trained observers will be present on crew vessels and other project vessels without PSOs.
Habitat Alteration	• US Wind will locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches, where feasible. The use of HDD for cable installation under the Barrier Beach Landfalls will avoid impacts on beaches. • Construction is anticipated to occur outside of turtle nesting season. Agency consultation and monitoring will be conducted as needed to mitigate disturbances.

Potential Impacts	Mitigation and Monitoring Measures
Routine/Accidental Releases	• Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination"), per BOEM guidelines for marine trash and debris prevention. • Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.
Monitoring	• US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.
Operations	
EMF	• Submarine cables that have electrical shielding will be used and the cables will be buried in the seafloor, where practicable. • Conduct a site-specific study of potential EMF impacts on electrosensitive marine organism

Terrestrial Species and Upland Habitats

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Habitat Alteration	• Previously disturbed areas will be used for the construction laydown area and access roads where feasible. • Tree clearing activities at the US Wind substations required for Project construction are not planned between April 1 through July 31 to avoid or minimize impacts to potentially mature forest and the northern long-eared bat during the summer maternity period.
Accidental Releases	• Project-specific SPCC Plan will be prepared prior to construction and for operations activities. • US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate.
Air Emissions	• Methods to reduce engine emissions will be implemented during construction and operation of the proposed Project where practicable, including restricting engine idling.
Operations	
Lighting	• Lighting-related impacts will be minimized by using best management practices (BMPs) where feasible. Examples of BMPs to minimize the adverse impacts of artificial lighting will include not lighting the facility at night except in the case of an emergency that requires an immediate response, and the use of down-shielded light fixtures to reduce the visibility of light by birds, bats, and insects flying above the facility.
Accidental Releases	• Project-specific SPCC Plan will be prepared prior to construction and for operations activities. • US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate.
Air Emissions	• Methods to reduce engine emissions will be implemented during construction and operation of the proposed Project where practicable, including restricting engine idling.

Marine Birds

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Monitoring	• US Wind is currently performing preconstruction aerial, digital surveys to monitor for avoidance and displacement of avian species (See Appendix II-N2). Additional surveys will be completed post-construction. • Avian monitoring equipment, including nanotag antennas and acoustic sensors, have been installed on the Metocean Buoy. • US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php. • Measures that minimize lighting impacts on avian species will be implemented where feasible, as approved by FAA, BOEM, USCG and other regulatory agencies. • At least 180 days prior to the start of commissioning of the first WTG, US Wind would distribute a Compensatory Mitigation Plan for piping plovers, rufa red knot, and roseate tern to BOEM, BSEE, and USFWS for review and comment. BOEM, BSEE, and USFWS would review the Compensatory Mitigation Plan and provide any comments on the plan to US Wind within 60 days of its submittal. US Wind would resolve all comments on the Compensatory Mitigation Plan to BOEM, BSEE, and USFWS's satisfaction before implementing the Plan and before commissioning of the first WTG. ○ The Compensatory Mitigation Plan would provide compensatory mitigation actions to fully offset the impact of the incidental take of piping plover, rufa red knot, and roseate tern. The Compensatory Mitigation Plan would require that the compensatory mitigation be implemented by the fifth year of WTG operation.
Operations	
Attractions	• Anti-perching measures may be installed on the deck/access platform of the WTGs to discourage birds from resting on and congregating around the structures.
Lighting	• Measures that minimize lighting impacts on avian species will be implemented where feasible, as approved by FAA, BOEM, USCG and other regulatory agencies.

Bats

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Habitat Alteration	• Following consultation with DNREC, US Wind would extend the restriction of tree clearing activities at the US Wind Substations location required for Project construction to April 1 through July 31 to avoid or minimize impacts to northern long-eared bat during the summer maternity period. • US Wind will conduct a bat habitat assessment and bat survey at the US Wind Substations location.
Monitoring	• The Metocean Buoy has been equipped with a bat acoustic recorder to monitor for the nocturnal calls of bats within the Lease area for up to two years. • Acoustic recorders to collect incidental bat calls offshore have been deployed on survey vessels throughout the Lease area and along the Offshore Export Cable Corridors. • US Wind will compile a comprehensive wildlife survey and observation information database to include surveys PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.

Cultural, Historic, and Archaeological Resources

Potential Impacts	Mitigation and Monitoring Measures
Construction	
	- The results of HRG and geotechnical surveys have been used to identify potential marine cultural resources and preserved submerged landforms. US Wind will avoid impacts to potential marine cultural resources and submerged landforms by micro-siting Project elements and planning construction around established avoidance areas. o Mitigation measures commensurate with potential adverse effects to historic properties impacted by views to the Project are proposed in a Historic Preservation Treatment Plan, through continuing coordination with SHPOs and consulting parties. - Planning has taken into account previously recorded cultural resources and areas of high archaeological probability, as well as the extent of prior disturbance, in order to minimize project impacts to known or potential archaeological resources. US Wind will avoid potential terrestrial cultural resources identified, to the extent practicable. A draft Historic Property Treatment Plan is included with the Terrestrial Archaeology Resource Assessment (Appendix II-I2) for BOEM's consultation with consulting parties. US Wind anticipates treatment of cultural resources will incorporate a phased approach to additional evaluation and treatment of the portions of the site that will be impacted by the Project. Treatment will include enhanced Phase II Evaluation of the affected portions of the site, consultation to assess effects, and mitigation if those areas are determined eligible for the NRHP. All evaluation and mitigation fieldwork shall be completed prior to construction at the US Wind Substations property. - US Wind will develop an Unanticipated Discovery Plan to be implemented during onshore and offshore construction. Draft Unanticipated Discovery Plans are included in both the Marine Archaeology Resource Assessment (Appendix II-I1) and Terrestrial Archaeology Resource Assessment (Appendix II-I2) for BOEM's consultation with consulting parties. o US Wind will continue to coordinate with the appropriate SHPOs and Native American tribes to refine measures to minimize and mitigate impacts to potential cultural resources generally and if particular resources are identified. o Temporary avoidance measures will be implemented during construction at the onshore US Wind substation location, including the export cable corridors, which will include protective barrier fencing to avoid an archaeological historic property to the greatest extent practicable. Cultural and tribal monitoring would be implemented as necessary. - US Wind developed a Monitoring Plan to be implemented during construction and is developing a Historic Property Treatment Plan in coordination with BOEM and consulting parties.

Visual Resources

Potential Impacts	Mitigation and Monitoring Measures
Operations	
	• US Wind commits to use aircraft detection lighting system (ADLS), if commercially feasible and approved by BOEM in consultation with FAA, USCG and other agencies. An FAA-approved vendor will be used to implement the ADLS for the Project, which is feasible per Chapter 10 of the updated Marking and Lighting Advisory Circular (70/7460-1M, November 2020). • The Project will minimize aviation lighting impacts, such as aiming lighting upward and using the longest permissible off cycles, in consultation with the FAA and BOEM. • Lighting and marking will be implemented in consultation with FAA, BOEM, USCG and other regulatory agencies. • Uniform spacing of WTGs and OSSs. • Use an FAA-recommended paint color that is not pure white (RAL 9010) for any WTG components visible from shore. The WTG paint color will be determined in consultation with BOEM, FAA, and USCG. • All offshore and onshore export cables are planned to be buried, or in locations where burial may not be achievable, protected to the greatest extent practicable.

Navigation, Air Traffic, and Military Activities

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Navigation Safety	• Coordinate with the appropriate regulatory agencies and other stakeholders during construction to provide timely and effective communications regarding planned vessel movements and construction activities. • Work with USCG to establish and maintain safety zones around active construction areas, and mark areas with highly visible marking and lighting. • Bury submarine cables at least 1.8 m (6 ft) below the maintenance depth of the Indian River Bay federal navigation channel. • Use existing transit lanes for construction and maintenance vessels to the extent practicable. • Route Offshore Export Cable Corridors to avoid USCG proposed anchorage. • Develop emergency procedures for potential vessel allisions with Project structures and other maritime emergencies, such as search and rescue, in consultation (e.g., coordinated drills) with relevant agencies and stakeholders. Establish appropriate chain of command with US Coast Guard and Maryland Department of Natural Resources to respond to emergencies in a timely, efficient manner and address ongoing issues. Procedures and potential equipment packages to benefit mariners, e.g. WTG cameras or data connectivity enhancements, will be developed through stakeholder outreach.
Operations	
Navigation Safety	• Uniform spacing of WTGs and OSSs of 1.02 NM (1.89 km) N/S and 0.77 NM (1.43 km) E/W • A proposed 1 NM (1.9 km) buffer zone between Project structures and the TSS outer boundary. • Use existing transit lanes for construction and maintenance vessels to the extent practicable. • Monitor Project operations continuously and maintain Project emergency contact channels with the USCG and other relevant agencies and stakeholders. • US Wind will work with the USCG to identify measures that may increase mariner and responder situational awareness in the vicinity of the Lease area such as cameras, distinct markings on towers, and enhanced communication connectivity. • Develop emergency procedures for potential vessel allisions with Project structures and other maritime emergencies, such as search and rescue, in consultation (e.g., coordinated drills) with relevant agencies and stakeholders. Establish appropriate chain of command with US Coast Guard and Maryland Department of

Potential Impacts	Mitigation and Monitoring Measures
	Natural Resources to respond to emergencies in a timely, efficient manner and address ongoing issues. Procedures and potential equipment packages to benefit mariners, e.g. WTG cameras or data connectivity enhancements, will be developed through stakeholder outreach.
Aircraft Traffic Safety	• US Wind commits to use aircraft detection lighting system (ADLS), or equivalent technology such as light dimming, if commercially feasible and approved by BOEM in consultation with FAA, USCG and other agencies. Use of ADLS would reduce nighttime obstruction lighting by 99% compared to not using ADLS. An FAA-approved vendor will be used to implement the ADLS for the Project, which is feasible per Chapter 10 of the updated Marking and Lighting Advisory Circular (70/7460-1M, November 2020). • Lighting and marking will be implemented following guidelines as practicable and in consultation with FAA, BOEM, USCG and other regulatory agencies.
Monitoring	• Meteorological and ocean observations from the Met Tower will be made available to the public.

Socioeconomics

Potential Impacts	Mitigation and Monitoring Measures
Construction	
Local Impacts	• US Wind will work with local officials to develop a traffic management plan to reduce impacts to local traffic during construction. • US Wind has sited and developed Project elements to minimize disturbance to resources, to the extent practicable, enjoyed by residents of and visitors to the region. • Route Offshore Export Cable Corridors to avoid marine mineral resources areas to the extent practicable.
Tourism Impacts	• US Wind will concentrate onshore construction activities outside of the summer recreation season to the greatest extent practicable and will coordinate with DNREC Parks and Recreation to minimize interference with beach activities.
Fisheries Impacts	• US Wind developed a Fisheries Communication Plan, in conjunction with the designated Fisheries Liaison Officer and will work with fisheries stakeholders to update it as appropriate. • US Wind established a process for gear loss compensation for commercial fishermen. • US Wind will work cooperatively with commercial/recreational fishing entities and interests to review planned activities and ensure that the construction and operation activities will minimize potential conflicts. • US Wind will conduct pre- and post-construction monitoring for regionally important species, in a partnership with the University of Maryland Center for Environmental Science to study black sea bass, to identify commercial and recreational fishing impact.
Operations	
Routine/Accidental Vessel Releases	• US Wind will implement practices and operating procedures to reduce the likelihood of vessel accidents and fuel spills. An Oil Spill Response Plan has been prepared and will be implemented for construction and for operations activities.
Fisheries Impacts	• US Wind developed a Fisheries Communication Plan, in conjunction with the designated Fisheries Liaison Officer and will work with fisheries stakeholders to update it as appropriate. • US Wind established a process for gear loss compensation for commercial fishermen. • US Wind will work cooperatively with commercial/recreational fishing entities and interests to review planned activities and ensure that the construction and operation activities will minimize potential conflicts.

Potential Impacts	Mitigation and Monitoring Measures
	• US Wind will evaluate potential pre- and post-construction monitoring for regionally important species, such as black sea bass, to identify commercial and recreational fishing impact.
EMF	• Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.
Visual Impacts	• Onshore cables and facilities at the Barrier Beach Landfalls will be buried. • WTGs, OSSs, and the Met Tower will be marked per USCG guidelines in consultation with USCG, BOEM and other regulatory agencies as appropriate. • Submarine cables will be buried and regularly inspected to maintain cable burial.
Construction and Operations	
Economic Benefits	• US Wind will coordinate with local stakeholders to develop opportunities for eco-tourism related to the Project. • US Wind is committed to creating full and equitable business opportunities for minority, women-owned, veteran-owned, and HUBZone businesses in the development of the Project. • US Wind has hired a team of MBE participation and compliance experts to lead the company’s outreach efforts to minority businesses and community organizations. • US Wind is coordinating with area organized labor organizations to develop a skilled local workforce for the Project. • US Wind has a strong interest in the welfare of workers employed by the construction managers, contractors and subcontractors on all components of the Project. • US Wind is committed to achieving substantial involvement of Maryland-based small businesses in all phases of the Project. • US Wind is committed to creating opportunities for Delaware-based companies able to deliver supply chain components and/or perform on-site work in Delaware. • US Wind has a particular focus on creating meaningful economic opportunities for environmental justice communities in the Baltimore, Maryland area. • US Wind will support workforce initiatives that are focused on providing support to minority and low-income populations, women, veterans, and underserved communities.

2.0 Environmental Conditions

US Wind has developed initial characterizations of environmental site conditions as they relate to Project design, construction, and operation. The initial site characterization is an integration of observed and modeled conditions from both public and site-specific data sets. Detailed analyses of the Project's metocean and geophysical site characteristics are presented in the following appendices, excerpts of which are summarized in this section:

- Appendix I-L1: Maryland OWF – Design Basis, r. 2, 2021
- Appendix I-L2: Independent Metocean Assessment, 2021
- Appendix II-A1: Integrated Site Characterization Report (initial), 2020
- Appendix II-A1: Integrated Site Characterization Report – Offshore (most recently updated May 2024)
- Appendix II-A2: Integrated Site Characterization Report – Indian River Bay, May 2024

US Wind collected additional wind resource, metocean, and high-resolution geophysical (HRG) information at the site. This site investigation work includes HRG surveys within the Lease area and along the Offshore Export Cable Corridors, contracted geotechnical investigations, and deployment of the Metocean Buoy within the Lease area for a planned 2-year metocean data collection campaign during the site assessment term of the Lease. HRG surveys of the Lease area, Offshore Export Cable Corridors, and Onshore Export Cable Corridor 1 were completed in June 2022 and geotechnical investigations, with the exception of the results of deep bores and related analysis at each WTG and OSS location which was approved as a departure request in a letter dated March 30, 2022, were completed in December 2022. In addition to the measurement and survey campaigns, US Wind is augmenting the existing site characterization with extreme event analyses to inform the Project's design basis.

In general, US Wind's characterization of the environmental conditions across the Lease area and export cable routes has not identified any unexpected risks or challenges from a design, construction, or operations perspective. The following subsections outline US Wind's current understanding of basic environmental and site conditions in the region of the Lease area and along the Offshore Export Cable Corridors.

2.1 Regional Overview – the Mid-Atlantic Shelf

Meteorological conditions in the vicinity of the Lease area generally reflect a temperate climate consistent with the regional weather of the mid-Atlantic coastal ocean. Seasonal weather in the late spring through mid-summer tends to exhibit lighter winds and, with the exception of summer thunderstorms, relatively fewer adverse weather systems. Stronger winds and more severe weather, including extra-tropical cyclones (e.g. Nor'easters), tropical depressions, and tropical cyclones (including hurricanes), typically occur in the period between late summer through spring.

The Lease area and Offshore Export Cable Corridors are located on the Mid-Atlantic Shelf, which extends from Long Island to Cape Hatteras. This is an area of dynamic oceanographic conditions and complex seafloor morphology.

The ocean circulation on the Mid-Atlantic Shelf is dominated by a counter-clockwise gyre and the counter-clockwise circulation created by large tropical and extra-tropical storms. That circulation creates: a) the north to south littoral currents along the coast and inner shelf and b) forms and defines the NNE-SSW-oriented sand ridges, which are the most predominate morphological features on the inner shelf. These ridges (shoals) are tens- to 100+-kilometers-long, typically spaced (crest to crest distance) at about 2-to 5-km-intervals (6.6 to 16.4 ft) and are as tall as 8 to 10 m (26.2 to 32.8 ft). The ocean and seafloor conditions in most of the Mid-Atlantic Shelf are considered to be storm driven.

The approximately 600-km-long Mid Atlantic Shelf includes three distinct areas that are defined by the Chesapeake and Delaware Bays: offshore New Jersey to the north of Delaware Bay, offshore the Delmarva Peninsula between Delaware Bay and Chesapeake Bay, and offshore Virginia-North Carolina to the south of Chesapeake Bay. The storm discharges from these bays, as well as the flood and ebb tides into and out from the bays, disrupt the regional ocean circulation and add a significant tidal-driven element to the water circulation, currents, seafloor morphology, and sediment transport in front of the two large bays (as well as to a lesser, localized effect seaward of other, smaller bays and outlets along the coast).

The storm discharges and tidal flows associated with the two large bays alter and add complexity to the storm-driven dynamics, which otherwise dominate the ocean column and seafloor processes along most of the inner Mid-Atlantic Shelf. Seaward of the two bays, the predominant NNE-SSW (linear) ridges (shoals) become more irregular and ultimately end. Hence, the character of the seafloor (morphology and bedforms) and sediments that form those seafloor features are more variable in the areas influenced by the storm flows from and tidal flows associated with the two bays.

Since the US Wind lease is located immediately to the south of the mouth of Delaware Bay, the seafloor bedforms and sediments are affected by the interplay among storm-driven currents, storm discharges from the Bay, and flood and ebb tidal flows associated with Delaware Bay. The various seafloor features and bedforms are viewed as being in a state of dynamic equilibrium which can be altered episodically during large storms.

2.2 Air and Sea Temperature

Air and sea temperatures, particularly at the sea bottom, surface, hub height, and at other key structural points (e.g. OSS topside), affect numerous project design and operations parameters. For example, hub height air density is strongly influenced by hub height air temperatures, as is WTG performance in the form of de-rates at high or low temperatures. Further, WTG suitability and lifetime estimates of the site-specific tower and foundation designs are partly based upon the range of temperatures in which they are operating. At the surface, the air and sea temperatures affect operations and maintenance (O&M) planning (e.g. due to fog conditions) and seasonal health and safety practices (e.g. personal protective equipment requirements).

US Wind monitored surface air temperature, sea surface temperature, and sea floor temperature with the Metocean Buoy. In advance of a full year of observations from that station, regional reference observations provide an initial picture of the air and sea temperatures at the site. Specifically, the NOAA National Data Buoy Center buoy 44009 (NOAA 2021a) provides a long-term metocean data record that is generally representative of conditions at the Lease area. NOAA Buoy 44009 is located approximately 6 km northeast of the Lease area at the terminus of the south-bound Traffic Separation Scheme from Delaware Bay. Plots of monthly air temperatures and sea surface temperatures are provided below in Figures 2-1 and 2-2, respectively. A tabular summary of these temperatures is provided in Table 2-1 below.

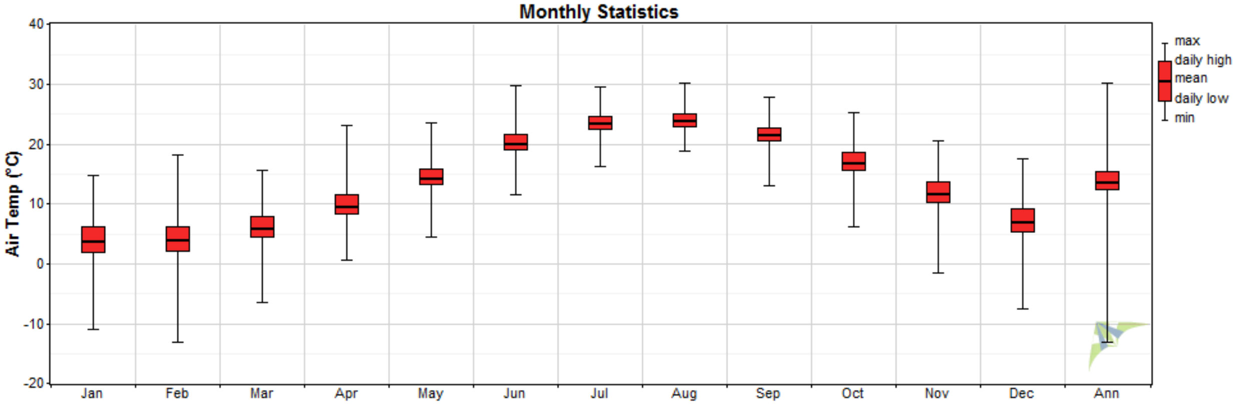

Figure 2-1. Monthly Air Temperature Statistics at 3.8 m MSL, NOAA Buoy 44009 (1997–2021)
(NOAA 2021a)

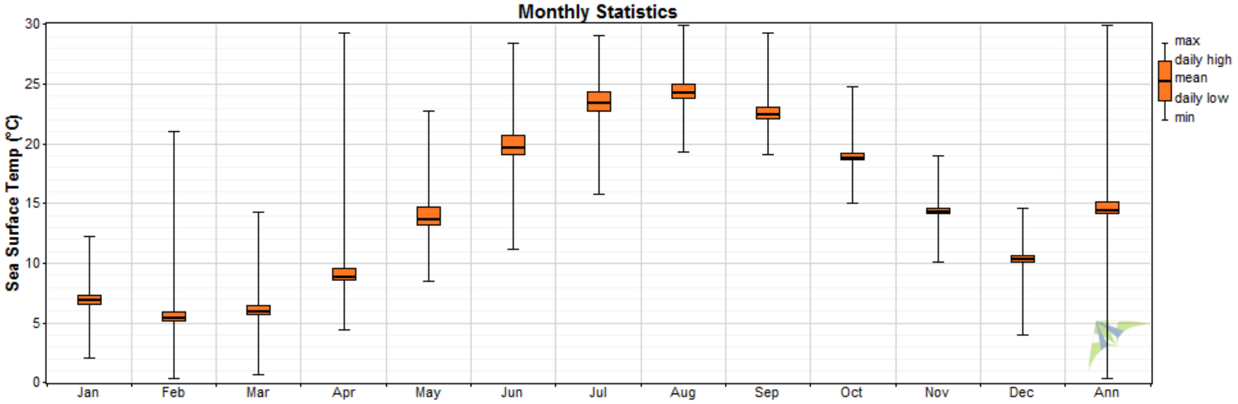

Figure 2-2. Monthly Sea Surface Temperature Statistics at -2.0 m MSL, NOAA Buoy 44009 (1997–2021)
(NOAA 2021a)

Table 2-1. Monthly Air and Sea Surface Temperature Statistics, NOAA Buoy 44009 (1997–2021)

	Month	Air Temp. at 3.8 m MSL			Sea Surface Temp. at -2 m MSL		
		Mean [°C]	Min [°C]	Max [°C]	Mean [°C]	Min [°C]	Max [°C]
1	Jan	3.91	-10.90	14.90	6.97	2.10	12.30
2	Feb	4.02	-13.00	18.30	5.56	0.40	21.10
3	Mar	6.01	-6.50	15.60	6.04	0.70	14.30
4	Apr	9.72	0.70	23.20	8.96	4.40	29.30
5	May	14.45	4.50	23.50	13.79	8.50	22.80
6	Jun	20.22	11.50	29.80	19.78	11.20	28.40
7	Jul	23.55	16.30	29.50	23.47	15.80	29.10
8	Aug	24.01	18.90	30.20	24.33	19.30	29.90
9	Sep	21.59	13.10	27.80	22.55	19.10	29.30
10	Oct	16.98	6.30	25.30	18.89	15.10	24.80
11	Nov	11.82	-1.50	20.50	14.44	10.10	19.00
12	Dec	7.12	-7.40	17.70	10.40	4.00	14.60
	Annual	13.70	-13.00	30.20	14.56	0.40	29.90

(NOAA 2021a)

US Wind's planned updates to the Design Basis include integration of the on-site air and sea surface and sea bottom temperature measurements collected by the Metocean Buoy with the long-term observations from NOAA Buoy 44009 and long-term modeled atmospheric conditions at hub height. These planned updates are expected to inform WTG, foundation, and OSS design efforts in 2022 and beyond.

2.3 Hydrography

Regionally, the seafloor across the Lease area slopes to the west to the east at a gentle gradient of less than 1 percent. The water depth in the Project lease ranges from a minimum of approximately 13.0 meters (42.6 feet) (re: MLLW datum), along the western lease-border, to a maximum of about 41.5 meters (136.1 feet) at the southeast corner of the Lease area. The water depth, however, is typically between about 18 and 32 meters (59 and 105 feet) in most of the Lease area. Many seafloor features and bedforms are present in the Lease area, and significant local water depth variations reflect the presence of many types of seafloor features and bedforms of different orientations, and sizes.

Topographic variations, or seafloor morphology, are due to relict geologic features associated with the last glacial sea level low stand, modification of these geologic features during the subsequent post-glacial period sea level transgression, and subsequent erosion and deposition (after submergence of the OCS) due to storm and/or tidal currents.

The most prominent bathymetric features in the lease area are the prominent SSW – NNE-trending ridges and swales offshore the Delmarva Peninsula and the Delaware Valley that extends seaward from Delaware Bay and borders the northeast perimeter of the Lease area.

The northeastern ends of the ridges and swales extend several kilometers into the Lease area (See Appendix II – A1 for illustration). To the NNE, the ridgetops deepen and their height diminishes. To the north and east of the prominent sand ridges, the seafloor in the Lease area is flatter and more undulating. Lesser sizes and scale of seafloor bedforms (e.g., sand ripples, waves, and dunes) are present on the flanks of the ridges, and elsewhere. These bedforms are inferred to reflect both geologic processes and sediment mobility. Nearer to the northeast border of the Lease area, many of the smaller seafloor features and bedforms have SW-NE to WSW-ENE orientation.

The tallest and steepest natural slopes in the lease include the up to 8-meter-tall (26-feet-tall) flanks of the SSW – NNE-trending dunes, and a 10-meter-tall (33-feet-tall), ESE-facing slope in the southeast corner of the Lease area.

These conditions extend to underlie the portions of the Offshore Export Cable Corridors bordering the northeastern and northern Lease area perimeter. Similar conditions are present along much of the corridors.

2.4 Tides and Currents

Water levels and currents in the Project area are produced by storms and tidal conditions as well as the other associated oceanographic processes. These various, related phenomena can affect project siting, design, construction, and operations in an assortment of ways. The phenomena transfer environmental loads, affect vessel access to the offshore structures, and can cause sediment mobility and associated scour. These effects, particularly scour and sediment mobility, may affect Project components within the Lease area, along the Offshore Export Cable Corridors, and at offshore landfall locations.

Along the coast, currents are driven by strong, reversing, semidiurnal tides (tidal current) and the prevailing wind direction (wind currents) and vary seasonally. The mean tidal ranges at Ocean City, Maryland and Indian River Inlet, Delaware are approximately 0.64 meters[2] and 0.76 meters (2.10 and 2.51 feet), respectively. NOAA Coast Pilot[3] publication for the Delmarva Peninsula notes that “currents have considerable velocity in the inlets and in the narrow channels connecting the inlets with adjacent bays and sounds. Surface current velocities of as much as 3 knots may be encountered at times.” Monthly surface currents are provided in Table 2-2. Surface current direction frequency distribution is provided in Figure 2-3.

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[2] Datums for NOAA station 8570283, Ocean City Inlet MD, https://tidesandcurrents.noaa.gov/datums.html?datum=MLLW&units=1&epoch=0&id=8570283&name=Ocean+City+Inlet&state=MD

[3] NOAA, US Coast Pilot 3, Chapter 8, p. 251, 07 November 2021, https://nauticalcharts.noaa.gov/publications/coast-pilot/files/cp3/CPB3_C08_WEB.pdf

Table 2-2. Monthly Surface Current Speed Statistics, MIKE 21 Hindcast (1998–2017)

	Month	Modeled Surface Current Speed							
		Mean [m/s]	Max [m/s]	Weibull k	Weibull A [m/s]	Mean [knots]	Max [knots]	Weibull k	Weibull A [knots]
1	Jan	0.151	0.720	1.929	0.171	0.294	1.400	1.929	0.332
2	Feb	0.148	0.610	1.957	0.167	0.287	1.186	1.957	0.324
3	Mar	0.149	0.720	1.945	0.168	0.289	1.400	1.945	0.326
4	Apr	0.147	0.520	2.015	0.166	0.285	1.011	2.015	0.322
5	May	0.139	0.560	2.053	0.157	0.270	1.089	2.053	0.305
6	Jun	0.134	0.420	2.139	0.152	0.261	0.816	2.139	0.295
7	Jul	0.132	0.440	2.144	0.150	0.257	0.855	2.144	0.291
8	Aug	0.132	0.490	2.18	0.149	0.256	0.952	2.180	0.290
9	Sep	0.140	0.510	2.061	0.159	0.273	0.991	2.061	0.308
10	Oct	0.148	0.700	1.916	0.167	0.287	1.361	1.916	0.324
11	Nov	0.148	0.600	1.956	0.167	0.288	1.166	1.956	0.325
12	Dec	0.146	0.530	1.98	0.165	0.285	1.030	1.980	0.322
	Annual	0.143	0.720	1.996	0.161	0.278	1.400	1.996	0.314

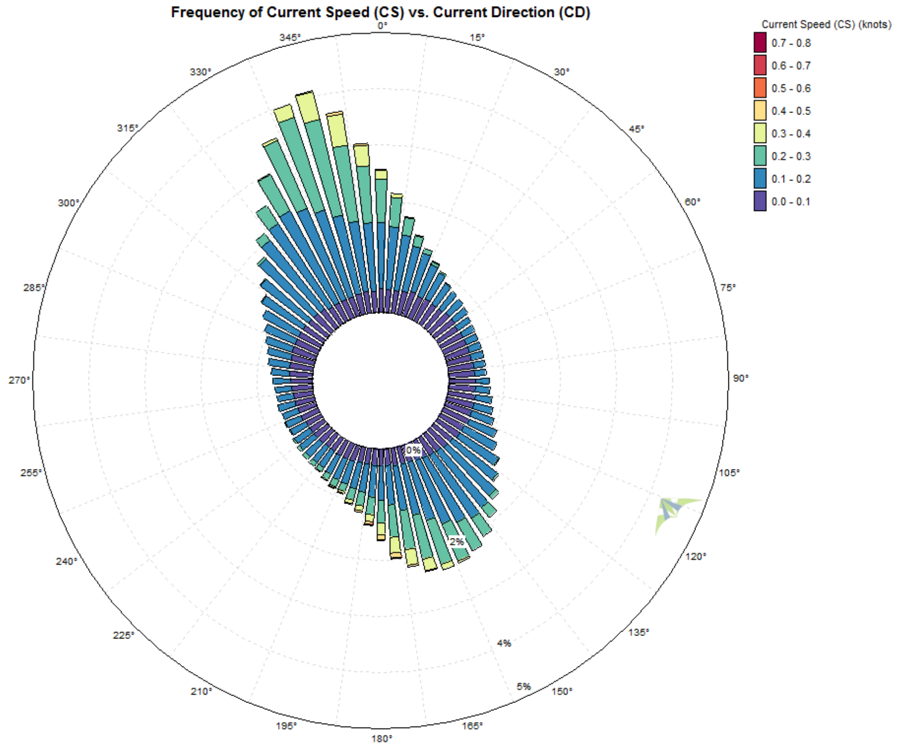

Figure 2-3. Surface Current Direction Frequency Distribution, MIKE 21 hindcast (1998–2017)

US Wind also estimated the 50-year storm current at the Lease area, including wind driven, geostrophic, and tidal current contributions. This initial estimate of extreme current speed is presented below in Table 2-3.

Table 2-3. 50-year Extreme Current Speed at Surface in Lease Area

Return Period	Surface Current Speed [knots]	Surface Current Speed [m/s]
50-year	3.26	1.68

Normal and extreme water levels in the vicinity of the Lease area were assessed based upon the 20-year MIKE 21 hindcast data set and NOAA tide station data. Table 2-4 presents the estimated normal water levels, and Table 2-5 presents extreme water levels at various return periods.

Table 2-4. Normal Water Levels in Lease Area – Astronomical Tides

Astronomical Tide	Tide Levels [m MSL]
Highest Astronomical Tide (HAT)	0.650
Mean Lower Low Water (MLLW)	-0.387
Lowest Astronomical Tide (LAT)	-0.650

Table 2-5. Extreme Water Levels in Lease Area – Storm Surge and Extreme Still Water Levels

Return Period [Years]	1	10	50	500	1000
Storm Surge [m]	1.14	1.19	1.23	1.27	1.29
Highest Still Water Level (HSWL) [m MSL]	1.79	1.84	1.88	1.92	1.94
Lowest Still Water Level (LSWL) [m MSL]	-1.79	-1.84	-1.88	-1.92	-1.94

The Metocean Buoy monitored water level and current profiles at the site. US Wind plans to update these site characteristics with onsite observations as part of ongoing development and design efforts.

2.5 Winds

2.5.1 Normal Wind Conditions

Normal wind conditions are some of the primary inputs to Project design, construction, and operations. In design, these inputs at hub height (and across the rotor plane) drive WTG fatigue calculation and energy production estimates. The normal conditions also influence assumptions on offshore installation workability, particularly with respect to WTG erection. During operations, normal wind conditions at the surface and hub height influence seasonal O&M planning and execution.

Representative long-term surface wind characteristics from NOAA Buoy 44009 are summarized below. Figure 2-4 and Table 2-6 present observed surface wind conditions at NOAA Buoy 44009 by month. Figure 2-5 illustrates the wind direction distribution (wind rose) by frequency and energy.

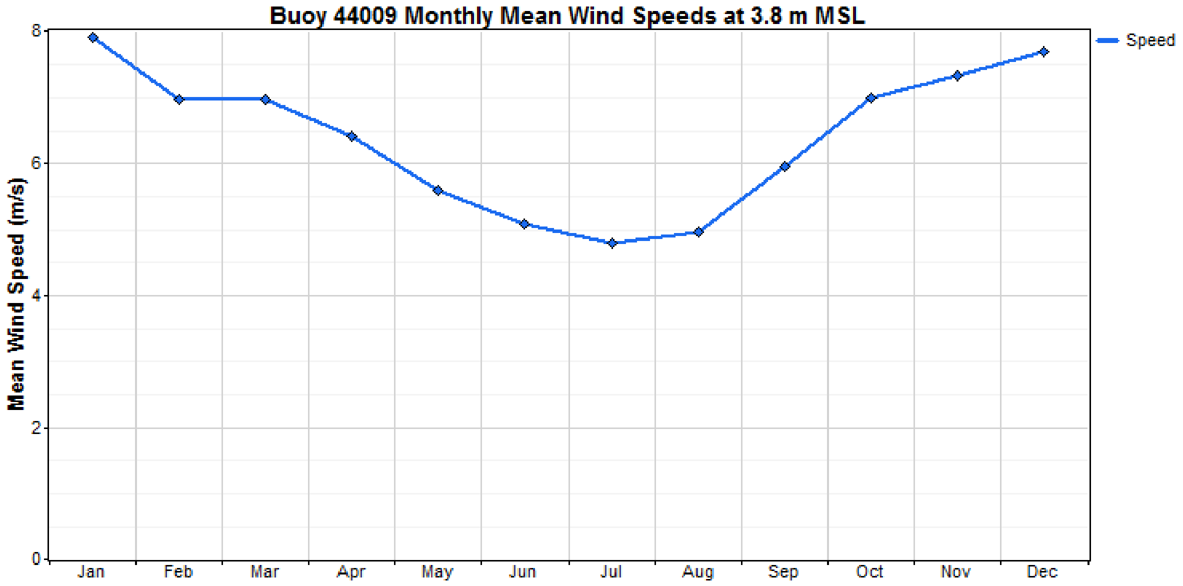

Figure 2-4. Monthly Mean Wind Speeds at 3.8 m MSL, NOAA Buoy 44009 (1997–2021)*(NOAA 2021a)*

Table 2-6. Monthly Mean Wind Speeds at 3.8 m MSL, NOAA Buoy 44009 (1997–2021)

(NOAA 2021a)

	Month	Average Wind Speed at 3.8 m MSL							
		Mean [m/s]	Max (m/s)	Weibull k	Weibull A (m/s)	Mean [knots]	Max [knots]	Weibull k	Weibull A [knots]
1	Jan	7.91	23.70	2.26	8.92	15.37	46.07	2.26	17.34
2	Feb	6.96	21.40	1.92	7.79	13.54	41.60	1.92	15.13
3	Mar	6.96	23.10	2.04	7.83	13.53	44.90	2.04	15.22
4	Apr	6.41	19.30	2.05	7.22	12.47	37.52	2.05	14.03
5	May	5.60	19.20	1.99	6.31	10.88	37.32	1.99	12.26
6	Jun	5.08	16.50	2.22	5.73	9.88	32.07	2.22	11.13
7	Jul	4.81	15.60	2.05	5.40	9.34	30.32	2.05	10.49
8	Aug	4.96	20.30	1.96	5.56	9.65	39.46	1.96	10.81
9	Sep	5.95	20.10	1.94	6.69	11.57	39.07	1.94	13.01
10	Oct	6.99	23.10	2.11	7.87	13.58	44.90	2.11	15.30
11	Nov	7.34	20.50	2.09	8.25	14.26	39.85	2.09	16.04
12	Dec	7.70	19.90	2.22	8.68	14.97	38.68	2.22	16.87
	Annual	6.36	23.70	1.94	7.15	12.35	46.07	1.94	13.89

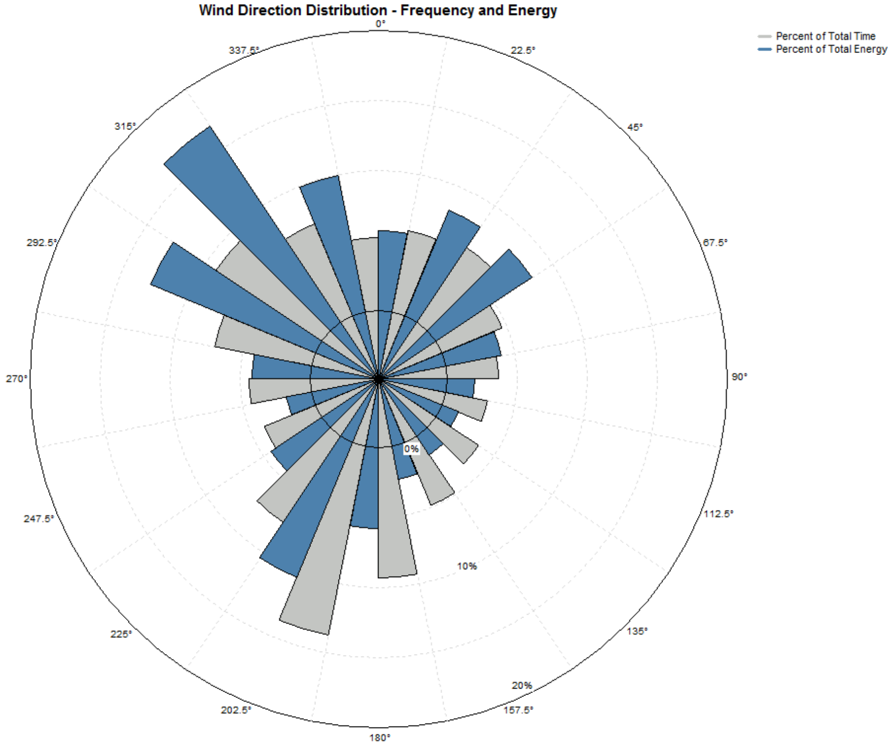

Figure 2-5. Wind Direction Distribution at 3.8 m MSL, NOAA Buoy 44009 (1997–2021)*(NOAA 2021a)*

In advance of collecting a full year of on-site measurements with the floating lidar buoy - the typical minimum duration used to estimate long-term conditions at a site - US Wind acquired a modeled time series of atmosphere conditions at multiple elevations to assess expected normal wind conditions. The data set was comprised of wind speed (including standard deviation), wind direction, air temperature, and pressure near the center of the Lease area from Vortex FdC.[4] The one-year duration time series was provided at 10-minute timestamps at multiple heights between 50 meters and 210 meters (164 and 689 feet) MSL.

The data set was developed using Vortex's Weather Research and Forecasting numerical weather prediction model in Large Eddy Simulation mode, based on ERA5 reanalysis input data and run at a final horizontal resolution of 100 meters (328 feet). This model configuration has been validated at multiple offshore locations globally, including the New York Bight.[5] The time series is representative of long-term conditions, and is based upon Vortex's "one year rolling method."[6] Conditions at the proposed hub height of 139 meters (456 feet) MSL were interpolated from provided heights on a 10-minute basis.

This modeled wind and atmosphere data set has informed most of US Wind's initial concept designs, as well as initial energy production estimates, and ancillary analyses (e.g. the Navigation Safety Risk Assessment, Appendix II-K1). A summary of the normal wind and atmosphere conditions reflected in the modeled time series at hub height is presented in Appendix I-L1.

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[4] https://vortexfdc.com/
[5] Vortex FdC, "LES Offshore Validation", 2020, https://vortexfdc.com/knowledge/les-offshore-wind-data-validation/
[6] Vortex FdC, "Vortex LES: One-year Rolling Methodology", 2018, https://vortexfdc.com/knowledge/one-year-rolling-les/

The Metocean Buoy monitored wind speed and direction characteristics at 11 heights from the surface to approximately 250 m MSL. US Wind plans to update the characterization of normal wind conditions with additional long-term, high-fidelity atmospheric modeling, which is currently underway, and integration of onsite floating lidar buoy observations once sufficient data have been collected.

2.5.2 Extreme Wind Conditions

Severe weather caused by tropical systems and seasonal local weather patterns contributes to wind forcing/sea state events, more typically during the fall and winter, from November through April, with gale force winds sometimes occurring as early as September (NOAA 2021b). Seasonal nor'easters, or extra-tropical cyclones during the fall and winter months, frequently bring with them wind speeds in excess of 30 to 50 knots. A week of high sea conditions and wind speeds above the average seasonal mean may linger in the region after the weather system has cleared. Summer storms moving in from the Great Plains and Southwest can bring heavy rains, water-spouts, lightning, micro-bursts, and, rarely, hail. These transient systems are occasionally capable of producing localized extreme winds and other storm-related damage. These events typically develop and pass the region very quickly.

The hurricane season along the U.S. Atlantic seaboard runs from June 1 through November 30 each year. Peak hurricane season is typically considered to begin in late summer (mid-August) and extend through October, although substantial and destructive hurricanes can and have occurred prior to and after peak season. Hurricane force winds, storm surge, storm tide, heavy rainfall, inland flooding, rip currents, and tornadoes are all categorized by the NOAA National Hurricane Center (NHC) as major hazards that may be present at the Lease area (National Oceanic and Atmospheric Administration NOAA 2016).

The NHC Risk Analysis Program (HURISK) was developed to assess the vulnerability of areas subject to tropical cyclone weather impacts. HURISK develops chart overviews that depict severe weather tracks, intensities, and return periods for coastal areas along the Atlantic tropical cyclone basin (Neumann 1987). While HURISK return periods are generated with the 1987 methodology, it uses data through 2010 (National Oceanic and Atmospheric Adminstration NOAA 2010). The NHC HURISK published return periods for both Category 1 and 2 hurricanes passing within 50 NM (92.6 km) of the U.S. Coast (Figure 2-6).

The HURISK data analysis for the Project indicates the Lease area experiences return periods of 15 – 20 years for hurricanes with wind speeds equal to or in excess of 64 knots. The estimated return period for hurricanes with wind speeds equal to or in excess of 96 knots is 44 – 68 years for the Lease area.

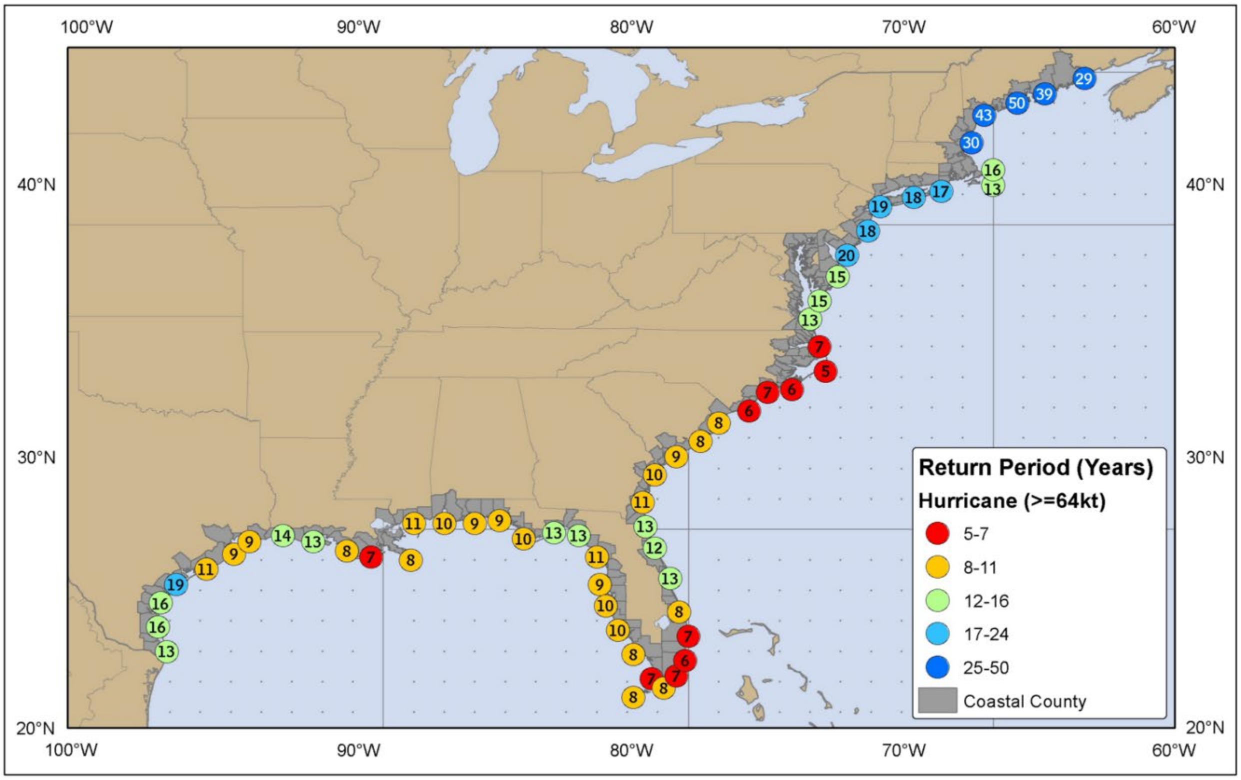


Figure 2-6. NHC HURISK Return Period for Hurricanes (NHC)

Depending on a number of variables including sea surface temperature, adjacent weather systems, and track of a severe storm, wind directions will vary as they rotate counterclockwise along the storm track. The highest winds will occur at the right side of the storm system due to the relative motion of the advancing storm system plus the wind speed of the storm system itself (National Oceanic and Atmospheric Administration NOAA 2016). Figure 2-7 shows the storm tracks passing through the area around the Project since 1940.

Tropical storms and hurricanes typically pass across the Mid-Atlantic Shelf over a period of hours to a few tens of hours. Thus, the main effects of such storms extend for only a limited duration. Like tropical storms, Nor'easters have counter-clockwise circulation around an area of low pressure. In contrast to tropical systems, however, Nor'easters can cross the Mid-Atlantic Shelf more slowly and can also stall on the shelf. For example, Nor'Ida (in November 2009) formed from the remnants of Hurricane Ida. This storm stalled while offshore the mid-Atlantic coast, maintained wind gust above 60 knots, and produced five tide cycles of storm surge approaching the HAT with low tides above MHHW. Thus, the effects from large Nor'easters can exceed the effects of tropical cyclones with similar wind speeds.

US Wind has engaged an International Electrotechnical Commission compliant hurricane assessment to more thoroughly characterize the expected design input conditions and implications of tropical systems across the Project area. This work is underway.

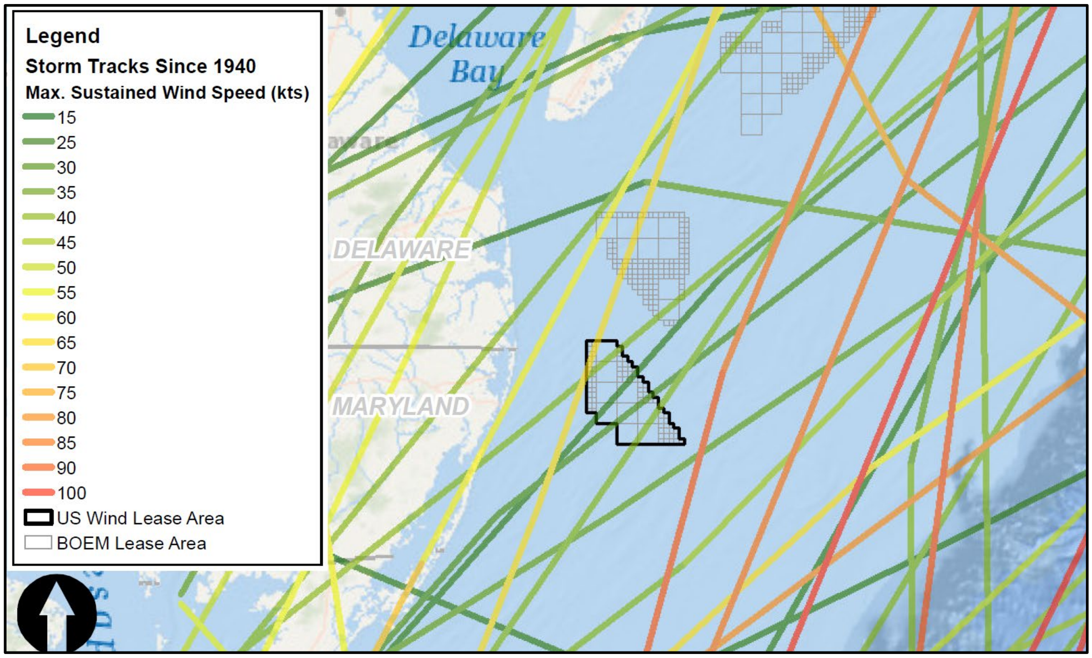


Figure 2-7. Storm Tracks and Maximum Sustained Winds (1940–2018)

2.6 Waves

Representative wave characteristics from NOAA Buoy 44009 are summarized below. Figure 2-8 and Table 2-7 present observed significant wave height conditions at NOAA Buoy 44009 by month. Figure 2-9 illustrates the wave direction distribution (wave rose) by frequency and significant wave height.

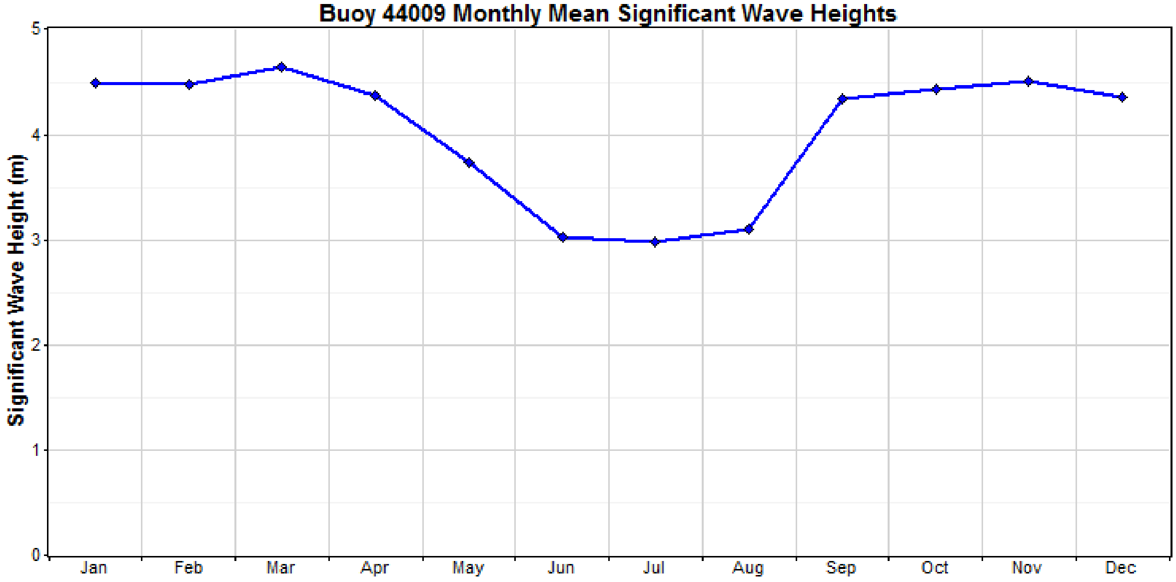


Figure 2-8. Monthly Mean Significant Wave Height, NOAA Buoy 44009 (1997–2021)
(NOAA 2021a)

Table 2-7. Monthly Significant Wave Height Statistics, NOAA Buoy 44009 (1997–2021)

(NOAA 2021a)

	Month	Significant Wave Height							
		Mean [m]	Min [m]	Max [m]	Std. Dev. [m]	Mean [ft]	Min [ft]	Max [ft]	Std. Dev. [ft]
1	Jan	1.37	0.00	8.41	0.76	4.50	0.00	27.58	2.49
2	Feb	1.36	0.00	7.70	0.78	4.47	0.00	25.26	2.57
3	Mar	1.42	0.24	7.80	0.80	4.64	0.79	25.58	2.62
4	Apr	1.33	0.22	5.38	0.66	4.37	0.72	17.65	2.18
5	May	1.14	0.18	6.30	0.60	3.74	0.59	20.66	1.97
6	Jun	0.92	0.19	4.14	0.39	3.02	0.62	13.58	1.28
7	Jul	0.91	0.28	3.82	0.36	2.99	0.92	12.53	1.18
8	Aug	0.95	0.26	6.36	0.47	3.10	0.85	20.86	1.54
9	Sep	1.32	0.27	6.76	0.73	4.34	0.89	22.17	2.41
10	Oct	1.35	0.27	7.38	0.81	4.43	0.89	24.21	2.66
11	Nov	1.38	0.00	8.11	0.78	4.51	0.00	26.60	2.56
12	Dec	1.33	0.00	6.50	0.71	4.36	0.00	21.32	2.32
	Annual	1.23	0.00	8.41	0.70	4.03	0.00	27.58	2.29

(NOAA 2021a)

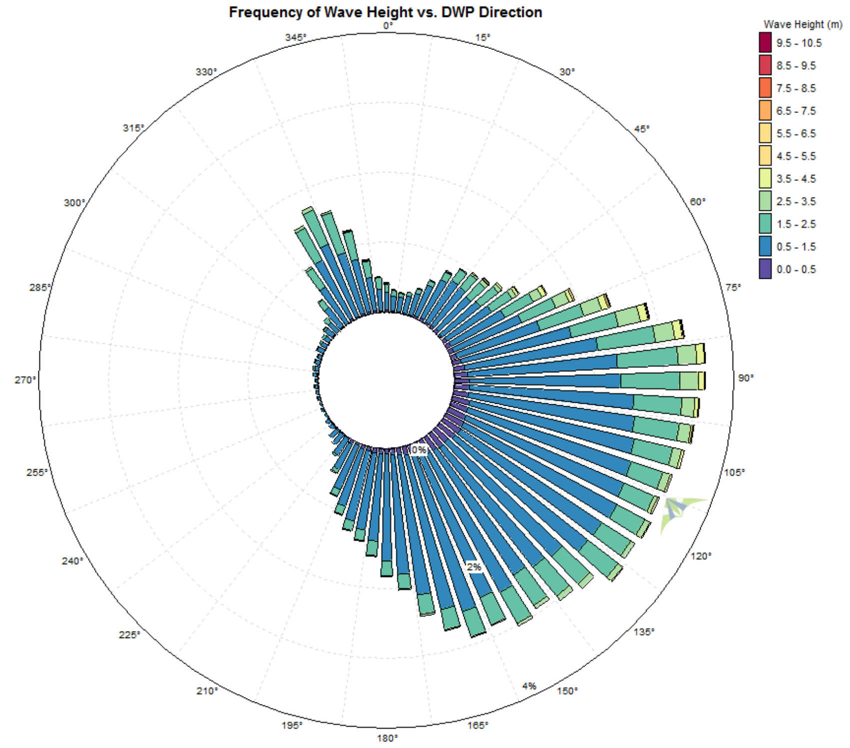


Figure 2-9. Wave Direction Distribution by Frequency and Significant Wave Height, NOAA Buoy 44009 (1997–2021)
(NOAA 2021a)

The NOAA Buoy 44009 wave data, along with third party metocean analyses from A.H. Glenn, have informed most of US Wind's initial concept designs. More detailed review of the wave conditions onsite as they relate to design of the normal wind and atmosphere conditions reflected in the modeled time series at hub height is presented in Appendix I-L1 and Appendix I-L2.

US Wind's Metocean Buoy monitored wave conditions onsite with two instrument packages. US Wind plans to update the characterization of the wave and joint wind-wave site characteristics with those observations, when available. Additionally, long-term, high-fidelity ocean modeling is currently underway to support more detailed preliminary analyses.

2.7 Visibility/Fog

Visibility in the region can occasionally be impaired by fog, precipitation, and haze. During the spring and early summer advection fog can occur via east and southeast winds; which can result when a front holds to the south or the Bermuda High is displaced northward. These instances of fog can be persistent, but often lift somewhat during the day, and more so near the shoreline. Visibilities are most likely to be constrained from December through June. Fog is most likely during April, May, and June when warm air blows over still-cold water and visibilities may drop below 0.5 mile (0.8 km), which is about 3 percent of the time. Visibility of 2 miles (3.2 km) or less is most likely in January and February due to the greater frequency of precipitation, particularly heavy rain and/or snow. Fog is less likely in July, August, and September (NOAA 2021b).

A summary of meteorological conditions and of visibility can be found in Tables 2-8 and 2-9 (see Appendix D of the Visual Impact Assessment [Appendix II-J1] for the complete Meteorological Conditions Report).

Table 2-8. Summary of Meteorological Conditions (2006-2015)

	Winter	Spring	Summer	Autumn	Annual
Days/Year with 1 or More Daylight Observations					
Clear	80	82	87	78	**327**
Foggy	5	7	2	4	**19**
Rainy	36	40	41	38	**155**
Hazy	6	15	19	6	**45**
Cloudy	40	52	48	51	**191**
Days/Year with 50% or More Daylight Observations					
Clear	62	66	74	59	**260**
Foggy	1	<1	0	<1	**1**
Rainy	13	8	4	12	**37**
Hazy	<1	<1	2	<1	**4**
Cloudy	14	16	11	21	**61**
Distribution of Hourly Daylight Observations (%)					
Clear	66	66	71	65	**67**
Foggy	2	1	<1	<1	**1**
Rainy	17	13	10	14	**13**
Hazy	1	3	6	1	**3**
Cloudy	15	17	13	19	**16**
Distribution of Hourly Nighttime Observations (%)					
Clear	63	60	62	57	**60**
Foggy	1	2	<1	2	**2**
Rainy	20	19	18	20	**19**
Hazy	<1	3	5	1	**2**
Cloudy	15	16	14	20	**17**

Table 2-9. Summary of Visibility (2006-2015)

	Winter	Spring	Summer	Autumn	Annual
Days/Year with 1 or More Daylight Observations					
10 nm	78	78	78	74	**309**
20 nm	67	57	52	58	**233**
30 nm	45	35	19	31	**130**
Days/Year with 50% or More Daylight Observations					
10 nm	68	60	55	64	**246**
20 nm	52	37	26	41	**157**
30 nm	25	14	4	14	**57**
Days/Year with 75% or More Daylight Observations					
10 nm	58	44	35	51	**187**
20 nm	39	21	10	25	**95**
30 nm	14	6	<1	4	**24**
Average Daylight Visibility (nm)					
Clear	26	21	17	21	**21**
Foggy	<1	<1	<1	<1	**<1**
Rainy	7	6	6	6	**6**
Hazy	5	4	4	4	**4**
Cloudy	18	15	14	15	**15**
Average	21	17	15	17	**17**
Average Nighttime Visibility (nm)					
Clear	18	13	10	14	**14**
Foggy	<1	<1	<1	<1	**<1**
Rainy	6	5	5	5	**5**
Hazy	5	4	4	4	**4**
Cloudy	14	11	11	12	**12**
Average	15	11	9	11	**12**

2.8 Magnetic Compass Anomalies

The Coast Pilot does not report any Magnetic Compass Anomalies in the vicinity of the Lease area, along the Offshore Export Cable Corridors, or along the Onshore Export Cable Corridors.

2.9 Ice

The Lease area is located in the open ocean of this area of the Atlantic Ocean at a latitude where ice is not a common occurrence. Air temperatures may occasionally stay below freezing long enough that ice may form on the WTG blades, nacelle, tower, work deck, or other components. These events are expected to be rare and short in duration and therefore, related impacts are anticipated to be largely negligible. Where appropriate, US Wind has built in conservative estimates of icing into Project energy projections and O&M planning.

Ice can occur in Indian River Bay during the winter months and may affect the ability to navigate. Floating aids to navigation in Indian River Bay are typically removed during the winter months due to the potential for ice.

2.10 Project Induced Flow Effects

The placement of WTG, OSS, their respective foundations, and other Project components into the offshore environment can influence the flow of air and water around, and in the vicinity of, the structures. Several of these effects merit consideration during Project design, notably scour and wind turbines wakes.

Scour effects and related seabed mobility topics are addressed in Appendix II-A1.

Wake effects are the product of wind turbines extracting energy from the atmosphere, resulting in reduced wind speeds and increased turbulence downstream of individual turbines and the Project as a whole. The magnitude and implications of these wake effects are influenced by numerous atmospheric, ocean, and Project characteristics. These include, but are not limited to: individual turbine performance characteristics, the total number of turbines in a region, inter-turbine and inter-project spacing, atmospheric stability, sea state, and others. The primary effects of wakes within a project and on neighboring projects, are reduced wind speeds and power output, and increased fatigue loading on WTG and foundation components.

US Wind has considered both internal and external wake effects in the design of the Project. For example, the array layout was developed in part based upon optimized energy output from the turbines. Additionally, wake-induced turbulence will be included as an input to the ongoing wind turbine suitability assessment, wind turbine tower design, and foundation design. In all cases, the wake effects will be evaluated with validated wake models embedded in industry-standard energy modeling software packages. Additionally, US Wind's energy production projections will include internal and external wake effects, as well as blockage effects, estimated by qualified 3rd party practitioners.

New offshore wind project structures are estimated to have local and regional hydrodynamic effects and may impact ocean circulation (van Berkel et al. 2020); however, differing industry build-out and metocean conditions in the US necessitate more study on the Atlantic OCS (National Academy of Sciences 2024). Previous studies have shown that the turbines' effects on the wind pattern may cause local upwelling and impact stratification of the water column

(Broström and G. 2008; Paskyabi and Fer 2012). More recent observations do not give clear evidence of similar large scale regional effects (van Berkel et al. 2020). Most of the existing studies are primarily based on models of the wind farms located in the North Sea and have limited observational verification (National Academy of Sciences 2024). In general, the effects of wind turbines on hydrodynamics are difficult to isolate from natural and anthropogenic effects (i.e., climate change) (National Academy of Sciences 2024).

3.0 Geology and Physical Conditions

This section is a summary of the site geology in the Lease area along the Offshore Export Cable Corridors and Onshore Export Cable Corridor 1. Geophysical and geotechnical survey reports are provided in Appendix II-A. The geophysical survey report of the Lease area and export cable corridors conducted in 2021-2022 has been provided in Appendix II-A1. The geophysical survey report of Onshore Export Cable Corridor 1 has been provided in Appendix II-A2.

3.1 Description of Affected Environment

3.1.1 Geological Background

The Lease area lies offshore from the Delmarva Peninsula, which is part of the Atlantic Coastal Plain Province of the eastern United States. The Atlantic coast is a passive margin and therefore a tectonically quiet area with dominant processes related to weathering and erosion. This creates a low relief landscape with thick accumulations of sedimentary deposits. The peninsula overlies a seaward thickening wedge of unconsolidated sediments dating back to Cretaceous time (> 65 million years ago), which are over 2,400 m (7,874 ft) thick near Ocean City, Maryland. Tertiary age (Paleocene-Eocene, 34 – 65 million years ago) marine sediments overlie the Cretaceous deposits (Hobbs, Krantz, and Wikel 2008; Andreasen et al. 2016). A disconformity is present between the Eocene sediments and overlying marine Miocene sands, silts and clays. The top of the Miocene (5 million years old) generally lies between 27 – 43 m (89 – 141 ft) below the Maryland coast.

The Tertiary aged sediments of the Delmarva Peninsula and coastal areas are disconformably overlain by younger Quaternary aged sediments consisting of fluvial sands and gravels, littoral and shallow marine clay, silt, and sand. Fluvial deposits comprise the majority of the Pleistocene age sediments (10,000 - 1.8 million years ago), with upper Pleistocene deposits consisting of barrier, back-barrier and foreshelf origin.

Holocene sediments are typically fine to coarse-grained sands ranging in thickness from less than 1 to 10 m (3.2 to 32.8 ft), are generally deposited in coastal and marsh environments, and are similar to the Pleistocene littoral and shallow marine sediments.

Assateague - Fenwick barrier island is the wave dominated barrier island along the Maryland Coast of the Delmarva Peninsula (CB&I 2014; Oertel and Kraft 1994). Although once connected, a major hurricane in 1933 formed the Ocean City Inlet and separated the two islands. Once the inlet was formed, the inlet was stabilized and is now maintained by the U.S. Army Corps of Engineers (CB&I 2014). Coastal features, such as dune systems, back-bay lagoons and salt marshes, and sedimentary features, such as outwash fans, are typically observed (CB&I 2014).

Indian River Bay, Delaware is located along the eastern shore of the Delmarva Peninsula and is part of the Atlantic Coastal Plain Province (Cross et al. 2013). Indian River Bay is comprised of Holocene age flood tidal delta deposits and lagoon deposits. The flood tidal delta deposits are light-gray to gray, clean to silty, and silty sand and range from well-developed cross-bedding to structureless. Lagoon deposits are generally comprised of medium-grey to dark-grey clayey silt, with rare structures consisting of relic borrows, thin laminae of marsh grass fragments, or very fine sand. The Holocene age sediment deposits are up to 30 feet thick, with the thickest tidal delta deposits located in the eastern portion of Indian River Bay and the thickest lagoon deposits located near the center of Indian River Bay (Wunsch 2012).

Figure 3-1 depicts the soft sediment types found in the Project area.

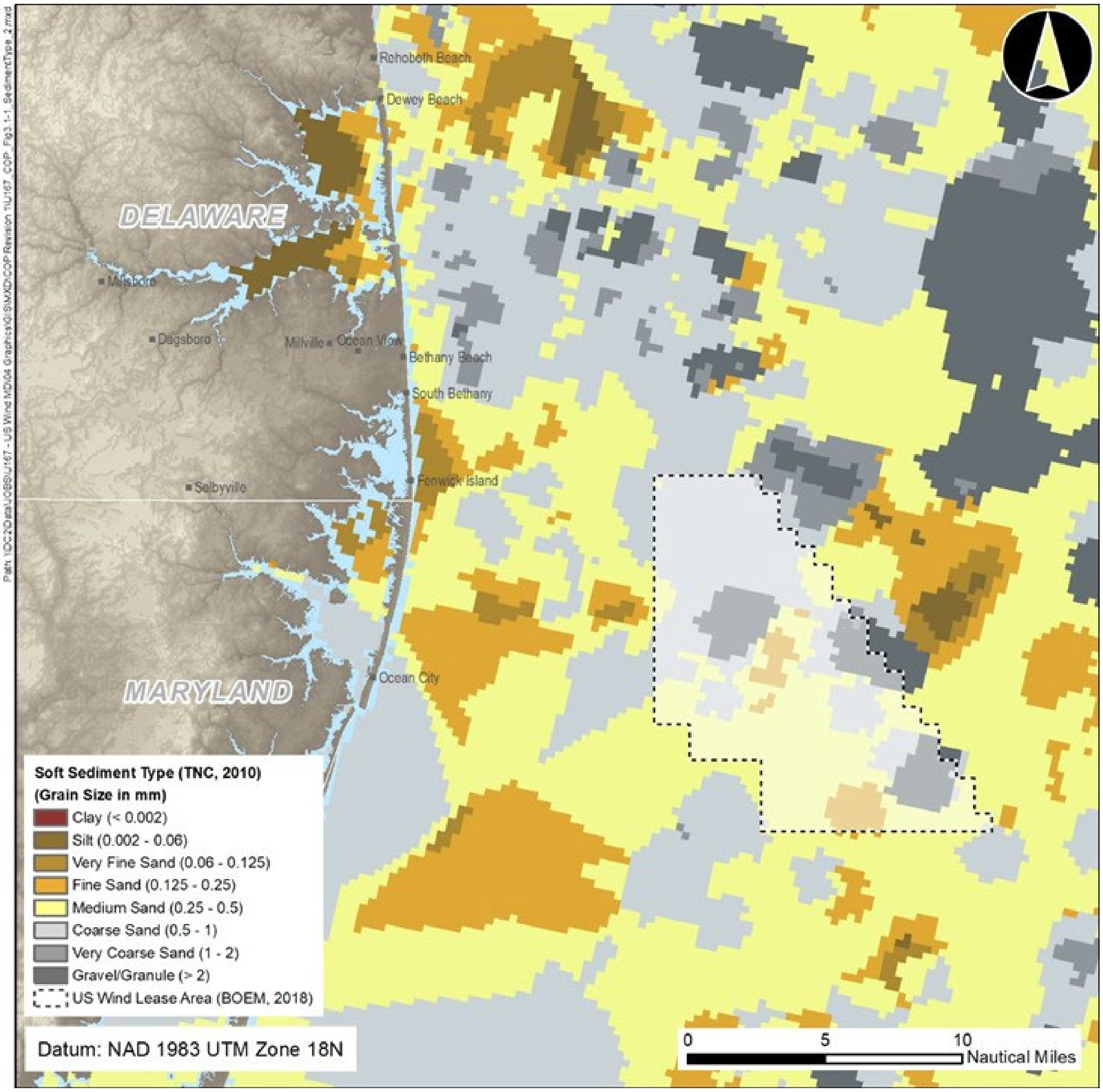


Figure 3-1. Sediment Types

3.1.2 Geotechnical and Geophysical Surveys

Geotechnical and geophysical surveys were conducted in 2013, 2015, 2016, 2017, 2021, 2022, and 2023. The findings of those surveys are summarized below and include surveys of the entire Maryland Wind Energy Area (Maryland WEA) as well as portions of the Lease area and formerly planned offshore export cable route and Onshore Export Cable Corridor 1. Figure 3-2 depicts the Lease area and export cable corridor survey areas.

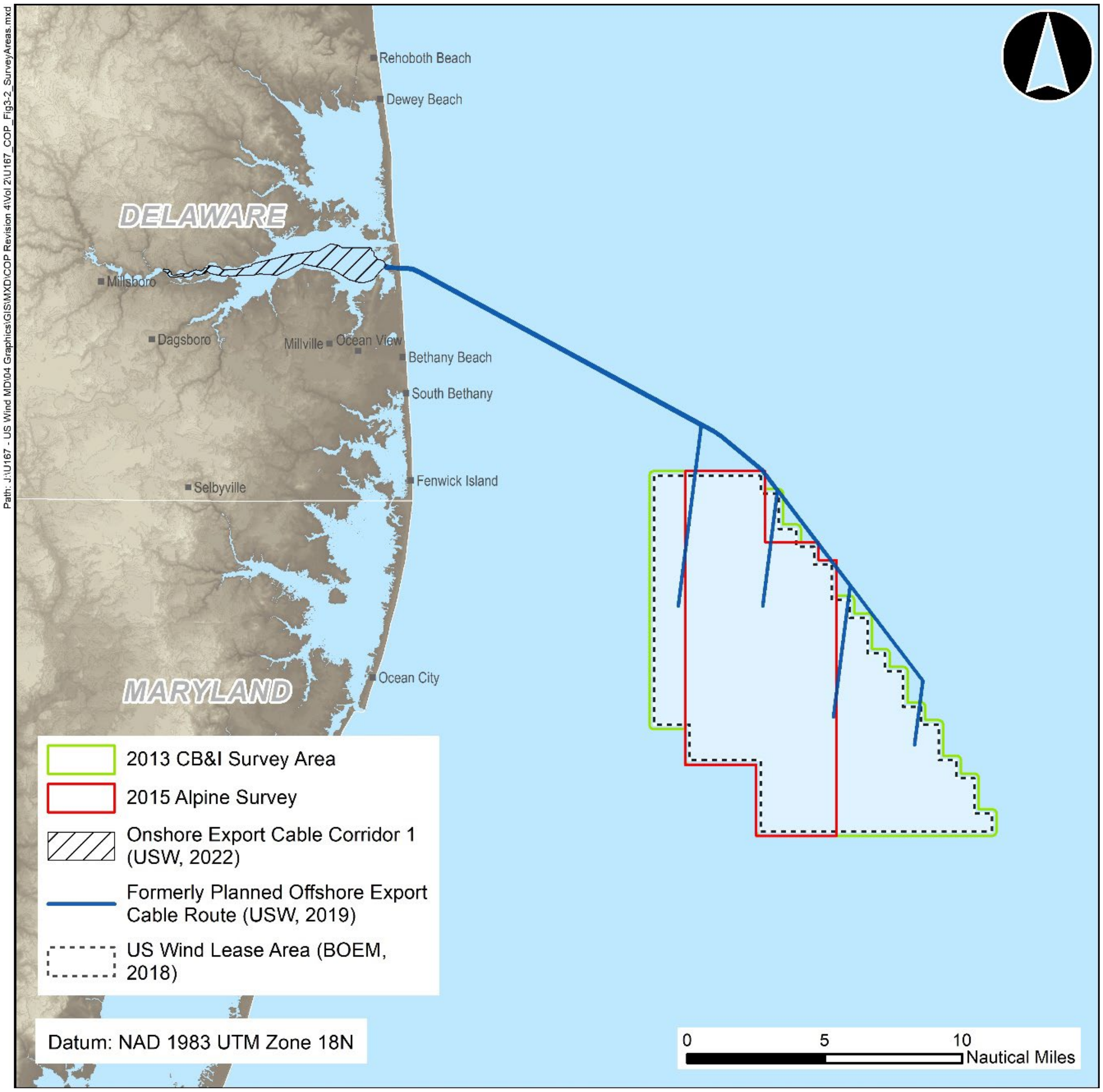


Figure 3-2. Lease Area and Cable Corridor Surveys 2013-2015

2013 CB&I High Resolution Geophysical Resource Survey (CB&I 2014)

In 2013, Coastal Planning & Engineering, Inc. (CB&I) was contracted by the Maryland Energy Administration to conduct a high-resolution geophysical survey of the Outer Continental Shelf (OCS) offshore Maryland in an area designated by the U.S. Department of the Interior as the Maryland WEA. The main objective of the survey was to collect and compile a comprehensive geophysical dataset as well as to identify potential hazards and submerged cultural resources in support of the future development of a large utility-scale wind farm. The surveys consisted of 150 m (492 ft) spaced survey lines together with 900 m (2,953 ft) spaced perpendicular tie lines covering the entire Maryland WEA and a surrounding 304.8 m (1,000 ft) buffer zone. The survey included multibeam hydrographic data, side scan sonar, magnetometer, shallow-penetration chirp sub-bottom profiler, and medium-penetration multi-channel sparker seismic-reflection geophysical systems.

Multibeam hydrographic data collected during the 2013 CB&I geophysical survey show that seafloor elevations in the survey area range from approximately -10 to -45 m (-33 to -148 ft) mean lower low water (MLLW). Data collected with side scan sonar, a chirp sub-bottom profiler, and multi-channel sparker seismic-reflection were analyzed and the results indicate that the bottom material across the survey area is primarily unconsolidated sand with some gravel overlaying a layer of unconsolidated to consolidated muds with occasional organic materials. Analysis of the side scan sonar data and magnetometer data revealed 104 sonar contacts and 1,142 magnetic anomalies, respectively.

Analysis of the data collected using the multi-channel sparker seismic-reflection geophysical system and the chirp sub-bottom profiler indicate that there are three major seismic facies (Unit 1, Unit 2, and Unit 3) present within the Project Area. Unit 1, which ranges between 0 and 10 m (0 and 33 ft) thick, was interpreted as sandy sediments deposited and/or reworked during the Holocene. Unit 2, which was deposited by a combination of fluvial, tidal, estuarine, and marine processes during the Pleistocene, contains a mixture of muds, sands, and gravels. Unit 3, which was interpreted to be Neogene in age, is presumably comprised of coastal and marine sediments with some fluvial or estuarine sediments mixed in.

The CB&I report is provided in Appendix II-A4.

2015 Alpine Marine Geotechnical and Geophysical Survey (Alpine 2015)

In 2015, US Wind contracted Alpine Ocean Seismic Survey, Inc. (Alpine) to undertake high resolution geophysical, geotechnical, and environmental surveys on the OCS within the Lease area to determine site suitability for WTG design and installation. The 2015 survey covered 251 square km (97 square mi) and took place within the Lease area located 21 km (13 mi) offshore of Ocean City, Maryland. Alpine collected side-scan sonar, shallow penetration sub-bottom, and magnetometer data at a 30 m (98 ft) line spacing to acquire bathymetric and geophysical data to supplement the data collected during the 2013 CB&I survey. Geotechnical data was obtained by advancing a geotechnical borehole at the location where the Met Tower was formerly to be installed and six other pre-determined locations, drilling and cone penetrometer test pushing with the acquisition of samples for physical description and laboratory testing, collecting grab samples, and obtaining underwater video/photography at select locations.

A multibeam echosounder was used to collect bathymetric data in this area only, as bathymetric data for the area outside of the Alpine 2015 survey area was obtained during the 2013 CB&I survey. Two surface sediments were identified in the survey area; medium coarse-grained sand, with trace amounts of gravel and fine-grained sand and medium to coarse-grained sand mixed with gravel. Sub-surface sediments are predominantly sands with occasional interlays of clay and gravel. Geotechnical data were compared to shallow penetration sub-bottom data collected during Alpine’s 2015 survey, and with medium penetration sub-bottom data collected during the 2013 CB&I survey. The geophysical and geotechnical data sets correlate well and the three units, Unit 1, Unit 2, and Unit 3, as described above, were identified.

The 2015 Alpine report is provided in Appendix II-A5.

2016 and 2017 Alpine High Resolution Geophysical, Geotechnical, and Environmental Survey (Alpine 2017)

In 2016 and 2017, US Wind contracted Alpine to carry out a marine survey investigation to complete bathymetric, marine high-resolution geophysical, environmental, and geotechnical surveys along the formerly planned offshore export cable route and the majority of Onshore Export Cable Corridor 1. The marine surveys covered an approximate 35 km (22 mi) long route from the substation landfall location near the Indian River Substation located in Dagsboro, Delaware out to the Lease area. Alpine collected bathymetric and geophysical data using a multibeam echosounder, side-scan sonar, a shallow penetration sub-bottom profiler, and a marine magnetometer. Primary line spacing for the offshore portion and the onshore portion of the corridor was 30 m (98 ft) and 15.24 m (50 ft), respectively. An environmental and geotechnical survey was conducted to gather underwater photography and video, benthic grab samples and vibracores. These combined data sets provided the seafloor, bay bottom and sub-surface characterization needed to determine site suitability for the installation of a submarine cable.

Formerly Planned Offshore Export Cable Route

Bathymetry data collected along the formerly planned offshore export cable route indicate that the seafloor dips an average of approximately 1 degree in the offshore direction and seafloor elevations ranged between -2.8 and -31.1 m (-9.1 and -10.2 ft) MLLW. Seabed sediments characterized along this portion of the cable corridor range from silt-clay, sand, gravel, cobbles, and possible small boulders. Side scan sonar data were analyzed and 271 sonar contacts identified, 44 of which are likely of synthetic origin (debris, tires, fishing gear, etc.). The remaining 227 sonar contacts were classified as possible geology. In addition, magnetometer data were analyzed and 178 magnetic anomalies were identified, four (4) of which have corresponding side scan sonar targets.

A total of 14 grab samples and 34 vibracore samples were collected and analyzed along the offshore section of the corridor. The sediments recovered in the grab samples were predominantly fine to coarse-grained sand with some gravel and with occasional cobble. Fine-grained silt-clay was also observed. The vibracore samples recovered silt, clay, peat, organics, sand, and gravel. The core data collected correlates well with the sub-bottom data.

Onshore Export Cable Corridor 1

Bathymetry data collected along the majority of Onshore Export Cable Corridor 1 indicate that the bay bottom is relatively flat and elevation ranged between 0.7 and -9.3 m (2.3 and -30.5 ft) MLLW. Along this portion of the cable corridor, 356 contacts were identified. The majority of the contacts were interpreted as debris or fishing gear and some of the contacts were interpreted as having possible geological origins. In addition, magnetometer data were analyzed and 1,756 magnetic anomalies identified, 59 of which have corresponding side scan sonar targets.

A total of 14 grab samples and 18 vibracore samples were collected and analyzed along Onshore Export Cable Corridor 1. The sediments recovered in the grab samples were predominantly silty-sandy with some medium to coarse sand. The vibracore samples recovered silt, clay, peat, organics, and sand. The core data collected correlates well with the sub-bottom data.

The 2017 Alpine report is provided in Appendix II-A6. The Field Evaluation Report is provided in Appendix II-A7.

2020 McNeilan & Associates Initial, Integrated Geophysical and Geotechnical (G&G) Site Characterization Report (McNeilan & Associates 2020)

In 2020, US Wind contracted McNeilan & Associates to prepare an initial Integrated Site Characterization Report for the Project. The study was based on the geophysical and geotechnical reports described above. These reports, while limited, provide adequate information to:

- Detail the requirements for future G&G surveys and explorations.
- Define the general geologic, seafloor and subsurface conditions that underlie the site.
- Anticipate subsurface layering and its variability.
- Define the types of geohazards that will be most relevant to project development.
- Initiate the ground model development efforts that will be advanced during the different phases of project development.
- Conduct initial foundation design and installation evaluations.

The 2020 McNeilan & Associates report was initially provided in Appendix II-A1.

An updated Integrated Marine Site Characterization Report dated May 2024, has been provided as an updated Appendix II-A1 (see section below).

2021 EPI Combined MEC/UXO Detailed Threat and Risk Assessment and Risk Mitigation Strategy for the OCS-A 0490 Offshore Lease (EPI Group 2021)

In 2021, US Wind contracted EPI to conduct a desk-based threat and risk assessment and management strategy for munitions of explosive concern (MEC) and unexploded ordnance (UXO) for the Lease area and Offshore Export Cable Corridors. The report indicates that the most likely potential for MEC/UXO is within the nearshore Offshore Export Cable Corridors and from vessels sunk by mine action within the Lease area. There is the potential for MEC/UXO across the Lease area, but this was assessed to not be a significant threat.

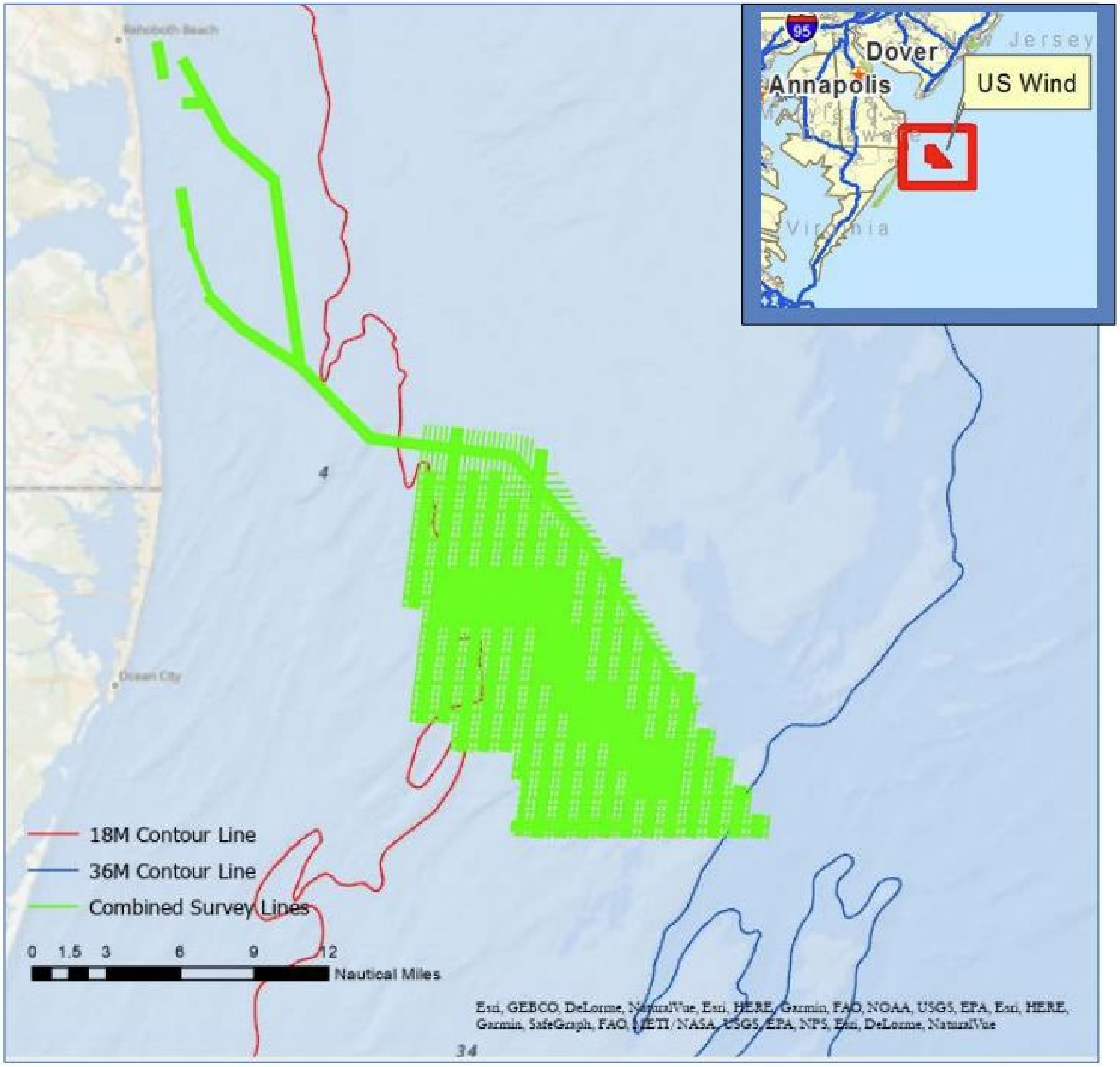
The probability of encountering MEC for this project is considered to be moderate to low. MEC is reasonably expected to be identified during HRG survey activities that include side-scan sonar and a magnetometer array. Smaller items of MEC that may be missed during such surveys are considered of lower risk and the risk may be considered to be As Low As Reasonably Practicable (ALARP). Recommended mitigation measures for reducing the risk of MEC are provided in Volume II, Section 3.3.

The EPI report is provided in confidential Appendix II-A3, most recently revised May 2024.

2021 TDI/Fugro Lease Area and Offshore Export Cable Corridors Survey

The Lease area and Offshore Export Cable Corridors were surveyed in 2021 and 2022 by TDI Brooks International (TDI) and Fugro USA Marine, Inc (Fugro) (Figures 3-3 and 3-4). TDI vessels surveyed from April 2021, to November 2021. Fugro vessels surveyed from December 2021, to May 2022. The survey consisted of three components: geophysical data, shallow geotechnical data, and benthic data. Collected geophysical data from both surveys included side scan sonar seafloor imaging, marine magnetometer measurements, multibeam bathymetry, and seismic reflection data. The bathymetry data from both contractors was combined and can be found in

Figure 3-5. TDI collected geotechnical data consisting of vibracores and cone penetration tests to examine sediment characteristics at depth. The benthic data consisted of grab samples for both infauna and grain size analysis, as well as planview imagery of the grab locations and transect imagery collected using a remotely operated vehicle. The results of the benthic analysis can be found in Appendix II-D4.



Esri, GEBCO, DeLorme, NaturalVue, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, Esri, DeLorme, NaturalVue

Figure 3-3. TDI Offshore Survey Extents

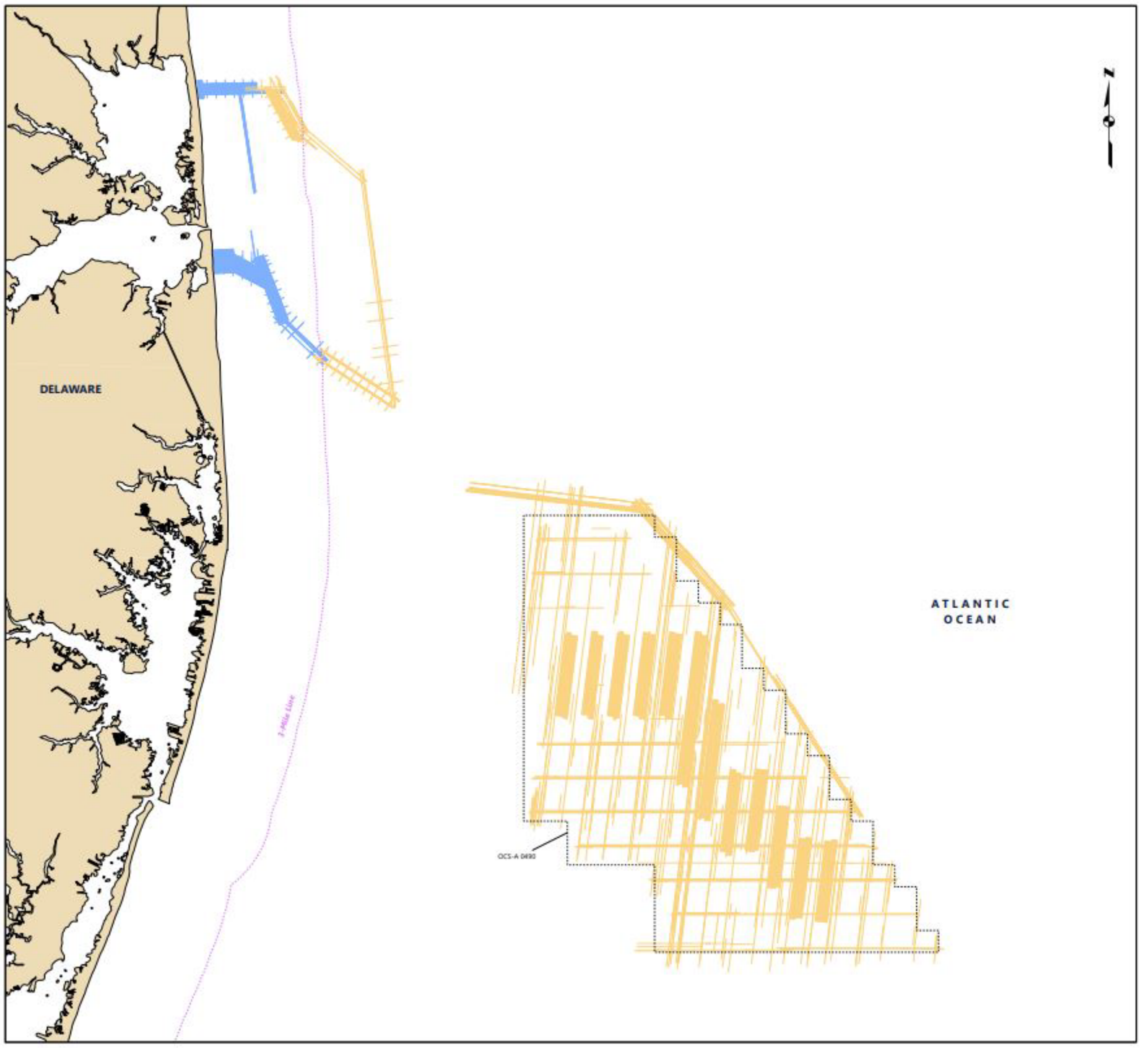


Figure 3-4. Fugro Offshore Survey Extents

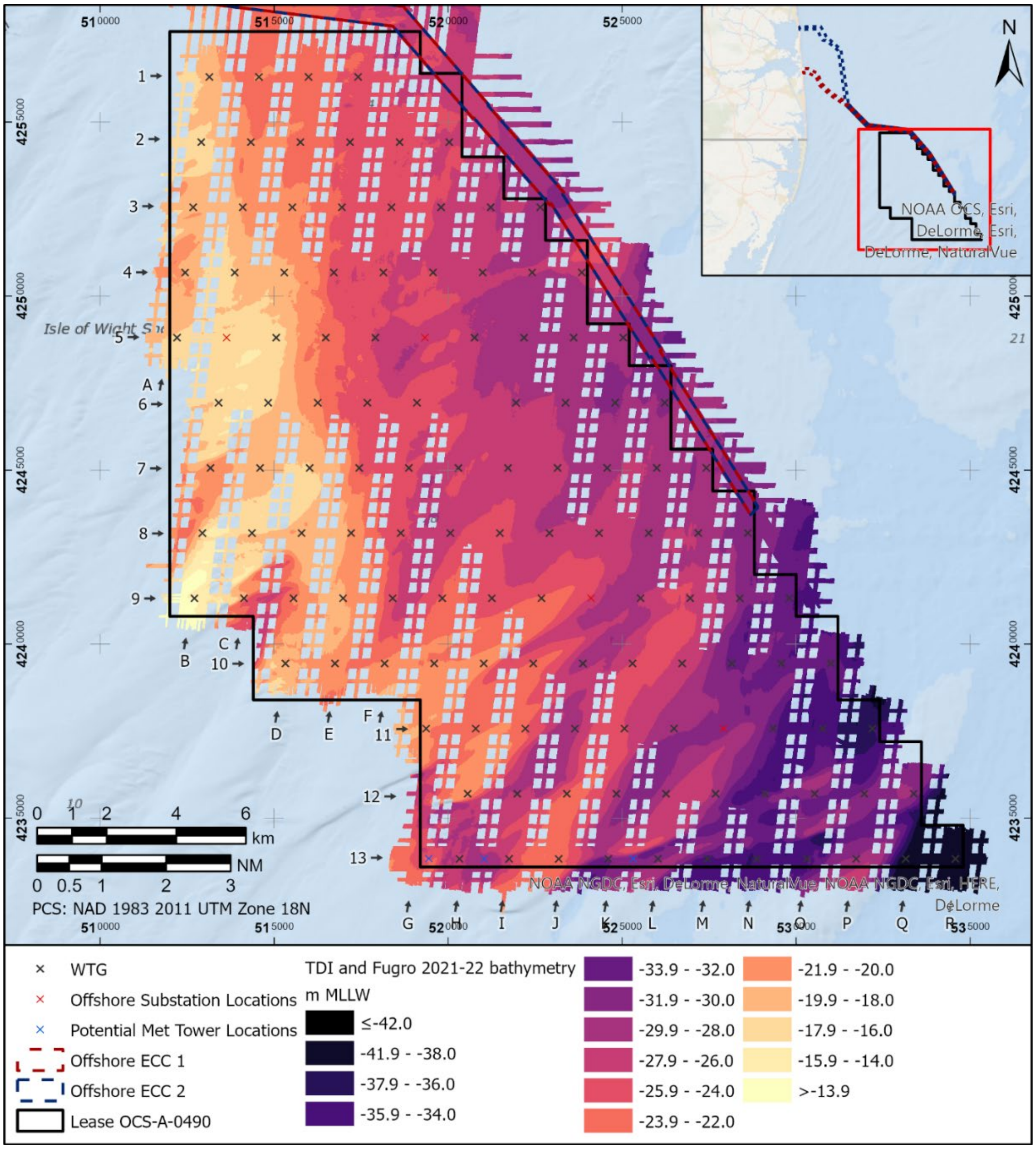


Figure 3-5. Merged Bathymetry Data from TDI/Fugro 2021-2022 Surveys

2022 and 2023 Indian River Bay/Nearshore Atlantic Geotechnical and Geophysical Surveys

Geophysical survey of Indian River Bay was conducted by S.T. Hudson Engineers Inc. (S.T. Hudson) from May to June 2022. Collected geophysical data included side scan sonar seafloor imaging, marine magnetometer measurements, multibeam bathymetry, and seismic reflection data. The area surveyed is shown in Figure 3-6.

Geotechnical surveys in 2022-2023 included Indian River Bay and nearshore Atlantic locations in Delaware state waters, with vibracores (VC), cone penetrometer test (CPTs) and deep CPTs collected. Alpine conducted nearshore Atlantic geotechnical surveys from September through December 2022. Ocean Surveys, Inc. and Sealaska Engineering and Applied Sciences (SEAS) conducted geotechnical surveys in Indian River Bay in September 2022 and January through March 2023, respectively.

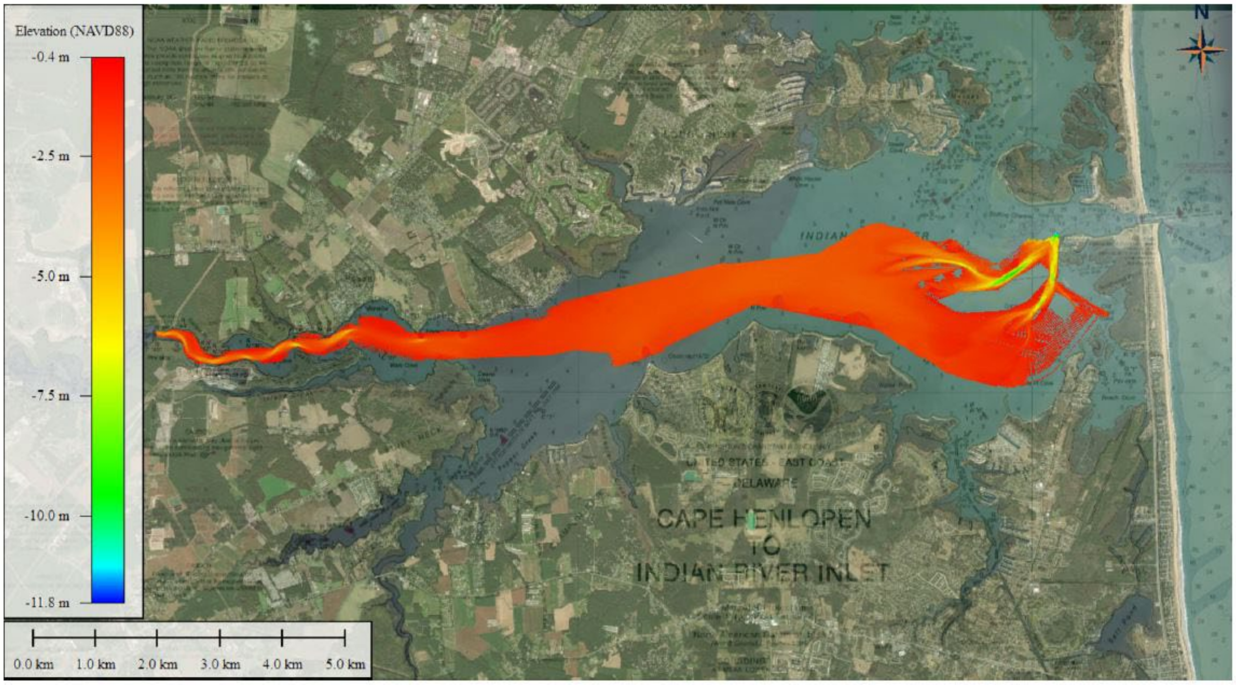


Figure 3-6. ST Hudson Geophysical Survey Extents

2022/2023 Updated Integrated Marine Site Characterization Reports

The 2020 Integrated Site Characterization Report, authored by McNeilan & Associates, was initially provided as Appendix II-A1 with the COP submitted August 2020.

Following the completion of surveys in 2021, 2022, and 2023, US Wind contracted Wood Thilsted to compile revised Integrated Marine Site Characterization Reports. Two separate reports are provided, which describe the conditions in the Atlantic Ocean for the Lease area and Offshore Export Cable Corridors (an updated Appendix II-A1) and for Indian River Bay (Appendix II-A2). The site characterization reports were compiled to fulfil the requirement of 30 CFR 585.626(a)(6) and focused on the following:

- Documentation of all investigations, surveys, in-situ and laboratory testing.
- An analysis of the potential for various hazards and processes.
- Description of sediment layers with geotechnical design parameters.
- Recommendations for mitigating geologic hazards.

Data hard drives of interpreted and raw survey data were submitted to BOEM in January, May, and June 2023, with additional raw data provided January 2024.

3.1.3 Geological Features and Hazards

Lease Area

The geophysical and geotechnical data collected during the CB&I, Alpine, and TDI/Fugro surveys were reviewed for the presence of natural or man-made hazards which could impact development of the site. The following (Tables 3-1 and 3-2) are a summary of the potential hazards from the CB&I and Alpine surveys in the Lease area and the Alpine survey of the formerly planned offshore export cable route and Onshore Export Cable Corridor 1. A number of sonar targets and magnetic anomalies were identified in the survey. Additional information on these geologic features and hazard areas are provided in the referenced reports.

Table 3-1. Lease Area Geological Features and Hazards Summary

	CB&I (2014)	Alpine (2015)	TDI/Fugro (2021)
Shallow Hazards			
Shallow Faults		Not Present	Not Present
Gas Seeps or Shallow Gas		Not Present	Potential to contain biogenic gas. No evidence of seafloor gas expulsion.
Mobile Sediments	Active zones of sediment transport in the southwest corner of the Survey Area	Present throughout the survey area in the form of sand ripples.	Present throughout survey area. Ranging from ephemeral ripples to major sand ridges.
Potentially Unstable Slopes	Steep Slopes approaching 10˚ exist throughout the western and southern section of the Survey Area	Small slopes of 2-5 percent grade are located in the western and southern region of the Survey Area Larger scale sand ridges are present in the western and southeastern part of Survey Area	Average slope throughout the survey areas is 0.5°. Slopes exceeding 2° are within only 1% of the area and confined to the lee sides of major sandwaves and wrecks.
Surface Live Bottoms (Rock exposed at the surface)		Not Present	Not Present

Table 3-1. Lease Area Geological Features and Hazards Summary

	CB&I (2014)	Alpine (2015)	TDI/Fugro (2021)
Buried Channels	Evidence of widespread paleochannels throughout the Survey Area Two highly organized buried channel complexes One large poorly organized buried tidal complex One smaller poorly organized buried channel and tidal complex	Buried paleochannels can be seen throughout the Survey Area	Buried paleochannels can be seen throughout the Survey Area
Scour Features	Active scouring in the southwest corner of the Survey Area	Potential scour area identified in the southwest area of survey, adjacent to sand ridges	Potential scour is possible due to sandy sediment. Scouring confirmed at seafloor obstructions.
Ice Scour of Seabed Sediments	Not Applicable	Not Applicable	Not Applicable
Soft Sediments	Map Series 7: Hazard Anomaly Map (Appendix G)		
Seismic Activity		Not Present	Not Present
Volcanic Activity		Not Present	Not Present
Man-made Hazards			
Cables / Pipelines		Not Present	Not Present
Debris	Magnetic Anomalies - 1,142 Sidescan Sonar Targets - 91	Magnetic Anomalies - 2,717 Sidescan Sonar Targets - 1,468	
Shipwrecks	Eight documented wrecks and obstructions on NOAA Chart 12200 Cape May to Cape Hatteras lie within the Survey Area	Four known shipwrecks and 2 potential wrecks were discovered within the Survey Area	Three wrecks were discovered within the Lease area

Table 3-1. Lease Area Geological Features and Hazards Summary

	CB&I (2014)	Alpine (2015)	TDI/Fugro (2021)
Ordinance		Possible throughout survey area due to active present and past military use in W-386 area	

Table 3-2. Formerly Planned Offshore Export Cable Route and Onshore Export Cable Corridor 1 Geological Features and Hazards – Alpine 2017

Shallow Hazards	
Mobile Sediments	Sand ripples observed along the tidal scour areas just west of the Indian River Inlet
Potentially Unstable Slopes	The seafloor generally dips in the offshore direction with an average slope of approximately 1.0˚ Prominent sand ridges occur along the offshore section of the corridor
Gas Hydrates	Biogenic gas layers were mapped along the onshore portion of the corridor
Buried Channels	Paleochannels were observed within the Survey Area
Scour Features	The bay bottom is relatively flat within Indian River Bay but exhibits areas of tidal scour near the cut banks along the Indian River as well as in areas west of Indian River Inlet
Man-made Hazards	
Cables / Pipelines	The large quantity of magnetic anomalies made it difficult to distinguish any linear patterns from possible cables or pipelines in most of the survey
Debris	Magnetic Anomalies -178 Sidescan Sonar Targets - 271

Formerly Planned Offshore Export Cable Route

The seabed along the offshore portion of the formerly planned offshore cable route alternates between a relatively smooth surface and a more irregular appearance with some sand ridges. Some areas of gravel and boulders were observed as well as evidence of paleochannels.

Onshore Export Cable Corridor 1

The bay bottom along Offshore Export Cable Corridor 1 is relatively flat within Indian River Bay but exhibits areas of tidal scour near the cut banks along the Indian River as well as in areas west of Indian River Inlet. The bay bottom is moderately smooth along the survey corridor with some sand ripples and ridges observed. Intermittent areas of biogenic gas from the breakdown of organic matter in the sub-surface were noted. Table 3-3 summarizes the potential hazards from the ST Hudson survey of Onshore Export Cable Corridor 1 in 2022.

Table 3-3. Onshore Export Cable Corridor 1 Geological Features and Hazards – Wood Thilstead 2023 (Appendix II-A2)

Shallow Hazards	
Shallow Faults	Not Present
Gas Seeps or Shallow Gas	Biogenic gas present in low concentrations. Small depressions present may be related to gas escape.
Mobile Sediments	Features ranging from ephemeral ripples to tidal shoals observed. Seasonal variation is expected. No evidence of slumps, slides, creep, or karst topography. Average slope for Onshore Export Cable Corridor 1 is approximately 0.5°.
Gas Hydrates	Not Present
Surface Line Bottoms, Buried Channels, and Scour Features	No intact or massive rock observed. Buried/infilled channels observed at shallow depths. Scour present within Indian River channel, shoal area tidal channels, and around seafloor debris. Scour patches possible in Indian River Bay. Ice scour is not expected nor observed.
Man-made Hazards	
Cables / Pipelines	Not Present
Artificial Reefs	Not Present
Debris	Debris was observed on the bay floor throughout the area. Future deposition of anthropogenic debris is possible due to marine recreational traffic within the area.
Other	Buoys are present, including ones for navigation. A possible infilled dredging channel has been observed.

3.2 Impacts

3.2.1 Construction

Lease Area

Throughout the construction and installation portion of the Project, sediment will be disturbed and displaced in the Lease area. Pile driving for the WTG and OSS foundations, the installation of scour protection, vessel anchoring, cable installation, and the installation of cable protection will impact the surficial geology within the Lease area. Pile driving will temporarily displace sediment; causing it to become suspended locally in the water column. Scour protection, which may include loose or bagged rocks or stones (Fugro 2011), will be placed atop the sediment around the bases of the WTG and OSS. This process may suspend finer grain sediment; however, any suspended sediment will settle out of the water column and then redeposit nearby on similar sediment type. Installation of the inter-array cables using the jet plow technique will cause a temporary disturbance to sediment, which will be suspended into the water column and then redeposited within, or within the vicinity of, the submarine cable routes. It is anticipated that the cable will be entirely subsurface, but up to 10% may require cable protection in the form of concrete mattresses or similar which would be installed as needed.

Offshore Export Cable Corridors

The offshore export cables will begin at an OSS in the Lease area and extend through the Offshore Export Cable Corridors to the proposed landfall located at the 3 R’s Beach in Delaware (or Tower Road in Delaware as an alternative), where they will cross under the barrier beach and then continue as “onshore export cables” beneath Indian River Bay (or by upland route as an alternative) until landfall near the existing Indian River Substation and Indian River Power Plant.

The offshore export cables will be installed beneath the seafloor using low–impact jet plow technology until they reach the offshore landfall. US Wind will use submarine cables that have electrical shielding and bury the cables in the seafloor, when practicable (Sharples 2011). The installation of the offshore export cables and associated cable protection may impact the surficial geology along the Offshore Export Cable Corridors. The installation will cause a temporary disturbance and sediment will be suspended into the water column and then redeposited within, or within the vicinity of, the Offshore Export Cable Corridors. Dredging, if required, will temporarily displace sediment; however, sediment will be replaced and seabed conditions will be restored to its original condition after the installation of the submarine cables. It is anticipated that the offshore export cables will be entirely subsurface, but up to 10% may require cable protection in the form of concrete mattresses or the equivalent which would be installed where burial depth is not achieved. While placing the concrete mattress over the existing sediment does not modify the sediment, it will increase the seafloor relief in that area.

Horizontal Directional Drilling (HDD) will be used to install the offshore export cable beneath the barrier beach into the transition vault. This process entails installing a gravity cell and drilling a borehole through sediment layers, which avoids disturbing nearshore subtidal, intertidal, and beach or backshore zones and will not degrade the integrity of the stratigraphic units at the shoreline.

Onshore Export Cable Corridor 1

Onshore export cables would then continue along Onshore Export Cable Corridor 1 beneath Indian River Bay and extend to the substation landfall, which is located at the existing Indian River Power Plant. Low-impact jet plow technology will be used as the preferred method to install the cable in Indian River Bay. HDD and gravity cells will be used to transition to and from Indian River Bay to land which is expected to minimize impacts to sediment. Turbidity monitoring will be conducted during construction as required by permitting authorities.

Dredging is anticipated for barge access in the shallow waters of Indian River Bay and to reach the required cable burial depth (see Volume I Section 3.6.3.1.1). Dredging would temporarily displace sediment and would stabilize after installation of submarine cables, consistent with the impacts analyzed in COP Appendix II-B3 and discussed in Section 4.2.1.

Dredging in Indian River Bay is a relatively regular occurrence. Maintenance dredging occurs in portions of Indian River and Indian River Bay to aid navigation, including during the 1990s, 2009, 2010, 2020, and 2022-2023. At the conclusion of the 2013 and 2020 work, dredge material was placed along the shoreline of Delaware Seashore State Park and along the Route 1 highway and bridge, respectively. Additionally, maintenance dredging in Indian River is under consideration, with the material proposed to be used to restore degraded wetlands.

Dredging proposed by US Wind would be considered new dredging, although occurring in the vicinity of past dredging projects, and in some cases overlapping potential maintenance dredging of the Indian River federal channel if it occurs in the future in the approved federal channel.

The installation of the onshore export cables and associated cable protection and dredging may impact the surficial geology along Onshore Export Cable Corridor 1. The installation will cause a temporary disturbance and sediment will be suspended into the water column and then redeposited within, or within the vicinity of Onshore Export Cable Corridor 1. It is anticipated that the cable will be entirely subsurface, but up to 10% may require cable protection in the form of concrete mattresses or the equivalent which would be installed if needed. While placing the concrete mattress over the existing sediment does not modify the sediment, it will increase the bay bottom relief in that area.

3.3 Operations

Scour protection around the WTG and OSS foundations will be monitored and maintained as necessary. This process may suspend finer grain sediment; however, any suspended sediment will settle out of the water column and then redeposit nearby on similar sediment type.

The submarine cables will be installed beneath the seabed; therefore, the operation of the submarine cables will not impact the surficial geology. Maintenance of the submarine cables and cable protection would include periodic inspections of the offshore and onshore export cables as well as inter-array cables. Buried submarine cables may be damaged by contact with vessel anchors or fishing trawls dragging over or being dropped upon the cable line (Sharples 2011). Cables can also become exposed due to scour, placing the cable at greater risk of damage (Sharples 2011). In the event of damage occurring to a cable, processes similar to those used during construction and installation would be utilized to expose, repair, and rebury the cable. This activity may cause local sediment displacement and temporarily suspend sediment in the water column. Suspended sediment will settle out of the water column and be redeposited within, or within the vicinity of, the submarine cable corridor.

3.3.1 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. During decommissioning activities, sediment will be temporarily suspended into the water column and then redeposited nearby. During cable removal, some change to the seafloor morphology or relief may occur. In addition, removal of scour protection and cable protection may result in a surficial change from hard bottom materials, rock or stone to a finer grain sediment. Overall, the decommissioning would result in a short term, localized impact.

3.4 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on geological resources.

Geological

- Select suitable geological locations for the installation of the WTG, OSS and Met Tower foundations and design foundations appropriate to geological conditions.
- To the greatest extent practicable, select areas with suitable seabed conditions for cable installation during cable route planning.
- Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable.
- Minimize sediment disturbance by utilizing the best available technologies to achieve deep burial of submarine cable into a stable sediment layer (i.e. jet plow technology, HDD, gravity cells, etc.).
- Minimize the amount of scour protection required.

MEC/UXO

- Prior to construction, analyze survey data at installation locations to identify potential MEC/UXO and plan avoidance in line with industry best practices. US Wind would avoid MEC/UXO through micro-siting, and if avoidance is not possible, by lifting and shifting a MEC/UXO. US Wind is not proposing detonation or deflagration of UXO, or disposal at particular sites.
- Prepare an MEC/UXO Emergency Risk Management Plan prior to construction.
- Prior to construction activities, provide an MEC/UXO awareness briefing to vessel crews.

4.0 Water Quality

4.1 Description of Affected Environment

The Project area includes both open marine waters and inland waters. Marine waters include the Atlantic Ocean within the Lease area and along the Offshore Export Cable Corridors between the Lease area and the Delaware shoreline. Marine waters also include coastal waters that could be affected by Project activities (e.g., traversed by vessels during Project installation, operation, decommissioning, and/or non-routine events). Inland waters include waters of the Indian River and Indian River Bay along Onshore Export Cable Corridor 1 from the Delaware coast to the proposed landfall at the Indian River Substation. Indian River Bay is part of the coastal watershed locally known as the Inland Bays, which also includes Rehoboth Bay and Little Assawoman Bay. Rehoboth Bay and Little Assawoman Bay are located outside of the Project area.

Water quality is controlled primarily by the anthropogenic inputs of land runoff, land point source discharges, and atmospheric deposition from discharges to the air. With increasing distance from shore, oceanic circulation patterns play an increasingly larger role in dispersing and diluting anthropogenic contaminants and determining water quality.

The condition of mid-Atlantic estuaries and coastal waters is fair to good in most locations, as measured by the National Coastal Condition Assessment water quality index (USEPA 2016). Among the water quality analytes examined, phosphorus and chlorophyll (algal productivity) were more likely to be rated as fair, while nitrogen, dissolved oxygen, and water clarity were predominantly rated as good. Coastal waters in the mid-Atlantic region have improved with regard to overall water quality since 2001 (USEPA 2016). The most consistent gains were observed in dissolved oxygen and water clarity.

4.1.1 Lease Area and Offshore Export Cable Corridors

Offshore water quality in the mid-Atlantic region is generally good and recent assessments have found no major indications of poor sediment or water quality. The region generally exhibits low nutrient concentrations and good dissolved oxygen and water clarity measurements (USEPA 2016). The 2006 mid-Atlantic Bight assessment found there were no major indications of poor sediment or water quality and that the dissolved oxygen, sediment contaminants, and sediment total organic carbon (TOC) component indicators were rated good throughout the survey area (USEPA 2012). Additionally, the National Oceanic and Atmospheric Administration (NOAA) rated sediment contaminants and sediment TOC component indicators as good (Balthis et al. 2009).

Within state waters along the Offshore Export Cable Corridors, the Delaware Surface Water Quality Standards (7 DE Admin Code 7401) classify waters of the Atlantic Ocean as suitable for industrial water supply, primary contact recreation, secondary contact recreation, and fish, aquatic life, and wildlife habitat. Along Delaware’s Atlantic coast, stormwater is the main source of pollutants, although water quality exceedances at beaches are rare (USEPA 2016).

Salinity, Temperature and Dissolved Oxygen

Deeper offshore waters of the Offshore Export Cable Corridors and Lease area appear to demonstrate little variation in salinity and temperature from location to location. However, vertical variation in these parameters does occur on a seasonal basis when the water column stratifies. This is supported by conductivity, temperature, and depth (CTD) cast data from numerous survey and research cruises within the Lease area presented on the World Ocean Database (World

Ocean Database 2021). Specifically, stratification typically reaches a maximum in the summer when surface waters are warmer and somewhat less saline than bottom waters (Table 4-1). This is followed by a turnover between September and October that results in a well-mixed and more uniform vertical salinity and temperature profile that lasts into the following spring.

Table 4-1. Five years (2014 – 2018) of CTD data from the Lease Area and Adjacent Waters Summarized by Season

Season	Depth (m)	Temperature (°C)			Salinity (PSU)		
		Min	Max	Mean	Min	Max	Mean
Spring	1	1.92	17.80	9.03	29.51	36.11	32.39
	20	4.14	12.86	8.33	31.31	35.63	33.25
	30	4.44	11.93	8.25	31.98	35.53	33.69
Summer	1	22.49	27.27	25.10	30.24	32.00	31.60
	20	10.00	18.62	14.04	32.09	33.16	32.46
	30	8.09	10.47	9.52	32.59	33.19	32.78
Fall	1	13.19	27.84	21.71	29.65	33.58	31.99
	20	10.97	26.11	18.02	31.01	35.46	33.02
	30	9.91	21.18	16.15	32.19	35.10	33.39

Source: World Ocean Database 2021

Additional CTD data were collected during benthic surveys conducted within the Maryland WEA in July 2013. The results from these surveys confirmed the presence of a strongly stratified water column. Coincident with this stratification was a reduction in dissolved oxygen from supersaturated conditions near the surface to less well-oxygenated (near 80% saturation) waters at the bottom. Water quality varied little horizontally, although a north-to-south gradient in the depths of the stratified layers was apparent (Guida et al. 2017).

The shallow coastal marine waters near the Offshore Export Cable Corridors are generally well-mixed, as indicated by salinity, temperature, and dissolved oxygen profiles. Scott and Wong (2012) collected water quality measurements in Delaware's Atlantic coastal waters as part of a study to characterize potential sand borrow areas. Over the course of this study, little to no stratification was observed at these locations, indicating a well-mixed water column. Salinity ranged from approximately 27 practical salinity units (psu) to almost 31 psu, while dissolved oxygen ranged from approximately 10 milligrams per liter (mg/L) to 12 mg/L (USEPA 2016).

Turbidity/Suspended Solids

The Lease area and adjacent coastal waters along the Offshore Export Cable Corridors are characterized by sand ridges and troughs that are oriented along a generally southwest to northeast axis (CB&I 2014; Conkwright, Van Ryswick, and Sylvia 2015). The sand ridges have a complex morphology that is superimposed with smaller scale bedforms (sand waves). This is suggestive of active sediment transport with frequent sediment mobilization, resuspension, and deposition occurring due to tides, currents, and storm activity. Along the Offshore Export Cable Corridors, wave action may also affect sediment transport in water depths shallower than approximately 20 m (66 ft). During these periods of naturally induced sediment transport, short-term increases in turbidity affecting water quality may occur.

Detailed studies of suspended sediment concentrations in the marine waters of the mid-Atlantic indicate turbidity can vary by an order of magnitude at a single location over time, from less than one mg/L to several hundred mg/L in federal waters. Higher values are typically associated with storm events (Louis Berger Group Inc. 1999).

An offshore sediment transport modelling study has been provided as Appendix II-B2. This study addresses turbidity and total suspended solids from the construction phase along Offshore Export Cable Corridor 1. Turbidity and total suspended solids from construction along Offshore Export Cable Corridor 2 were assessed in Addendum 1 of Appendix II-B2. Addendum 2 of Appendix II-B2 provides sediment transport modeling results for the proposed trailing suction hopper dredging (TSHD) that may be needed to prepare the seafloor for construction at each of the four proposed OSS locations.

Sediment

Because the state of Delaware has issued guidelines for classifying potential ecological impacts of sediment contamination, a field investigation was conducted within Delaware state waters along the formerly planned offshore export cable route in September 2016 for the purpose of collecting and analyzing environmental sediment core samples, as illustrated in Figure 4-1. Six environmental vibracores were collected and sampled for bulk physical and chemical properties. Samples were predominantly medium-fine-grained sand and silt, contained little organic matter (0.3-3.8%), and had bulk densities of 1.3 – 2.0 grams per cubic centimeter (gm/cm^3) (81.4-127.8 pounds per cubic feet (lbs/ft^3)).

Of the six cores collected along the formerly planned offshore export cable route, only one sample from one core exceeded a Delaware Ecological Marine Sediment Screening Level (DNREC 2018b). Sample VC-A-04-S1, collected at the sediment surface approximately 1 nautical mile offshore, exceeded the screening levels for arsenic and nickel, as well as the NOAA effects range-low (ERL) level for nickel. Arsenic is ubiquitous in the environment at low concentrations (1-40 milligrams per kilogram (mg/kg)), and is transported through natural phenomena such as erosion as well as through human activity, including the use of pesticides and as waste from metal refining processes (Tchounwou et al. 2014). Nickel is also a commonly encountered heavy metal that is widely used in the manufacturing of stainless steel and batteries.

Complete results of the sediment sample analysis are provided in Appendix II-A7.

US Wind is examining Offshore Export Cable Corridors 1 and 2. Approximately 50 vibracore locations were sampled during the summer of 2021. The resulting data has been provided in the geophysical survey report of the Lease area and export cable corridors conducted in 2021 as Appendix II-A1.

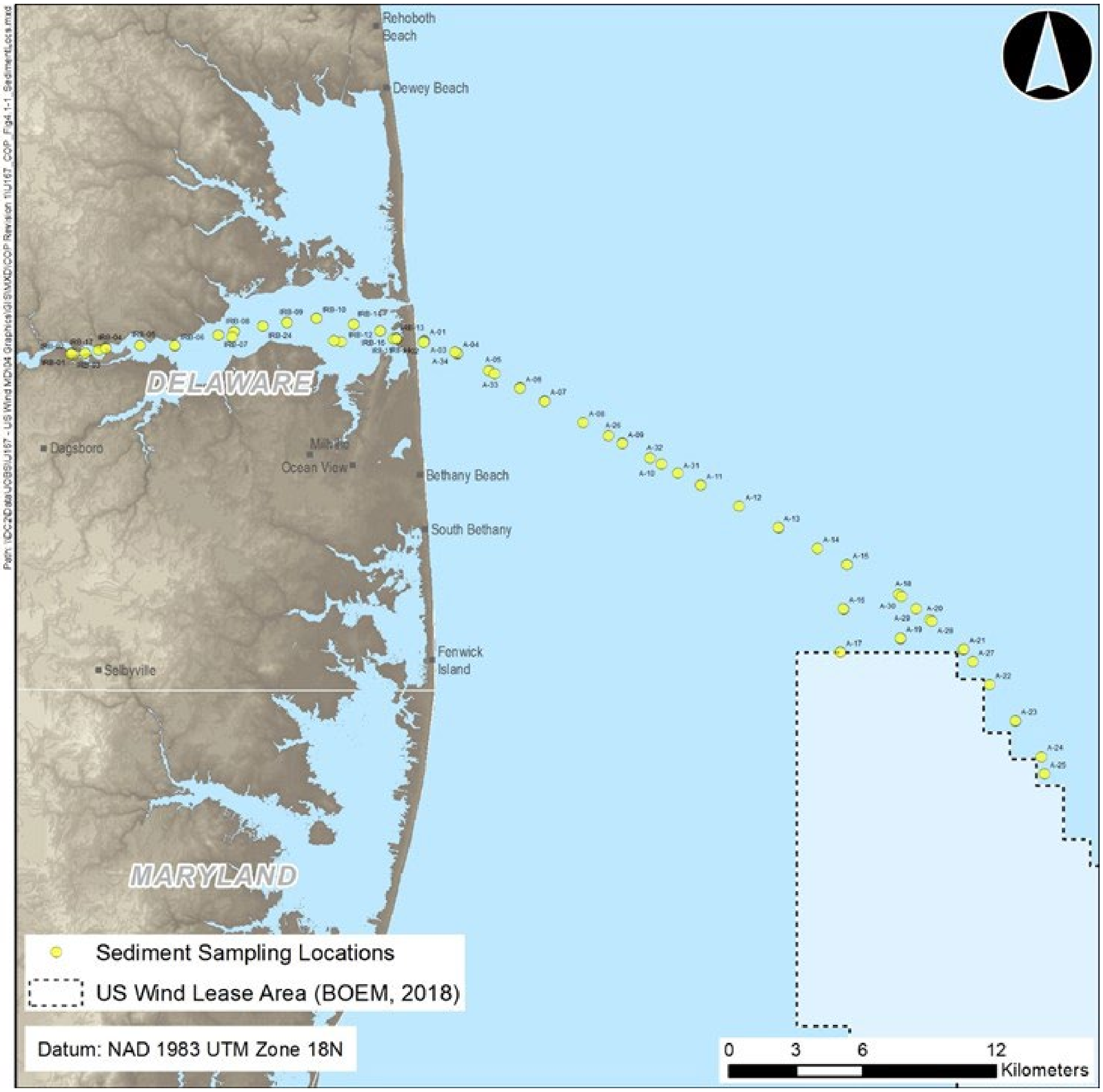


Figure 4-1. 2016 Sediment Sampling Locations

4.1.2 Onshore Export Cable Corridor 1

Onshore Export Cable Corridor 1 traverses Indian River Bay and estuarine portions of the Indian River. The Delaware Surface Water Quality Standards (7 DE Admin Code 7401) classify both of these waterbodies as suitable for industrial water supply; primary contact recreation; secondary contact recreation; and fish, aquatic life, and wildlife habitat. Parts of Indian River Bay are also classified as Harvestable Shellfish Waters. Additionally, both Indian River Bay and Indian River have been designated as waters of Exceptional Recreational or Ecological Significance.

Despite these water quality classifications, Delaware's 2020 *Combined Watershed Assessment Report* (DNREC 2020a) lists both Indian River and Indian River Bay as impaired. Water quality impairments include bacteria, nutrients, temperature, and total suspended solids.

Salinity, Temperature and Dissolved Oxygen

According to data available from the Delaware Water Quality Portal monitoring station buoy, salinity in Indian River Bay ranges from approximately 18 to 34 psu and is typically greatest from July to October. Indian River Bay exhibits a strong salinity gradient defined by three salinity segments: oligohaline, mesohaline, and polyhaline/euhaline. Onshore Export Cable Corridor 1 primarily traverses the polyhaline portion of Indian River Bay, where salinity exceeds 18 psu and approaches marine conditions. The polyhaline zone includes the onshore landfall and most of Onshore Export Cable Corridor 1 to the west. Salinity gradually declines toward the substation landfall, which is located in the mesohaline zone of the Indian River. In this zone, salinity regularly falls below 25 psu, but generally remains above 15 psu (DNREC 2023a; DEMAC et al. 2017).

In Indian River Bay, water temperature ranges from approximately 14 degrees Celsius (°C) (34°F) in the winter to the mid-20s°C (mid-70s°F) in the summer, with occasionally colder or warmer conditions. Shallow tidal creeks along the periphery of Indian River Bay may experience colder temperatures in the winter and warmer temperatures in the summer (DNREC 2023a; DEMAC et al. 2017).

Dissolved oxygen levels in Indian River Bay range from 5.0 - 13 mg/L in the spring and from to 3.5 - 8.9 mg/L in the summer, which is typically when dissolved oxygen drops to its lowest levels (DNREC 2023a; DEMAC et al. 2017). Adequate dissolved oxygen levels are critical to the survival of fish and other marine organisms. Hypoxic (low oxygen) events are rare but may have a significant impact on finfish and commercially harvested shellfish when they occur. In Indian River Bay, dissolved oxygen levels are typically adequate to support aquatic life year-round (DCIB 2016).

Turbidity/Suspended Solids

For tidal portions of Indian River Bay, the state water quality criterion for total suspended solids (TSS) is a seasonal average of 20 mg/L from March 1 to October 31. TSS data collected from Indian River Bay since 2000 indicate a range in TSS from approximately 5 mg/L to more than 184 mg/L over the course of the year (DNREC 2023a). Water clarity is too low to support the growth of submerged aquatic vegetation in Indian River and most of Indian River Bay, although it generally improves from west to east (DCIB 2016).

A sediment dispersion analysis in Indian River Bay has been prepared and is provided as Appendix II-B1. The analysis identified three potentially sensitive receptors:

- Tidal wetlands along the shoreline of Indian River Bay (sensitive to suspended sediment and deposition).
- Shellfish harvesting areas (sensitive to suspended sediment and deposition).
- The cooling water intake at the Indian River Power Plant (sensitive to suspended sediment). The Indian River Power Plant may soon be retired.

Sediment transport modelling for the Indian River Bay is provided in Appendix II-B3, which indicates that the majority of suspended sediments will settle out of the water column following the completion of jet plowing fairly quickly.

The three potentially sensitive receptors are shown in relation to the maximum suspended sediment concentration (Figure 4-2) and sediment deposition (Figure 4-3). Impacts to these receptors from suspended sediment is expected to be temporary and localized.

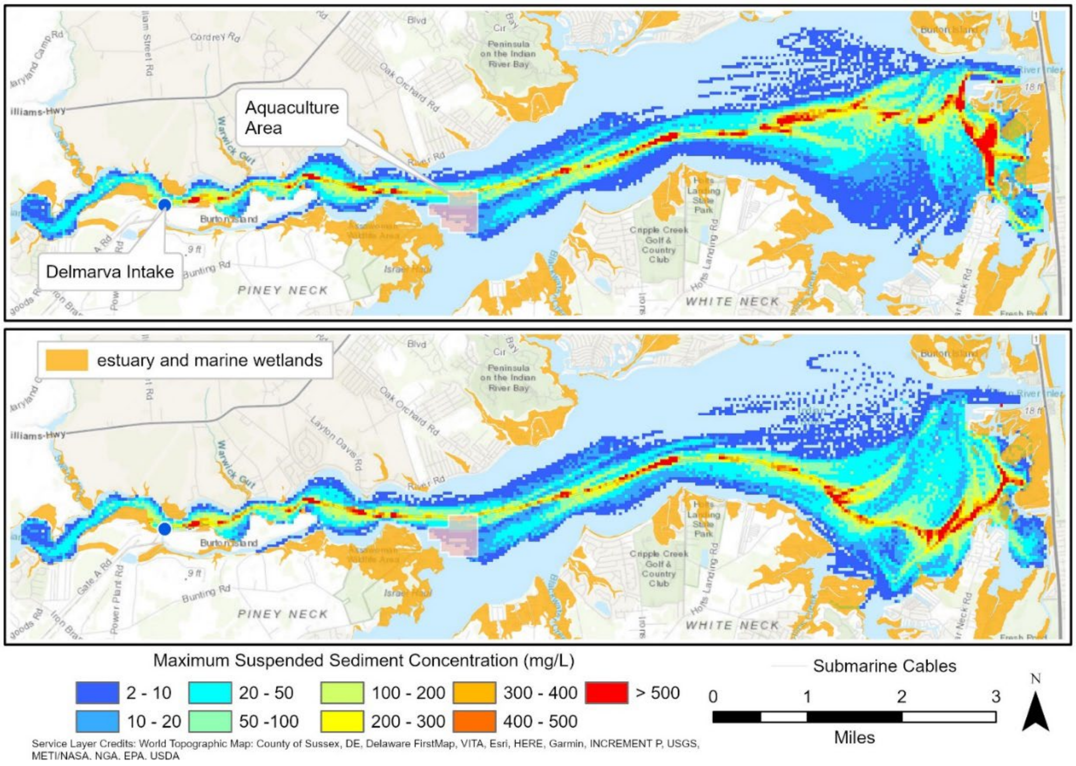


Figure 4-2. Sensitive Receptors Relative to the Maximum Suspended Sediment Concentration

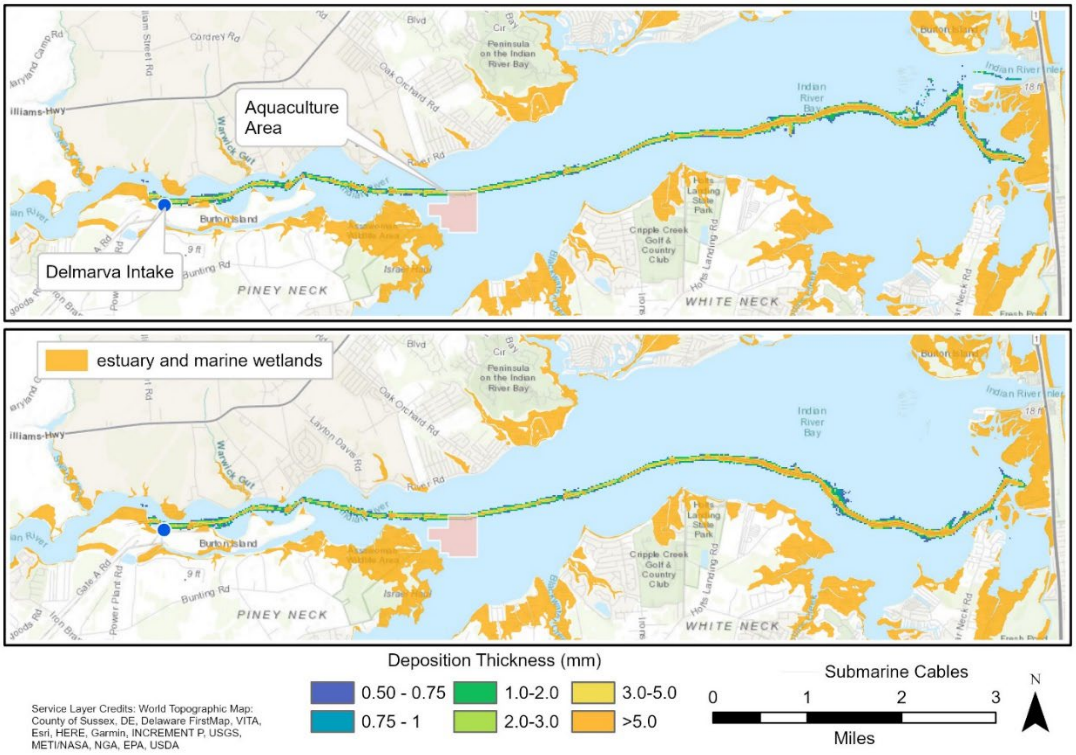


Figure 4-3. Sensitive Receptors Relative to Sediment Deposition

Sediment

US Wind 2017 Sediment Survey

A field investigation was conducted along the Onshore Export Cable Corridor 1 in October 2017 for the purpose of collecting and analyzing environmental sediment core samples, as illustrated in Figure 4-1. Seventeen environmental vibracores were collected from Indian River Bay. Samples were predominantly medium-fine-grained sand and silt, contained little organic matter (0.6-57%), and had bulk densities of 1.0 – 1.7 gm/cm^3 (60.5-107.4 lbs/ft^3). Of the samples analyzed from these cores, fifteen exhibited concentrations of select target analytes that exceeded one or more of the Delaware Ecological Marine Sediment Screening Levels (DNREC 2018b).

Two samples (VC-IRB-05-S2 and VC-IRB-08-ALT-S2) exceeded the screening levels and threshold effect levels (TELs) for one or both of the polycyclic aromatic hydrocarbons (PAHs) acenaphthene and naphthalene (Buchanan 2008). However, since the detected PAH concentrations were not significantly elevated (detected concentrations less than twice the screening levels) relative to the screening levels and these two samples exhibited the highest TOC results at 31% and 25%, it is anticipated that these contaminants are bound to the organic materials and would not become more available to aquatic organisms as a result of the proposed Project. Furthermore, the detected PAH concentrations did not exceed screening values that are more indicative of adverse biological impacts, such as probable effect levels (PELs) (Buchanan 2008).

Thirteen samples exceeded the screening levels for metals (arsenic and/or nickel), although concentrations were at or below 12 mg/kg for arsenic and 23.8 mg/kg for nickel. Exceedances of the Delaware Department of Natural Resources and Environmental Control (DNREC) screening levels were detected in eleven of the samples for arsenic and thirteen of the samples for nickel. However, the following observations were also made regarding the presence of arsenic and nickel in sediments of Indian River Bay:

- These heavy metals are widespread within the shallow sediments in Indian River Bay. Arsenic and nickel are also the only two heavy metals that exceeded ERL levels in sediment samples that were previously collected during an assessment of the mid-Atlantic Bight in 2006 (Balthis et al. 2009).
- The mean concentration from all of the sediment cores for both of these heavy metals (5.92 mg/kg - arsenic; 12.70 mg/kg – nickel) is below the applicable DNREC screening levels and TELs.
- Detected heavy metal concentrations did not exceed screening values that are more indicative of adverse ecological impacts, such as PELs, (Buchanan 2008).

Complete results of the sediment sample analysis are provided in Appendix II-A7. US Wind will conduct additional sediment sampling in 2023.

Indian River Dredging Project: Analysis of Chemical Contaminants in Sediments (2020b)

In September 2019, DNREC collected ten sediment cores within Indian River to evaluate the potential environmental risk associated with a proposed maintenance dredging project in the federal channel (D.D.o.N.R.a.E.C. DNREC 2020b). Of the 40,000 cubic yards of proposed dredged material, about 23,000 cubic yards was proposed to be placed in a previously constructed upland confined disposal facility (CDF) near the project site. The remaining 17,000 cubic yards was proposed for beneficial reuse to restore/create wetlands owned by the Town of Millsboro.

The ten sediment cores collected by DNREC were composited into two samples, a surface sample and a subsurface sample. Polychlorinated biphenyls (PCBs) were detected in both surface and subsurface composite samples. Total PCB levels were not significantly different between the two samples (D.D.o.N.R.a.E.C. DNREC 2020b). Despite the presence of PCBs in the sediment samples, toxicity to aquatic life due to PCBs was not expected. Furthermore, neither the surface nor subsurface sample PCB results exceeded DNREC Soil Screening Values for protection of human health.

Several semi-volatile organic compounds (SVOCs) were detected in the sediment samples (D.D.o.N.R.a.E.C. DNREC 2020b). However, none of the SVOCs detected exceeded their compound specific Equilibrium Partitioning Sediment Benchmarks (ESBs) so potential toxicity to aquatic life from SVOCs was not expected. Furthermore, neither the surface nor subsurface sample SVOC results exceeded the applicable DNREC Soil Screening Levels for protection of human health.

Metals were also present in the sediment samples. However, toxicity to aquatic life from dredging activities due to metals was not expected and the potential toxic impact to humans was considered low based on a comparison of the analytical results with the applicable Delaware Screening Values. Estimated arsenic concentration exceeded the Delaware chronic toxicity standards for surface water but were within the range of sediment values detected regionally within the Delaware Inland Bays (D.D.o.N.R.a.E.C. DNREC 2020b).

Organochlorine pesticides were not detected in either of the sediment composite samples at concentrations exceeding analytical detection limits.

Overall, the results of the DNREC (2020b) study on sediment contamination within Indian River Bay were consistent with the results of the 2017 survey work completed by US Wind (see Appendix II-A7).

US Wind 2023 Sediment and Surface Water Survey

US Wind performed additional sediment and surface water sampling surveys to assess impacts to ecological and/or human health associated with the proposed dredging in Indian River Bay, in response to a request from DNREC. Mercury was the only DNREC HSCA Screening Level exceeded for the surface water samples. However, the measured mercury concentrations were below the Delaware chronic and acute water quality criteria (WQC); therefore, no adverse impacts are expected. The human health evaluation indicated that thallium was the only constituent in the sediment samples with a concentration higher than its soil screening level. Further evaluation concluded that even when using the most conservative, default exposure assumptions, the measured thallium concentrations were below both the DNREC and USEPA thresholds for potential adverse human health effects.

The measured metals, mercury, and polychlorinated biphenyls (PCBs) concentrations did not exceed the DNREC screening levels. Arsenic was the only inorganic above the screening levels for marine surface water but is unlikely to result in adverse effects. Two semi-volatile organic compounds (SVOCs) exceeded the screening levels, however, further analysis determined that potential toxicity to aquatic life is unlikely. There is negligible potential for adverse effects from dioxins in the sediments on aquatic life. Per- and polyfluoroalkyl substances (PFAS) were infrequently detected and impacts are not considered to be significant or have adverse effects on aquatic life.

Dredged material placed in an upland disposal site would result in negligible potential for adverse effects based on the results of this analysis.

The report discussing the results of this work is provided as Appendix II-A8 and is consistent with the results of the 2017 survey work completed by US Wind (see Appendix II-A7).

Nutrients

Both nitrogen and phosphorus pollution are considered to be problematic in the Inland Bays watershed. DNREC conducted a TMDL analysis for nitrogen and phosphorus in Indian River and Indian River Bay in 1998 (DNREC 1998) and introduced a pollution control strategy (DCIB 2016). The majority of the pollutant reductions proposed in the plan targeted agriculture, because it is the dominant land use in the Inland Bays watershed (DCIB 2016). However, conversion of agricultural lands into developed areas has been occurring at a rapid pace since the plan was developed (DCIB 2016), making stormwater runoff an increasingly important driver of nutrient concentrations in the watershed.

A number of point sources have historically discharged nutrient pollution into Delaware's Inland Bays, but all of the significant sources of nutrient pollution have since been eliminated. The Town of Millsboro removed its wastewater discharge from the Indian River in 2015 (DCIB 2016), and the City of Rehoboth Beach rerouted its wastewater discharge from an outfall on Rehoboth Bay to an ocean outfall in 2018 (Peikes 2018). Of the thirteen nutrient pollution sources originally identified, only one small point source in Millsboro continues to discharge to the Indian River as of 2018 (DCIB 2018).

Water quality in the Indian River and Indian River Bay has been degraded by these sources of nutrient pollution. The water quality standard for dissolved inorganic phosphorus in both waterbodies is 0.010 mg/L (DNREC 1998). Average concentrations of dissolved inorganic phosphorus between 2011 and 2015 exceeded the standard at three of the four monitoring stations on the River and at three of the four monitoring stations in Indian River Bay (DCIB 2016). The four monitoring stations on the Indian River had average nitrogen concentrations more than double the standard of 0.14 mg/L, but three of the four stations in Indian River Bay met the standard (DCIB 2016). Algae concentrations in Indian River Bay have improved since 2010, but excess nutrients continue to fuel algal growth on the Indian River. From 2011 to 2015, concentrations of chlorophyll *a* at all four monitoring stations on the Indian River exceeded the 15 mg/L standard, but stations in Indian River Bay met the standard (DCIB 2016).

4.2 Impacts

4.2.1 Construction

Suspended Sediment/Deposition

Suspended sediment/deposition associated with construction is anticipated to have a negligible to minor impact on water quality. Pile driving during OSS and WTG foundation installation, use of jack-up and feeder vessels, jet plow operations during cable laying and embedment, and vessel anchoring will disturb sediment on the seafloor. Horizontal Directional Drill (HDD) operations at the landfall locations are also expected to result in some sediment disturbance in and around the gravity cells.

Lease Area

Increases in sediment suspension beyond baseline conditions will be limited during anchoring and pile driving. Sediment suspension is expected to be localized to the area of anchorage or pile driving activity and sediments directly disturbed by the anchor or jack-up vessel, respectively. The small volume of sediment displaced is expected to settle to the seafloor shortly thereafter. Therefore, water quality impacts associated with anchoring and pile driving are expected to be negligible.

Submarine Cables

Although jet plow embedment is the least impactful method for installing submarine cables, jet plow operations during cable laying and embedment will result in the disturbance of sediments within the Lease area and along the Offshore Export Cable Corridors and Onshore Export Cable Corridor 1. Based on sediment transport results for the Offshore Export Cable Corridors (Appendix II-B2), the vast majority of sediments disturbed by the jet plow will quickly return to the cable installation trench. Areas of sediment deposition greater than 0.2 mm (0.008 in) will occur within 91 m (300 ft) of the proposed cable path. Based on sediment transport assessment results for Onshore Export Cable Corridor 1 (Appendix II-B3), the vast majority of sediments disturbed by the jet plow in Indian River Bay will quickly return to the cable installation trench. A portion of the disturbed sediments will leave the immediate trench area, resulting in measurable, but temporary increases in suspended sediment that are anticipated to occur within 1,400 m (4,600 ft) of jet plow operations. Areas of sediment deposition greater than 5 mm (0.2 in) are also anticipated to occur within 30 m (95 ft) of jet plow operations.

Sediment suspension and deposition are expected to be locally higher in the immediate vicinity of jet plow operations. However, suspended sediment concentrations are expected to return to background levels no more than 24 hours after jet plow passage. Although concentrations of TSS associated with jet plow operations depend on the type of sediment present and the strength of local water currents, a study of particle settlement during cable laying for the Block Island Wind Farm found that measured TSS concentrations during and after plowing were as much as two orders of magnitude smaller than modeled concentrations. Measured TSS concentrations two weeks post plowing were rarely distinguishable from background levels (Elliott et al. 2017). Additionally, as discussed in Volume II, Sections 4.1.1 and 4.1.2, some of the material suspended by the plow may contain elevated levels of arsenic and nickel that are common nearshore and inshore in the Project area. Therefore, water quality impacts associated with jet plow operations are expected to be minor.

An offshore sediment transport modelling study for the Offshore Export Cable Corridors has been provided as Appendix II-B2 and Onshore Export Cable Corridor 1 in Appendix II-B3. These studies address turbidity and total suspended solids from the construction phase along the export cable corridors. Turbidity and total suspended solids from construction along Offshore Export Cable Corridor 2 were assessed in Addendum 1 of Appendix II-B2. Addendum 2 of Appendix II-B2 provides sediment transport modeling results for the proposed trailing suction hopper dredging (TSHD) that may be needed to prepare the seafloor for construction at each of the four proposed OSS locations.

Stormwater

Land-based construction activities related to the Project include the installation of the US Wind substations, associated laydown area and access roads and the possible construction of an O&M Facility. Potential stormwater impacts related to the construction of the Project include the discharge of sediment, or other pollutants, from the construction site(s) that may impact the quality of waters of the State. The total volume of stormwater discharge from the construction site is dependent on factors such as the size of the site and overall weather conditions.

DNREC regulates construction activities that result in land disturbance equal to or greater than one acre that discharge stormwater to Waters of the State through the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP), effective March 11, 2021. Construction of the Project may result in the disturbance of approximately 0.08 km^2 (20 acres) of land during the construction activities noted above. US Wind anticipates that a CGP will be required and will develop an associated Stormwater Pollution Prevention Plan (SWPPP) for construction activities as appropriate.

Onshore Export Cable Corridor 1

Alternative cable installation methods may be necessary in Indian River Bay (e.g., vibro-injector or trenching) where jet plow operation is not feasible. This would result in suspended sediment concentrations that may vary from what would be produced by jet plow installation methods. However, increases in suspended sediment would still be expected to be temporary. Therefore, water quality impacts associated with alternative cable installation methods, if used, are anticipated to be minor.

Dredging would be conducted using mechanical, or most likely, hydraulic means, based on sediment information in Indian River Bay and Indian River. Mechanical dredging would involve the use of an excavator working off of a barge to dig out the sediment to be hauled away for disposal or reuse. Because mechanical dredging is robust and does not filter the dredge material, it is most often used to remove rock and gravel. The benefits of mechanical dredging are speed, mobility, accuracy, and the ability to handle larger dredge material. Its biggest potential drawback can be high resuspended sediment in the water column. However, these impacts are expected to be less than those resulting from jet plow installation and are anticipated to be negligible.

Hydraulic dredging involves a dredge that floats on the water and pumps the material as a slurry through a temporary pipeline to a barge or coastal location. A hydraulic dredge acts like a floating vacuum removing sediment precisely, and is best suited for removing fine silt, sand, and dirt. Hydraulic dredging has a lower percentage of suspended sediment than mechanical dredging although the process may take longer depending on the site.

The use of HDD at the landfalls will minimize water quality impacts in the nearshore environment, and gravity cells will help to contain sediment that becomes suspended in the water column. Some sediment may be displaced during the installation and removal of the gravity cells; however, this would be a relatively small volume of material that would settle out relatively quickly. Consequently, water quality impacts associated with HDD are anticipated to be negligible.

Appropriate avoidance, minimization, and mitigation measures for potential impacts associated with the low concentrations of heavy metals and PAHs that were detected in some of the sediment samples collected along Onshore Export Cable Corridor 1 will be addressed in the water quality certificate obtained for this Project under Section 401 of the Clean Water Act. For example, turbidity monitoring will be conducted during Project construction, if required by the permitting authorities.

Routine/Accidental Releases

During the course of construction, pollutants may be discharged into the environment as part of routine activities, such as the operation of construction vessels and vehicles, or due to accidental spills. Pollutants may be discharged directly into a waterbody or discharged into the air and deposited on the surface of a waterbody. It is anticipated that these releases will have a negligible impact on water quality.

Installation of the WTGs, OSSs, Met Tower, export cables, and inter-array cables will require the operation of vessels. Any discharge of greywater, uncontaminated bilge and ballast water, and treated deck drainage from construction vessels will comport with U.S. Coast Guard and EPA requirements. Refer to Volume I for a discussion of waste and discharge information.

While oil and grease, sanitary waste, and solid waste will be stored securely until they can be disposed on land in accordance with federal regulations (33 CFR 151.10, CFR 140 and 149, and 33 CFR 151.51-77), it is possible that small amounts of litter could be unintentionally released to surface waters. Any de minimis amounts of litter inadvertently released during construction of the Project will be insignificant in comparison to the high existing levels of marine debris along the coastline within the Project area.

Procedures for preventing and controlling spills will be documented in the Project's Construction Spill Prevention Control and Countermeasures (SPCC) and Oil Spill Response Plans. As described in Volume II, Section 5.0, vessel engines will emit particulates into the air as they combust fuel. Vessels will comport with air permitting and emissions limitations and violations are not anticipated. In addition, the emissions of construction vessels will be insignificant in comparison with other existing sources of atmospheric deposition that impact the Atlantic Ocean. Small releases of lubricants, solvents, or other chemicals could occur during the installation of nacelles, turbines, and blades on the WTGs. In the event of a collision, allision, or other accident, oils and hydraulic fluids contained within components of the WTGs and OSSs could be spilled during installation; however, this is highly unlikely to occur and spill prevention plans will mitigate any impacts. As such, water quality impacts due to routine and accidental releases are anticipated to be negligible.

The HDD operation will include a drilling fluid fracture or overburden breakout monitoring program during borehole drilling operations to minimize environmental impacts, which, at worst, will be temporary and localized. The use of gravity cells will help contain any HDD drilling fluids that may be released. In the case of potential inadvertent release of HDD drilling fluids, nearshore waters of the Atlantic Ocean, Indian River Bay, and Indian River could be affected by localized release of HDD drilling fluids from deeper subsurface borehole drilling, if drilling fluids are released and not properly contained by the gravity cells. However, HDD drilling fluids (bentonite, clay and water) are biologically inert and would not cause appreciable poor water quality conditions. The bentonite contained in the drilling fluid will gel or coagulate upon contact with saline or brackish water. In the event of a fluid release, the bentonite fluid density and composition will cause it to remain as a cohesive mass on the seabed, which can be quickly cleaned up and removed by diver-operated vacuum equipment. Given the small area covered and the short-term duration of HDD operations, impacts to water quality are expected to be negligible.

Construction vehicles will also emit particulates into the air as they combust fuel. While these particles could settle on the surface of the Indian River, Indian River Bay, or the Atlantic Ocean, much of the pollution associated with vehicle emissions will settle over land. The operation of construction vehicles in the Project area will be short-term and temporary, and insignificant when compared to existing sources of atmospheric pollutants that impact the Inland Bays and the Atlantic Ocean. Therefore, water quality impacts due to routine and accidental releases are anticipated to be negligible in nearshore waters. Project activities will comply with all reporting and monitoring conditions established under applicable permits.

4.3 Operations

Suspended Sediment/Deposition

Temporary increases in suspended sediment and resulting deposition would be possible during emergency cable repairs, if these become necessary over the course of Project operation, due to cable replacement and/or repair vessel anchoring. However, increases in suspended sediment concentrations will not be a routine occurrence during operations and will have localized impacts similar to or less than the impacts of construction; therefore, their impact on water quality is expected to be negligible.

Increases in suspended sediment may also be possible due to the potential for localized scour of sediments around structures, such as WTG foundations. However, scour of seabed sediments will be minimized by the placement of scour controls around the base of these structures. Therefore, increases in suspended sediment concentrations due to scour are expected to have a negligible impact on water quality.

Routine/Accidental Releases

It is anticipated that routine and accidental releases associated with the Project will have negligible impacts on water quality during operations. Over the lifetime of the installation, regular maintenance will be necessary, as well as potential non-routine repairs. Maintenance personnel and equipment will access the WTGs, OSSs, Met Tower, and submarine cables by boat. Boats traveling to the Project area may discharge sanitary waste, litter, and engine emissions into the Atlantic, as described in Volume II, Section 4.2.1. However, the discharged volume of these materials would be small and unlikely to have a measurable impact on water quality. Materials such as paint, solvent, or lubricant could also be spilled during maintenance work, but these would also be used in relatively small quantities. Boats may also experience accidental oil spills. These scenarios are unlikely to occur and spill prevention plans will mitigate any impacts. Because marine discharges are not a part of routine operations for the Project, it is anticipated that they will have a negligible impact on water quality.

4.3.1 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. As during construction, sediment suspension and routine or accidental releases during decommissioning may temporarily impact water quality within the Project area. Some bottom sediment will be disturbed during removal of the foundations. This sediment could temporarily become suspended in the water column followed by deposition on the seafloor. Cable removal would increase the extent of sediment disturbance, suspension, and deposition, if it were to occur. Discharges to surface waters could result from accidental releases associated with vessel operations and removal of parts from the WTGs, OSSs and Met Tower. However, decommissioning is not expected to result in long-term impacts. Because it is expected that decommissioning will occur decades after the Project goes into operation, it is also likely that improved technology will be available at that time to further minimize environmental impacts.

4.4 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on water quality.

- Based on feedback from DNREC, US Wind will implement the following time of year restrictions to minimize impacts of sediment disturbance:
    - No in-water work (e.g., cable installation, HDDs, dredging) in Indian River March 1 through September 30.
    - No HDD in the Atlantic to the beach landfall April 1 through September 15 (inclusive of recreational period avoidance May 15 through September 15).
    - Sediment disturbance associated with submarine cable laying will be minimized by jet plowing, HDD techniques and the use of gravity cells where feasible.
    - Turbidity monitoring will be conducted during construction as required by the permitting authorities. Conduct TSS and water quality monitoring during cable installation activities and post installation as needed.
    - A drilling fluid fracture contingency plan will be in place prior to the start of HDD activities. Operations will be shut down immediately in the event a frac-out occurs.
    - US Wind will monitor for and report any environmental release or fish kill to the appropriate authorities, e.g., in Delaware state waters, reports will be made via DNREC 24-hour hotline.
    - Project-specific SPCC Plan and Oil Spill Response Plan will be prepared prior to construction and for operations activities.
    - US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate.
    - Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination"), per BOEM guidelines for marine trash and debris prevention.
    - Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.

5.0 Air Quality

5.1 Description of Affected Environment

Air quality may be impacted in the Project area near the vessel routes and ports to be used during the construction, operation and decommissioning of the Project, as discussed below. See Volume I for more information on the vessels, ports and vessel routes to be used for the Project.

5.1.1 National Ambient Air Quality Standards

Air quality is characterized by comparing the ambient air concentrations of criteria pollutants to the National Ambient Air Quality Standards (NAAQS), which have been established by the United States Environmental Protection Agency (EPA) to be protective of public health and the environment. The Clean Air Act (CAA) establishes two types of NAAQS: (1) primary standards, which set limits to protect public health, including the health of "sensitive" populations (e.g., asthmatics, children, and the elderly); and (2) secondary standards, which set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The NAAQS have been established in 40 CFR Part 50 for each of the six criteria pollutants: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$, particulate matter with a diameter less than or equal to 10 and 2.5 micrometers (µm), respectively), and lead (Pb). Current NAAQS levels are provided in Table 5-1 (NAAQS 2019).

Table 5-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
CO	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	Not to be exceeded more than once per year
Pb	Primary and Secondary	Rolling 3-month average	0.15 ug/m³	Not to be exceeded
NO_2	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary and Secondary	1 year	53 ppb	Annual Mean
O_3	Primary and Secondary	8 hours	0.07 ppm	Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years
$PM_{2.5}$	Primary	1 year	9.0 µg/m³	Annual mean, averaged over 3 years
	Secondary	1 year	15.0 µg/m³	Annual mean, averaged over 3 years
	Primary and Secondary	24 hours	35 µg/m³	98th percentile, averaged over 3 years

Table 5-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
PM_{10}	Primary and Secondary	24 hours	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
SO_2	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

When the monitored concentrations in an area exceed the NAAQS for any pollutant, the area is classified as "nonattainment" for that pollutant. The state of Maryland is presently "in attainment" with the NAAQS, except for twelve counties in the Baltimore and Washington, D.C., metropolitan areas. These counties are in densely populated urban core areas and are presently in nonattainment with the ozone NAAQS (Anne Arundel, Baltimore, Baltimore City, Calvert, Caroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery and Prince George's counties) and the sulfur dioxide NAAQS (Anne Arundel and Baltimore counties). The state of Virginia is presently in attainment with the NAAQS, except for nine counties in the Washington, D.C., metropolitan area and Giles County. These counties are presently in nonattainment with the ozone NAAQS: Alexandria City, Arlington, Fairfax, Fairfax City, Falls Church, Loudoun, Manassas Park City, Manassas City and Prince William counties. Giles County is in nonattainment with the sulfur dioxide NAAQS. The state of Delaware is presently in attainment with the NAAQS, except for two counties in the Wilmington metropolitan area. Newcastle and Sussex counties are presently in nonattainment with the ozone NAAQS (USEPA 2019).

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

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

The USFWS and NPS formally requested that a Class I Air Quality Related Values (AQRV) modeling analysis be completed for the Project by email on April 16, 2024. A Class I AQRV Assessment Modeling Protocol for the Project was submitted to the USFWS and NPS on May 23, 2024. The Modeling Protocol was approved by email by the USFWS on May 28, 2024, and by the NPS on June 4, 2024. The results of the Class I AQRV modeling will be submitted to the USFWS, NPS, and MDE in July of 2024.

5.2 Impacts

Activities associated with the construction, operation, and decommissioning of the Project have the potential to temporarily affect air quality in the immediate area around Project activities. Potential offshore emission sources include tugboats, crane barges, cable laying vessels, crew boats, jack-up vessels, survey vessels, supply ships and generators. Land based emissions sources may include non-road construction equipment, worker vehicles and delivery vehicles. The WTGs and OSSs themselves are a negligible source of air emissions and will reduce shore-based emissions from existing fossil fuel power plants. Prevailing westerly (west to east flow) winds will minimize the dispersion of offshore emissions associated with the Project to onshore areas.

The combustion of fuels (diesel oil and gasoline) in the propulsion engines of vessels and stationary equipment on vessels installing the WTGs and OSSs (e.g., cranes and generators) will produce emissions of criteria pollutants. These emissions will primarily be NO_x and CO, with lesser amounts of volatile organic compounds (VOCs), an ozone precursor, and PM_{10} (mostly in the form of $PM_{2.5}$), and negligible amounts of sulfur oxides (SO_x) and lead. Emissions of non-criteria pollutants are expected to be negligible. Greenhouse gas emissions, including carbon dioxide (CO_2) and small amounts of nitrous oxide (N_2O) and methane (CH_4) will also be emitted.

US Wind has not completed the design for its proposed onshore substations and it is unknown at the time whether sulfur hexafluoride (SF_6) will be used in its switchgear. US wind will adopt the appropriate industry best management practices to minimize leaks of SF_6 from substation switchgear, if it is used as a coolant.

US Wind initially utilized the Bureau of Ocean Energy Management (BOEM) Offshore Wind Energy Facilities Emission Estimating Tool, Version 2.0 (BOEM 2021a) to estimate the potential offshore emissions from the construction and operation of the Project, as well as the estimated emissions avoided due to the reduction in operation of on-shore fossil fuel combustion facilities as a result of the energy generated by the Project.

Version 2.0 of the BOEM Tool uses the latest EPA emission factors from the Ports Emission Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions (EPA 420-B-20-046, September 2020).

Version 2.0 of the BOEM Tool uses marginal emission factors from EPA’s AVERT to estimate avoided emissions in the AVERT region where the user-defined offshore wind project will plug into the landside power grid.

The estimated Project potential emissions presented below have been updated for consistency with the OCS air permit submission discussed in Section 5.2.6. Land based emissions related to the installation of cabling and at the landfall will be evaluated during the Project general conformity determination, as discussed in Section 5.2.6. Figure 5-1 shows the anticipated vessel routes and destinations. There are two vessel routes from the proposed staging facility at Sparrows Point, the Chesapeake and Delaware Canal (C & D Canal) route and the Chesapeake Bay route. Most vessels are anticipated to travel to the Project area using the Chesapeake Bay route and return to port using the C & D Canal route.

Appendix II-C1 contains detailed Project emissions summaries, including the expected number and size of each engine type, the expected usage of each engine, and the load and emission factors used for the Project potential emissions estimates. Summaries of the expected annual emissions during Project construction, operation, and decommissioning are provided in Volume II, Sections 5.2.1 to 5.2.3.

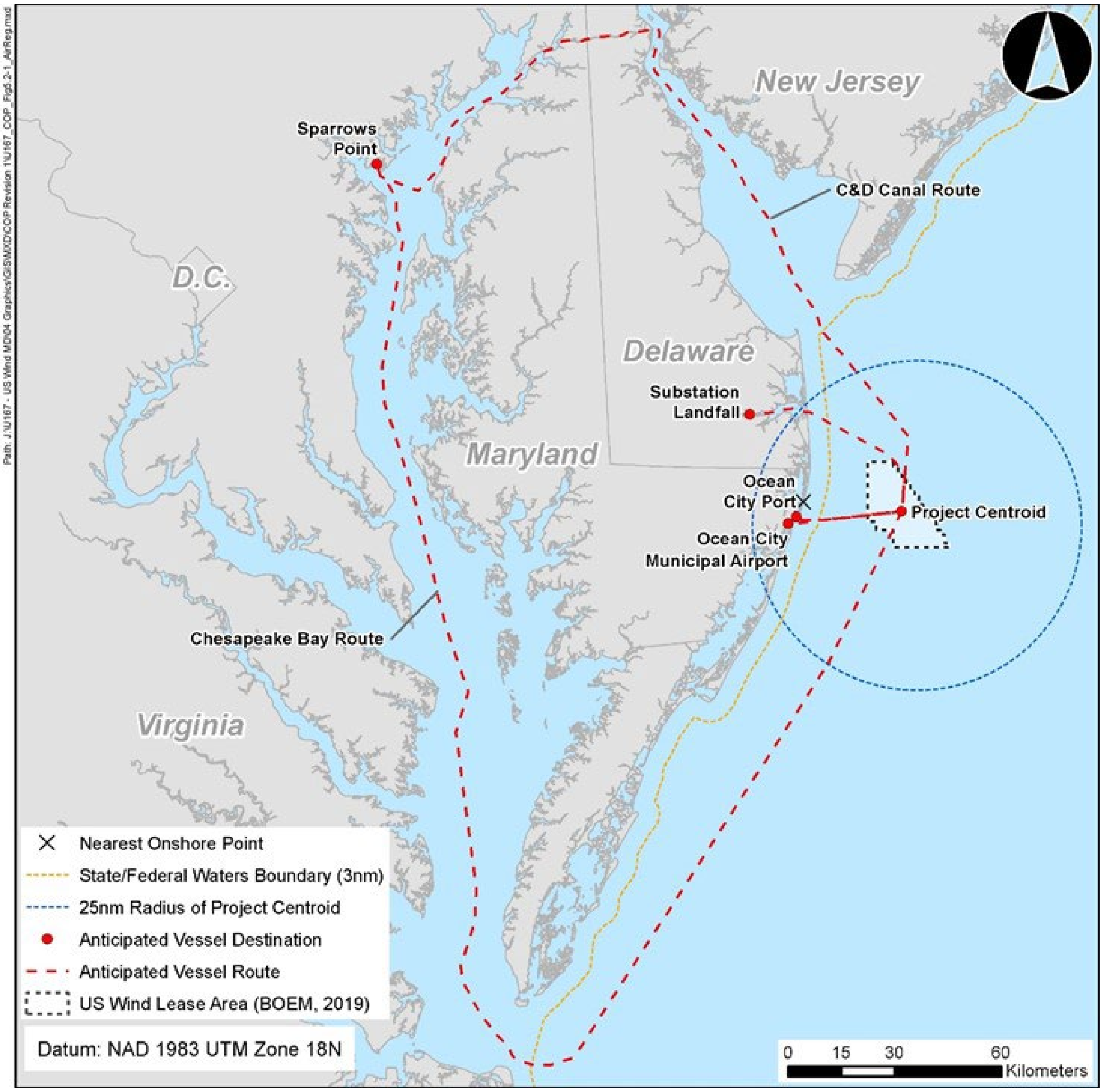


Figure 5-1. Air Regulatory Boundaries and Vessel Routes

5.2.1 Construction

It is anticipated that installation of the Project will require one or more jack-up vessels containing the installation crane and other support equipment. The jack-up vessel will be supported by additional tugboats, feeder vessels, and crew boats as necessary. Emissions from cable laying operations are also included in the construction emissions estimate. Detailed information on the expected Project emission sources during construction is provided in Appendix II-C1. Estimated Project potential pollutant emissions during construction are provided in Table 5-2.

Table 5-2. Estimated Project Potential Emissions – Construction

Pollutant	Metric Tons	Short Tons
NO_X	1,252	1,380
SO_2	4.1	4.5
$PM_{2.5}$	40	44
CO_2	85,772	94,547
VOC	24	26
HAPs	2.7	3.0

5.2.2 *Operations*

The Project will be powered by wind and will produce no emissions during normal operations. Back-up diesel generators will be located on the OSSs. There will be vessels servicing the Project periodically throughout its operational period. Additional information on the expected Project emission sources during operation is provided in Appendix II-C1. Estimated Project potential pollutant emissions during operation are provided in Table 5-3.

Table 5-3. Estimated Project Potential Emissions – Operations

Pollutant	Metric Tons	Short Tons
NO_X	543	598
SO_2	1.9	2.1
$PM_{2.5}$	15	17
CO_2	144,500	159,284
VOC	52	57
HAPs	4.9	5.4

5.2.3 *Decommissioning*

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Similar equipment used for Project construction will be used for decommissioning. Project emissions during decommissioning activities are expected to be similar to the construction emissions. Estimated Project potential pollutant emissions during decommissioning are provided in Table 5-4.

Table 5-4. Estimated Project Potential Emissions – Decommissioning

Pollutant	Metric Tons	Short Tons
NO_X	1,252	1,380

Table 5-4. Estimated Project Potential Emissions – Decommissioning

Pollutant	Metric Tons	Short Tons
SO_2	4.1	4.5
$PM_{2.5}$	40	44
CO_2	85,772	94,547
VOC	24	26
HAPs	2.7	3.0

5.2.4 Estimated Avoided Project Emissions

The Project will produce negligible emissions during operation and the energy generated will have the ability to displace the energy production from existing fossil fuel fired power plants resulting in avoided emissions from energy generation. The estimated avoided potential emissions for the proposed project design capacity of 1,676 MW (114 14.7 MW WTG) are provided in Table 5-5. The estimated avoided potential emissions for the maximum project design envelope capacity of 2,178 MW (121 18 MW WTG are provided in Table 5-6.

Table 5-5. Estimated Potential Emissions – Avoided 1,676 MW Project

Pollutant	Metric Tons/ Project Lifespan	Short Tons/ Project Lifespan
NOx	46,774	51,560
SO_2	72,981	80,447
$PM_{2.5}$	8,387	9,245
CO_2	97,148,921	107,088,323

Table 5-6. Estimated Potential Emissions – Avoided 2,178 MW Project

Pollutant	Metric Tons/ Project Lifespan	Short Tons/ Project Lifespan
NOx	60,785	67,003
SO_2	94,840	104,543
$PM_{2.5}$	10,899	12,014
CO_2	126,247,225	139,163,704

5.2.5 Estimated Annual Project Emissions

The Project will be completed in up to four campaigns as discussed in Volume I, Section 2.3. The estimated operational period for each campaign is 25 years. The estimated annual potential emissions over the lifetime of the Project are provided in Table 5-7.

Table 5-7. Estimated Annual Project Emissions

Year	Phase	Campaign	Metric Tons				Short Tons			
			NOx	SO_2	$PM_{2.5}$	CO_2	NOx	SO_2	$PM_{2.5}$	CO_2
Year 1	Construction	Campaign 1	226	1	7	14,984	249	1	8	16,517
	Operations	Not Applicable	0	0	0	0	0	0	0	0
	Total	Total	226	1	7	14,984	249	1	8	16,517
Year 2	Construction	Campaign 2	554	2	17	36,220	611	2	19	39,926
	Operations	Campaign 1	4	0	0	1,051	4	0	0	1,158
	Total	Total	558	2	17	37,271	615	2	19	41,084
Year 3	Construction	Campaign 3	454	2	15	29,715	500	2	16	32,755
	Operations	Campaigns 1,2	15	0	0	3,802	16	0	0	4,191
	Total	Total	469	2	15	33,517	516	2	16	36,946
Year 4	Construction	Campaign 4	0	0	0	0	0	0	0	0
	Operations	Campaigns 1,2,3	23	0	0	6,054	25	0	0	6,673
	Total	Total	23	0	0	6,054	25	0	0	6,673
Years 5 - 26	Operations	Campaigns 1,2,3,4	500	2	13	133,172	551	2	14	146,797
Year 27	Operations	Campaigns 2,3,4	18	0	1	4,940	20	0	1	5,445
Year 28	Operations	Campaigns 3,4	7	0	0	2,018	8	0	0	2,224
Year 29	Operations	Campaign 4	0	0	0	0	0	0	0	0
Project Total Emissions	Construction	Project	1,252	5	40	85,772	1,380	5	44	94,547
	Operations	Project	543	2	15	144,500	598	2	17	159,284
	Total	Project	1,795	7	55	230,272	1,978	7	61	253,831

5.2.6 Regulatory Permitting

Outer Continental Shelf Sources

Section 328 of the Clean Air Act Amendments of 1990 (CAA 1990) directs the EPA to promulgate regulations for Outer Continental Shelf (OCS) sources that may affect the air quality of any state (42 U.S.C. 7627). These regulations are found in 40 CFR Part 55. Under 40 CFR Part 55, the EPA has the authority to regulate the air emissions associated with OCS sources, any vessels used for the purposes of constructing, servicing, or decommissioning them, and the equipment used for seafloor boring. All OCS sources located within 25 NM (46.3 km) of States' seaward boundaries must satisfy the same air permitting requirements as would be applicable if the source were located in the corresponding onshore area. US Wind expects that any CAA permit that may be required for the Project would be issued by the state of Maryland, which has been delegated by the EPA to permit OCS sources. In accordance with 40 CFR § 55.14(e)(10), the Project must comply with all applicable sections of the Maryland Department of Environmental (MDE) Regulations listed in 40 CFR § 55, Appendix A. These regulations include construction and operating permit requirements, control of emissions from fuel burning equipment and new source review.

Section 328 of the CAA 1990 and 40 CFR Part 55 establish a unique treatment for vessels associated with OCS sources. With respect to the calculation of an OCS source's Potential to Emit (PTE) to determine permitting applicability, emissions from vessels that are servicing or are associated with the operations of the OCS source must be counted as direct emissions from the OCS source when those vessels are at the source or en-route to or from the source when within 25 NM (46.3 km) of the source.

General Conformity Rule

BOEM has determined that general conformity does not apply for actions on the OCS for which it has permitting authority. Some of the emissions associated with OCS sources may require compliance with the General Conformity Rule established in 40 CFR Part 93, Subpart B. These regulations implement Section 176 of the CAA 1990 and require that Federal actions conform to applicable State Implementation Plans developed by States and approved by EPA for the purpose of attaining or maintaining compliance with the NAAQS. To determine whether a conformity determination is required for activities described in a particular COP, BOEM would conduct an applicability analysis when the COP is received. A conformity determination is required when the total direct and indirect emissions of criteria pollutants in a nonattainment or maintenance area exceed the rates (known as de minimus rates) specified in 40 CFR 93.153(b)(1) and (2). The emissions estimates must include emissions from the transportation of materials, equipment, and personnel, and must include the construction, operation, and decommissioning of the action.

General conformity applies to emissions within State boundaries (onshore and in state waters). Vessels supporting the Project will travel through state waters of Maryland, Delaware and Virginia. Staging and assembly activities are anticipated at Sparrows Point. It is expected that the materials will travel to the site via the C & D Canal and/or via the Chesapeake Bay and the work crews will travel to the site from Ocean City, Maryland. Operations and maintenance activities would be based out of the O&M Facility located in Ocean City, Maryland.

Permitting Applicability

Based on US Wind's emissions estimates, the potential emissions from the Project during construction, operation, and decommissioning will exceed permitting thresholds. It is anticipated that the Project will require the following permits from MDE:

- OCS Air Permit.
- Air Quality Permit to Construct.
- Air Quality Permit to Operate.

In addition, US Wind will be required to demonstrate general conformity in each of the states in which Project emissions will exceed the established de minimis rates.

US Wind submitted the Notice of Intent required for 40 CFR § 55.4 on August 5, 2022, to commence the air permitting process with EPA and MDE. The Air Quality Permit to Construct will address the implementation of Best Available Control Technology (BACT) for Project emissions sources and will require air dispersion modeling to comply with Code of Maryland Regulation (COMAR) 26.11.15.06, Ambient Impact Requirement. If required, US Wind will follow MDE Guidance Document "Demonstrating Compliance with the Ambient Impact Requirement under the Toxic Air Pollutant (TAP) Regulations (COMAR 26.11.15.06)" (MDE 2016a) or other acceptable air dispersion modeling procedures for the analysis. US Wind submitted an Air Dispersion Modeling Protocol to MDE on September 16, 2022, and US Wind submitted an OCS Air Permit Application to MDE on August 17, 2023. An Alternative Modelling Request was approved by MDE on September 11, 2023. US Wind's OCS Air Permit Application was deemed administratively complete on January 4, 2024. Additional mitigation measures may be identified during the OCS air permitting process.

5.2.7 Social Cost of Greenhouse Gases

The estimates of the social cost of carbon (SC-CO_2), social cost of methane (SC-CH_4), and social cost of nitrous oxide (SC-N_2O) presented here allow for an estimation of the social benefits of reducing emissions of each of these greenhouse gases, or the social cost of increasing such emissions. Collectively, these values are referenced as the "social cost of greenhouse gases" (SC-GHG). The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts, including, but not limited to, changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-GHG, therefore, reflects the societal value of reducing emissions of the gas in question by one metric ton.

On January 20, 2021, President Biden issued Executive Order 13990 (86 FR 7037), *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*. Section 5 of Executive Order 13990 emphasizes the importance for Federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and establishes an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG). In February 2021, the IWG published *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide; Interim Estimates under Executive Order 13990* (IWG 2021).

The IWG provides impact estimates evaluated at three different discount rates (5%, 3%, and 2.5%) (IWG 2021). The guidance includes three sets of SC-GHG values—one each at the 5%, 3%, and 2.5% discount rates and the average level of damage—and a fourth set at the 3% discount rate and the 95th percentile of damages. The different discount rates and their assumption of a statistical level of damages represent uncertainty within SC-GHG estimates. With higher discount rates, future damages are more discounted and less significant in the total estimated costs. Because damages from GHG emissions are long term, higher discount rates lead to lower estimates of the SC-GHG. This trend is evident when comparing the SC-GHG at a 2.5% discount rate versus 5% discount rate, both at average statistical damages.

The assumption of a statistical level of damages plays a significant role in capturing uncertainty. IWG (2021) contains frequency distributions that show uncertainty in the quantified parameters defining the damage functions of the three models used to estimate the sets of SC-GHG values. The magnitude of uncertainty reflected in the distribution of damages is evident by comparing the average and 95th percentile values of the 3% discount rate models.

5.2.7.1 Methodology for Estimating the Social Cost of Greenhouse Gas Emissions

IWG (2021) SC-GHG estimates represent the monetary value of the net harm to society associated with adding a metric ton of GHG to the atmosphere in any given year. This SC-GHG estimated value is specific to a given year and increases through time as the harm in later years leads to greater damages given the compounding nature of GHG emissions and their relationship to an increasing Gross Domestic Product (IWG 2021*)*. The SC-GHG estimates represent the value of the future stream of damages associated with a given metric ton of emissions discounted to the year of emission.

US Wind used the IWG's annual SC-GHG estimates for each of the three GHGs to compute the Project construction, operation, and decommissioning (i.e., Build Scenario) and avoided emission (i.e., No-Build) scenarios social cost estimates. The total SC-GHG is then discounted back to a net present value using the same discount rate as the SC-GHG. Next, the net present value for the three GHGs are aggregated to derive the total SC-GHG for the Project operation and avoided emission scenarios under the specific discount rate and statistical damage assumptions for that set of SC-GHG values.

Table 5-8 provides a summary of the GHG emissions from the Project life cycle (construction, operation, decommissioning) as provided in Tables 5-2 through 5-5. Note that emissions of CH4 and N2O were calculated based on the CO_2 emissions resulting from fossil fuel use by the emission factors in 40 CFR Part 98 Subpart C, Tables C-1 and C-2 (i.e., the default emission factors in the U.S. EPA Greenhouse Gas Reporting Rule).

Table 5-8. Estimated Project Lifecycle (Build) and Potential Avoided (No Build) GHG Emissions

Phase	Metric Tons		
	CO_2	CH_4	N_2O
Build			
Construction	358,519	11.5	2.9
Operation	125,438	5.1	1.0
Decommissioning	358,519	11.5	2.9
Total	**842,476**	**28.1**	**6.8**
No Build			
Potential Avoid Emissions	97,148,921	1,017.0	101.7

Notes: The emission factors by fuel combustion type per 40 CFR Part 98, Subpart C, Tables C-1 and C-2 are:

Distillate Oil – CO_2 = 73.96 kg/mmBtu, CH_4 = 0.003 kg/mmBtu, N_2O = 0.0006 kg/mmBtu

Electricity Production – CO_2 = 95.52 kg/mmBtu, CH_4 = 0.001 kg/mmBtu, N_2O = 0.0001 kg/mmBtu

The emissions for CH_4 and N_2O were scaled by the ratio of the 40 CFR Part 98 factors using distillate oil for all Project phases (Build) and by the ratio of factors for electricity Production for the No Build scenario. Note that the emission factors for CH_4 and N_20 for the electricity production sector are not provided in Table C-2 of 40 CFR Part 98, thus, emissions were based on the electricity sector using the natural gas combustion factors.

Table 5-9 provides examples of the IWG SC-GHG values at the 3% discount rate and average statistical damages assumption during Project construction, operation, and decommissioning (Build) and the potential avoided emissions (No Build).

Table 5-9. Example of Social Cost of GHG Emissions

Phase	GHG Emissions - Metric Tons			SC-GHG Estimates - $/Metric Ton (at 3% discount rate, average damages)			Social Cost of GHG Emissions (2020 $, millions)		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Build									
Construction	358,519	11.5	2.9	56	1,700	21,000	20.08	0.02	0.06
Operation	125,438	5.1	1.0	73	2,500	28,000	9.16	0.01	0.03
Decommissioning	358,519	11.5	2.9	85	3,100	33,000	30.47	0.04	0.10
Total	**842,476**	**28.1**	**6.8**	**NA**	**NA**	**NA**	**59.71**	**0.07**	**0.18**

Table 5-9. Example of Social Cost of GHG Emissions

Phase	GHG Emissions - Metric Tons			SC-GHG Estimates - \$/Metric Ton (at 3% discount rate, average damages)			Social Cost of GHG Emissions (2020 \$, millions)		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
No Build									
Potential Avoided Emissions	97,148,921	1,017.0	101.7	73	2,500	28,000	7,091.9	2.5	2.8

5.2.7.2 Social Cost of Greenhouse Gas Results

Using the methodology described above, Table 5-10 provides estimates the social cost of the emissions expected from the Project life cycle analysis (construction, operation, decommissioning) and for the potential avoided emissions. The Project will produce negligible emissions during operation and the energy generated will have the ability to displace the energy production from existing fossil fuel fired power plants resulting in avoided emissions from energy generation.

Table 5-10. Incremental Change in Life Cycle Social Cost of GHG Emissions (2020 \$)

Discount Rate	Statistical Damage	Build	No Build	Incremental Cost
5.0%	Average	\$20.8 million	\$2.43 billion	-\$2.41 billion
3.0%	Average	\$60.0 million	\$7.09 billion	-\$7.04 billion
2.5%	Average	\$84.6 million	\$10.01 billion	-\$9.93 billion
3.0%	95th Percentile	\$182.7 million	\$21.87 billion	-\$21.69 billion
Notes: A positive incremental value is a cost and a negative incremental value is a benefit. Incremental SC-GHG represents the difference between the Build scenario and the No Build scenario. A negative incremental value suggests costs are lower under the Build scenario and higher under the No Build scenario.				

As shown in Table 5-10, the analysis assumed discount rates of 5 percent, 3 percent, and 2.5 percent,[7] and that the Project's emissions will be at a constant rate throughout the operational period. Noting these assumptions, the emissions from operation of this Project is calculated to result in a total social cost of GHGs equal to \$20.8 million, \$60.0 million, and \$84.6 million respectively (all in 2020 dollars).[8] Using the 95th percentile of the social cost of GHGs using the

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[7] IWG Interim Estimates Technical Support Document at 24. To quantify the potential damages associated with estimated emissions, the IWG methodology applies consumption discount rates to estimated emissions costs. The IWG's discount rates are a function of the rate of economic growth where higher growth scenarios lead to higher discount rates. For example, IWG's method includes the 2.5 percent discount rate to address the concern that interest rates are highly uncertain over time; the 3 percent value to be consistent with OMB circular A-4 (2003) and the real rate of return on 10-year Treasury Securities from the prior 30 years (1973 through 2002); and the 5 percent discount rate to represent the possibility that climate-related damages may be positively correlated with market returns. Thus, higher discount rates further discount future impacts based on estimated economic growth. Values based on lower discount rates are consistent with studies of discounting approaches relevant for intergenerational analysis.

[8] The IWG draft guidance identifies costs in 2020 dollars. Id. at 5 (Table ES-1).

3 percent discount rate,[9] the total social cost of GHGs from the Project is calculated to be $182.7 million (in 2020 dollars).

The potential avoided emissions is calculated to result in a total social cost of GHGs equal to $2.43 billion, $7.09 billion, and $10.01 billion respectively (all in 2020 dollars). The incremental costs range from benefits of $2.41 billion to $21.69 billion. Thus, the Project is projected to result in a substantial societal value over its lifetime as a result of its potential to reduce GHG emissions from fossil fuel electric generation.

5.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on air quality.

- US Wind will obtain any necessary Clean Air Act permits under the state of Maryland’s delegated program and comply with applicable permit conditions.
- Vessel engines will meet the applicable EPA and International Maritime Organization (IMO) marine engine emission standards.
- Engines will be operated and maintained in accordance with the manufacturer’s recommendations and industry practices.
- Diesel fuel for use in the diesel engines will meet the per gallon fuel standards of 40 CFR 80.510(b) as applicable.
- Land based engines that meet the EPA non-road engine standards will be used, as applicable.
- Unnecessary idling of engines will be limited, where practicable.
- Where practicable, engines with add-on emission controls will be used.

As a result of these and other measures that may be identified during the permitting process, the impacts of the Project to air quality during construction, operation, and decommissioning will be minimized and the overall impact to onshore air quality is expected to be negligible.

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[9] This value represents “higher-than-expected economic impacts from climate change further out in the tails of the [social cost of CO_2] distribution.” Id. at 11. In other words, it represents a higher impact.

6.0 Coastal Habitat and Birds

6.1 Description of the Affected Environment

The Project area includes coastal habitat between marine subtidal unconsolidated bottom on the Atlantic coast of the barrier beach to the east and intertidal salt marsh located at the substation landfall to the west. The following components of the Project are located within coastal habitat: the Barrier Beach Landfalls, Onshore Export Cable Corridor 1, and the proposed HDD locations within Indian River Bay. The habitat affected by each of these components is described below.

6.1.1 Barrier Beach Landfalls

Coastal habitat in the vicinity of the Barrier Beach Landfalls, defined as the Offshore Export Cable landfall locations at 3 R's Beach and Tower Road including the area where onshore export cables would enter Indian River Bay via HDD to the west, includes areas that fall under the following National Wetland Inventory classifications as shown in Figure 6-1 and 6-2: estuarine and marine deepwater (marine and estuarine subtidal unconsolidated bottom), estuarine and marine wetland (marine and estuarine intertidal unconsolidated shore, Atlantic coastal beach and dune, and tidal salt marsh), freshwater emergent wetland (non-tidal freshwater marsh), and freshwater forested/scrub-shrub (non-tidal freshwater scrub-shrub wetland). These habitat types are discussed in the following sections.

6.1.1.1 Unconsolidated Bottom and Shore

Largely unvegetated, regularly flooded, marine intertidal unconsolidated shore of the sand subclass (M2US2N (USDOI and USFWS 2018b)) occupies the intertidal zone on the eastern side of the Barrier Beach Landfalls. Marine subtidal unconsolidated bottom (M1UBL (USDOI and USFWS 2018b)) is located east of the intertidal shore. There is estuarine subtidal unconsolidated bottom (E1UBL (USDOI and USFWS 2018b)) in Indian River Bay, west of 3 R's Beach. Sediment cores collected in Indian River Bay indicate that the substrate is a mixture of predominantly sand (~65%) and silt (~35%) (Appendix II-A6).

6.1.1.2 Atlantic Coastal Beach and Dune

Above the high-tide line, sandy beaches extend landward to grassy dunes and overwash areas, to a complex of shrub-dominated back dunes. Coastal dunes near the Barrier Beach Landfall support a variety of grasses, but the dominant one is American beach grass (*Ammophila breviligulata*). These grassed areas develop on the crests and faces of primary foredunes as well as within the back dune area.

6.1.1.3 Tidal Salt Marsh

The eastern side of Indian River Bay in Delaware Seashore State Park includes 0.65 km^2 (160 acre) of estuarine intertidal salt marsh. Salt marsh consists of two distinct habitats: high marsh (E2EM1Pd (USDOI and USFWS 2018b)) and low marsh (E2EM1Nd (USDOI and USFWS 2018b)). The former occurs at a higher elevation, where it is subject to shorter tidal inundation, while the latter is flooded for extended periods during daily tidal cycles. High marsh experiences a salinity ranging from 18 to 30 parts per thousand and is dominated by saltgrass (*Distichlis spicata*) and saltmeadow cordgrass (*Spartina patens*) (Mitsch and Gosselink 2007). High marsh also provides microhabitats such as tidal creeks, salt pannes and pools. The more seaward low marsh is a stressful environment for most plant species due to high salinity and frequent flooding and is predominately vegetated by smooth cordgrass (*Spartina alterniflora*).

6.1.1.4 Non-tidal Freshwater Scrub-Shrub Wetland

A 0.03 km^2 (6.70 acre) non-tidal freshwater scrub-shrub wetland (PSS3A (USDOI and USFWS 2018b) is located on the western or inland side of the landfall location at 3 R’s Beach, adjacent to Route 1, approximately 1.6 km (1 mile) south of the Indian River Bay Inlet. This wetland type only experiences temporary flooding and is able to support shrubs and low saplings. Loblolly pines (*Pinus taeda*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*), red cedar (*Juniperus virginiana*), and American holly (*Ilex opaca*) are saplings that may be found in scrub-shrub wetlands around Indian River Bay (DCIB 2017). These trees may provide nesting habitat for piscivorous birds that forage in salt marshes, such as bald eagles, egrets, herons and osprey (DCIB 2017).

6.1.1.5 Non-tidal Freshwater Marsh

The HDD operations area will be staged out of the proposed landfall location at the existing 3 R’s Beach parking lot. There is a 809 m^2 (0.2 acre) freshwater marsh (PEM1E (USDOI and USFWS 2018b)) immediately south of the parking lot. The dune and swale landforms in this area create wetland habitat in the depressions between sand dunes. The Bethany Beach Firefly (*Photuris bethaniensis*), named for its type locale south of the Barrier Beach Landfalls, inhabits shrub thickets in these interdunal swales (Heckscher and Bartlett 2004).

6.1.1.6 Barrier Beach Landfall Coastal Habitat – 3 R’s Beach

The 3 R’s Beach landfall location (Figure 6-1) is the proposed landfall location. From the 3 R’s Beach landfall location, Onshore Export Cable Corridor 1 traverses in Indian River Bay proceeding westerly in Indian River for connection to the Interconnection Facilities. Location of gravity cells and export cable routes are approximate.

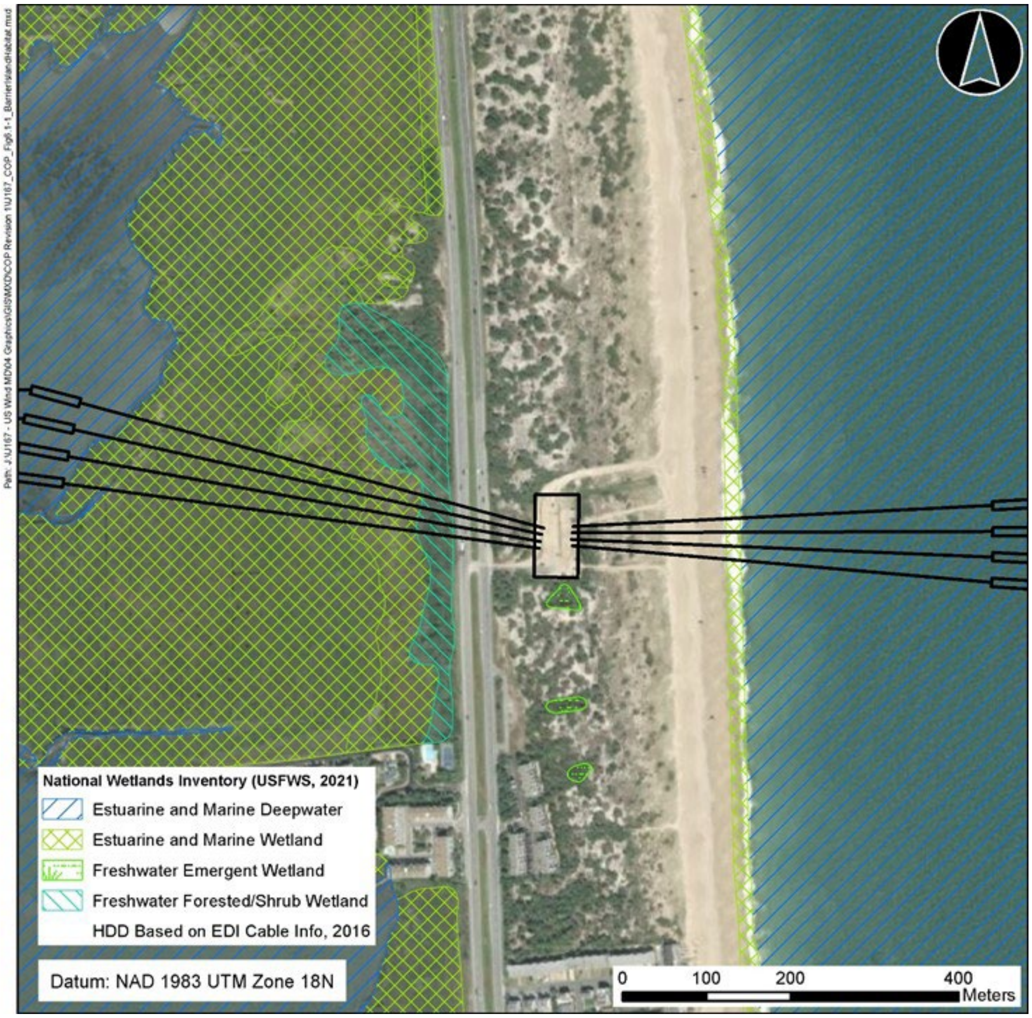


Figure 6-1. Barrier Beach Landfall Coastal Habitat – 3 R's Beach

6.1.1.7 Barrier Beach Landfall Coastal Habitat – Tower Road

A second cable landfall location under evaluation is Tower Road (Figure 6-2) and is associated with Onshore Export Cable Corridor 2 (Figure 11-1). There are no non-tidal freshwater wetlands at this location.

Figure 6-2. Barrier Beach Landfall Coastal Habitat – Tower Road

Birds

As described in Volume II, Section 12.0, birds that may be present in the coastal habitat found in the Project area have been documented by the mid-Atlantic Baseline Studies (MABS) Project and an expansion of the MABS study funded by the Maryland Department of Natural Resources and the Maryland Energy Administration (Williams et al. 2015b, 2015a). This section also considers other species that could occur in mid-Atlantic coastal habitats during at least a portion of the year based on data from field guides and mapping resources (Ridgely et al. 2003; Sibley 2014; Cornell University 2016; NAS 1996). These species can be grouped by shared habitats and life history characteristics as shown in Table 6-1. Groups that are most likely to be impacted by the Project are discussed below. At least some species in each of the first nine groups of birds may be present in the Project area year-round and nest there as well. Migratory birds are only likely to be in the Project area while stopping along their migration routes.

Table 6-1. Coastal Bird Families Occurring in the Project Area

Order	Family	Distribution and Ecology
Suliformes	Phalacrocoracidae (Cormorants)	Sit and swim on water. Roost colonially on perches. Nest colonially in the mid-Atlantic; found there year-round.
Pelecaniformes	Pelecanidae (Brown Pelican)	Typically seen sitting on water or in flight. Nests colonially on islands in the mid-Atlantic; found there year-round.
Charadriiformes (Shorebirds)	Recurvirostridae (Avocets and Stilts) Haematopodidae (Oystercatchers) Charadriidae (Plovers) Scolopacidae (Sandpipers, Yellowlegs, Godwits, Dowitchers, Snipe, and Phalaropes)	Diverse group that uses a variety of habitats including beaches, dunes, mudflats, saltmarshes, and rocky coasts. Found in the mid-Atlantic year-round, though few species nest there.
Pelecaniformes (Wading Birds)	Ardeidae (Bitterns, Egrets, Herons, and Night-herons) Threskiornithidae (Ibises)	Nest in coastal areas of the mid-Atlantic; found there year-round.
Gruiformes	Rallidae (Rails, Coots, and Gallinules)	Rails inhabit coastal marshes. Several species breed in the mid-Atlantic and occur there year-round. Coots and gallinules inhabit ponds and marshes, often near the coast. Coots winter in the mid-Atlantic.
Anseriformes (Waterfowl)	Anatidae (Geese, Swans, and Ducks)	Diverse group that uses a variety of habitats including coastal ponds, bays, saltmarshes, and rivers. Most do not breed in the Project area and are present primarily during winter; however, a handful of species do breed in the Project area including Canada Goose, Mallard, Wood Duck, and Hooded Merganser.
Coraciiformes	Alcedinidae (Belted Kingfisher)	Uses sheltered waters, including coastal bays and marshes. Nests in mid-Atlantic and occurs there year-round.

Table 6-1. Coastal Bird Families Occurring in the Project Area

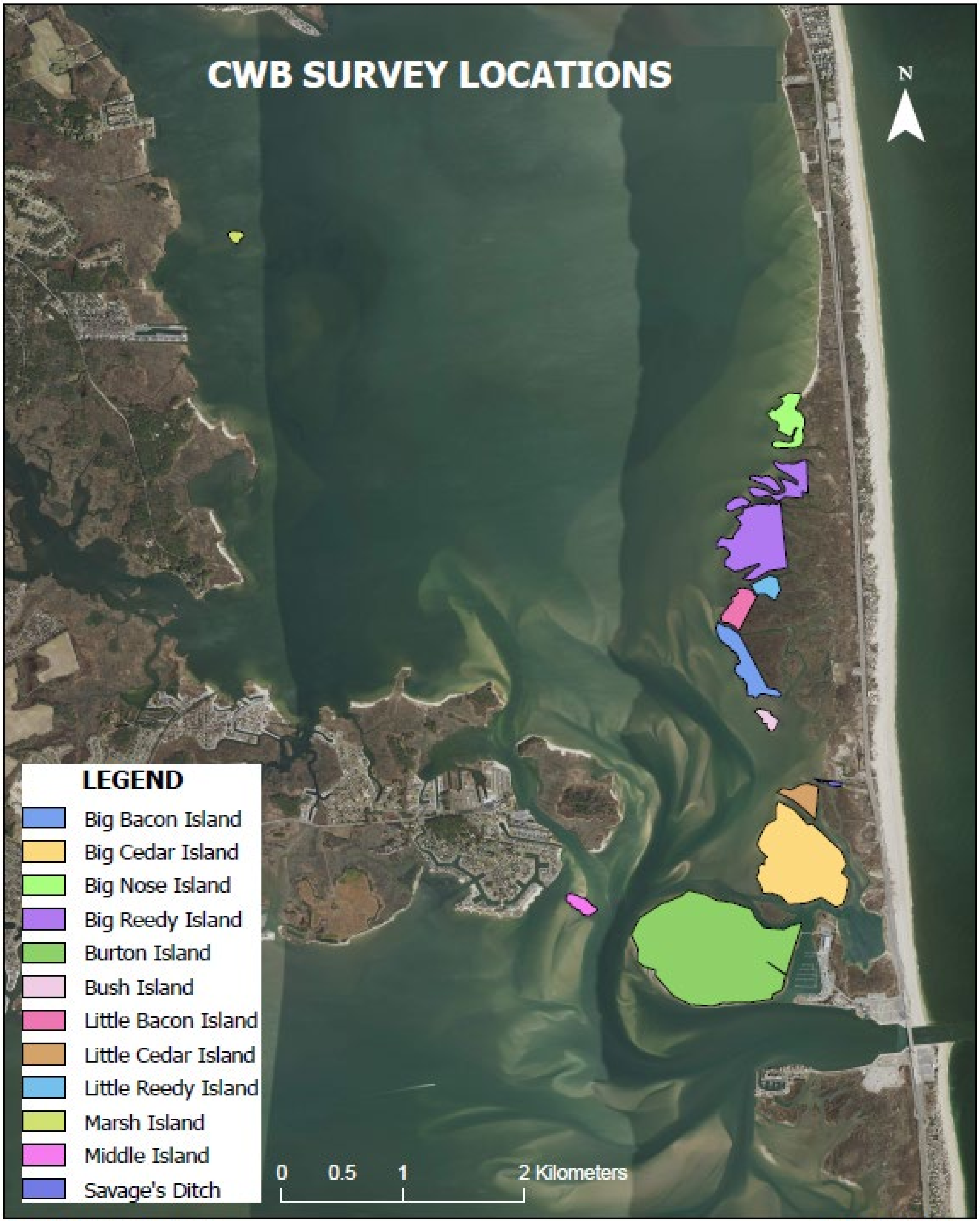
Order	Family	Distribution and Ecology
Passeriformes (Saltmarsh Perching Birds)	Emberizidae (Saltmarsh Sparrow and Seaside Sparrow) Icteridae (Red-winged Blackbird) Troglodytidae (Marsh Wren and Sedge Wren)	Nest in marshes along the mid-Atlantic coast and winter in the Project area. Wrens and Sparrows found in the mid-Atlantic primarily during breeding season. Red-winged Blackbird in the mid-Atlantic year-round.
Various (Birds of Prey)	Pandionidae (Osprey) Accipitridae (Eagles, Hawks, and Harriers) Falconidae (Falcons) Strigidae (Owls) Cathartidae (Vultures)	Found in mid-Atlantic coastal habitats year-round. Osprey and Bald Eagle nest prominently and feed in coastal areas. Northern Harrier, Merlin, Peregrine Falcon, and Short-eared Owl nest in terrestrial habitats but hunt in open coastal habitats.
Passeriformes	Various Species	Typically not associated with marine and coastal habitats in the Project area except during migration. Any species using the Atlantic Flyway could potentially occur in the Project area during migration.

DNREC Colonial Bird Study (DNREC 2021)

DNREC began colonial nesting waterbird (CWB) surveys in Rehoboth Bay in 2019. Surveyors counted birds, including laughing gulls, herring gulls, great black-backed gulls, great egrets and Forster’s tern, from the water using spotting scopes or binoculars during the April – September time period. Locations for the surveys, shown in Figure 6-3 below, were selected based on historic breeding records for Species of Greatest Conservation Need (DEDFW 2015). Although hundreds of nesting birds of various species have been documented at these locations, exact nest locations, reproductive success and colony boundaries are currently undetermined.

Mid-Atlantic Baseline Study (Williams et al. 2015a)

According to the MABS survey, cormorants and waterfowl are among the most frequently encountered birds on the mid-Atlantic coast. Most waterfowl are likely to be present in the Project area during their migration between northern breeding grounds and southern wintering areas. Green-winged teal (*Anas Crecca*), brant (*Branta bernicla*), and mallard (*Anas platyrhyncos*) are common in the Project area in the fall (Williams et al. 2015a). Waterfowl that may breed in the Project area include mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), and hooded merganser (*Lophodytes cucullatus*). Most waterfowl feed on aquatic vegetation and invertebrates. Shorebirds and pelicans are also likely to be present. Both double-crested cormorant (*Phalacrocorax auritus*) and brown pelican (*Pelecanus occidentalis*) are common in the mid-Atlantic region year-round, where they nest and feed on small schooling fish, such as menhaden and anchovies. Similar to waterfowl, while nearly three dozen shorebird species may be found in the Project area throughout the year, relatively few species would nest there. American oystercatcher (*Haematopus palliatus*), piping plover (*Charadrius melodus*), spotted sandpiper (*Actitis macularius*), and willet (*Tringa semipalmata*) are among the few shorebirds that may nest



Spatial Reference: WGS 1984
Imagery: First Map, State of Delaware

Surdex Corp, 2017

Figure 6-3. Rehoboth Bay Colonial Waterbird Nesting Survey Locations locally. Overwintering shorebird species include black-bellied plover (*Pluvialis squatarola*), ruddy turnstone (*Arenaria interpres*), dunlin (*Calidris alpina*), and sanderling (*Calidris alba*). Most shorebirds that may nest in the Project area build nests on the ground in beach face and back-dune habitats or in grassy marshes above the high tide line. Resident and migratory species often feed on invertebrates found in the intertidal zone.

Wading birds, saltmarsh perching birds, and birds of prey that may overwinter in the Project area may potentially be impacted by Project activities that are scheduled to occur in winter months. Wading birds that may overwinter in the Project area include American bittern (*Botaurus lentiginosus*), great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), and white ibis (*Eudocimus albus*). Wading birds feed primarily on fish, amphibians, crayfish, and aquatic insects. Saltmarsh perching birds that may nest and overwinter in the Project area include saltmarsh sparrow (*Ammodramus caudacutus*), seaside sparrow (*Ammodramus maritimus*), marsh wren (*Cistothorus palustris*), sedge wren (*Cistothorus platensis*) (Family Troglodytidae), and red-winged blackbird (*Agelaius phoeniceus*). The two wren species and red-winged blackbird nest in vegetation, while the two sparrow species nest directly on the ground, usually just above the high tide line. As top-level consumers in coastal food webs, birds of prey do not typically achieve large populations, which can make them more sensitive to disturbances than more abundant species. Osprey (*Pandion haliaetus*) were the only raptors that were detected repeatedly during the MABS boat surveys (Williams et al. 2015b, 2015a). Osprey typically nest in bare trees or on nesting platforms overlooking saltmarshes and are adapted to an exclusive diet of fish.

Migratory Birds

Table 6-2 details the migratory bird species that could occur within the onshore portions of the Project area, based on IPaC results. DNREC identified the potential for nesting migratory birds under bridges along the terrestrial cable corridors and recommended that construction occur between August 1 to April 15 (D.o.N.R.a.E.C.D.o.F.a.W. DNREC 2023b). If construction was to occur outside of this period, DNREC suggests mesh netting or other methods to block nesting areas for migratory birds should be in place by April 15.

Table 6-2. Migratory Birds That May Occur in the Project Area

Common Name	Scientific Name	Level of Concern
Bald Eagle	*Haliaeetus leucocephalus*	Non-BCC Vulnerable *
Bonaparte’s Gull	*Chroicocephalus philadelphia*	Non-BCC Vulnerable
Canada Warbler	*Cardellina canadensis*	BCC Rangewide (CON **)
Clapper Rail	*Rallus crepitans*	BCC-BCR ***
Common Loon	*Gavia immer*	Non-BCC Vulnerable
Common Tern	*Sterna hirundo*	Non-BCC Vulnerable
Double-crested Cormorant	*Phalacrocorax auritus*	Non-BCC Vulnerable
Dunlin	*Calidris alpina arcticola*	BCC-BCR
Evening Grosbeak	*Coccothraustes vespertinus*	BCC Rangewide (CON)
Great Black-backed Gull	*Larus marinus*	Non-BCC Vulnerable
Herring Gull	*Larus argentatus*	Non-BCC Vulnerable

Table 6-2. Migratory Birds That May Occur in the Project Area

Common Name	Scientific Name	Level of Concern
Lesser Yellowlegs	*Tringa flavipes*	BCC Rangewide (CON)
Prairie Warbler	*Dendroica discolor*	BCC Rangewide (CON)
Prothonotary Warbler	*Protonotaria citrea*	BCC Rangewide (CON)
Red-breasted Merganser	*Mergus serrator*	Non-BCC Vulnerable
Red-headed Woodpecker	*Melanerpes erythrocephalus*	BCC Rangewide (CON)
Red-throated Loon	*Gavia stellata*	BCC Rangewide (CON)
Ring-billed Gull	*Larus delawarensis*	Non-BCC Vulnerable
Royal Tern	*Thalasseus maximus*	Non-BCC Vulnerable
Ruddy Turnstone	*Arenaria interpres morinella*	BCC-BCR
Rusty Blackbird	*Euphagus carolinus*	BCC Rangewide (CON)
Semipalmated Sandpiper	*Calidris pusilla*	BCC Rangewide (CON)
Short-billed Dowitcher	*Limnodromus griseus*	BCC Rangewide (CON)
Surf Scoter	*Melanitta perspicillata*	Non-BCC Vulnerable
Willet	*Tringa semipalmata*	BCC Rangewide (CON)
Wood Thrush	*Hylocichla mustelina*	BCC Rangewide (CON)

Source: (USFWS 2021a, 2021b)
* BCC: Bird of Conservation Concern
** CON: Continental US and Alaska
*** BCR: Bird Conservation Regions (BCC in these areas only)

Terrapins

The Diamondback terrapin (*Malaclemys terrapin*) is the only estuarine turtle species found in North America, spending its life in bays, salt marshes, creeks, and coves (DCIB 2021). Although the terrapin is considered aquatic, female terrapins lay their eggs on sandy beaches and juveniles use adjacent fringe or salt marshes to feed and grow (DCIB 2021). In the winter, Diamondback terrapins hibernate by burying themselves in the muddy bottom of rivers and wetlands (DCIB 2021). Many of the Delaware Inland Bays, including Indian River Bay, have natural shorelines with alternating beach and marsh habitat, making them excellent terrapin habitat (DCIB 2021). Habitat loss is a significant threat to terrapin in Delaware, arising from shoreline development, shoreline stabilization, and beach disturbance (DCIB 2021).

DNREC conducted a terrapin nesting study in Delaware Seashore State Park in 2005 – 2006. The seven locations for the study, shown in Figure 6-4 below, were selected based on the presence of open-canopied, sparsely vegetated areas, which are considered ideal terrapin nesting habitat. Two of the sites (Creation and Haven Bay) are Delaware Department of Transportation habitat mitigation sites specifically designed to provide terrapin nesting habitat. Terrapin nests were noted at all seven sites, although the exact nest locations were not recorded. The sites were revisited in 2020 to assess vegetative changes and quality of nesting habitat. The sites still contain suitable nesting habitat and site management was determined not to be necessary (DNREC 2021).

Figure 6-4. Indian River Bay and Rehoboth Bay Diamondback Terrapin Nesting Area

Threatened and Endangered Species

Five coastal species that are classified as threatened or endangered under the federal Endangered Species Act (ESA) may be found in the Project area and are discussed below. These include three bird species and two plant species. The federally and state listed species are listed in Table 6-3 and discussed below.

Table 6-3. Federally and State-Listed Coastal Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Federal Status	DE State Status	MD State Status
Bald Eagle	*Haliaeetus leucocephalus*	-	E	-
Piping Plover	*Charadrius melodus*	T	E	E
Rufa Red Knot	*Calidris canutus rufa*	T	-	-
Eastern Black Rail	*Laterallus jamaicensis jamaicensis*	T	E	E
Black Skimmer	*Rynchops niger*	-	E	E

Table 6-3. Federally and State-Listed Coastal Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Federal Status	DE State Status	MD State Status
Seabeach Amaranth	*Amaranthus pumilus*	E	-	-
Bethany Beach Firefly	*Photuris bethaniensis*	-	E	-
Evergreen Bayberry	*Morella caroliniensis*	-	-	E
Swamp Pink	*Helonias bullata*	T	-	E

Source: (USFWS 2021a, 2021b)
E = Endangered; **T** = Threatened

Bald Eagles (16 U.S.C. 668-668d)

Bald eagles (*Haliaeetus leucocephalus*) nest in the mid-Atlantic and are present there year-round. After severe population declines throughout much of the United States during the early- to mid-20th century, the Federal government formally listed the bald eagle as endangered throughout most of its range in 1978. The bald eagle was federally de-listed in 2007 due to increasing numbers; however, the species continues to be protected by the Bald and Golden Eagle Protection Act of 1940, as well as other laws (USDOI and USFWS 2016). The state of Maryland has updated its listing for the bald eagle to secure (M.W.a.H.S. MDNR 2016b), but the bald eagle remains classified as endangered in Delaware (Delaware Division of Fish and Wildlife 2006), where it is described as inhabiting coastal plain upland forests.

Bald eagles are commonly found close to bays, rivers, lakes, or other bodies of water that reflect the general availability of their primary food sources – fish and waterfowl. They tend to avoid areas with nearby human activity (boat traffic, pedestrians) and development (buildings). Perch sites are typically in deciduous and coniferous trees. Communal roost sites used by two or more eagles are common; some may be used by 100 or more eagles during periods of high use. Large stick nests are usually built in tall trees near water. Nest trees include pines, spruce, firs, cottonwoods, oaks, poplars, and beeches. Females typically lay two eggs each year, sometime between January and April, and chicks fledge in approximately 3 months (USDOI and USFWS 2019). As of 2020, more than 220 pairs were successfully nesting in Delaware (Delaware River Basin Commission 2021). The Delaware River provides essential wintering habitat for bald eagles (Delaware River Basin Commission 2021). Bald eagles are less common on the coastline; only two were detected during the MABS-MD aerial surveys (Williams et al. 2015b). DNREC identified a bald eagle nest on Burton Island, where the Indian River Power Plant is located in response to a request from US Wind (DNREC 2017b). Project activities will not intersect the nest location, but if any work is done east of the Power Plant, DNREC requests that US Wind contact United States Fish and Wildlife Services (USFWS) about the nest location (DNREC 2017b).

Piping Plover (50 FR 50726)

The piping plover (*Charadrius melodus*) is a small, migratory shorebird that breeds on beaches from Newfoundland to North Carolina (Elliot-Smith and Haig 2004; USDOI and USFWS 1996). According to USFWS (USDOI and USFWS 2009b), piping plovers that breed on the Atlantic Coast belong to the subspecies *C. melodus*. The Atlantic Coast population is classified as threatened

(USDOI and USFWS 2015) and by both Delaware and Maryland as endangered (DNREC 2013; MDNR 2016a). The most recent abundance estimates by USFWS estimate approximately 1,762 nesting pairs in 2011 (USDOI and USFWS 2012).

Piping plovers inhabit coastal sandy beaches and mudflats. They use open, sandy beaches close to the primary dune of barrier islands for breeding, preferring sparsely vegetated open sand, gravel, or cobble for nesting sites. They feed on marine worms, fly larvae, beetles, insects, crustaceans, mollusks, and other small invertebrates. They forage along the wrack zone, or line, where dead or dying seaweed, marsh grass, and other debris is left on the upper beach by high tides (USDOI and USFWS 2015).

A key threat to the Atlantic Coast population is habitat loss resulting from shoreline development (USDOI and USFWS 1996). Piping plovers are sensitive to human activities, and disturbances from anthropogenic activities can cause breeding birds to abandon their nests. Since the listing of this species under the ESA in 1986, the Atlantic Coast piping plover population has increased 234 percent (USDOI and USFWS 2009b). Although increased abundance has reduced near-term vulnerability to extinction, piping plovers remain sparsely distributed across their Atlantic Coast breeding range, and populations are highly vulnerable to even small declines in survival rates of adults and fledged juveniles (USDOI and USFWS 2009b).

The USFWS has designated critical habitat for the wintering population of piping plovers in coastal areas south of the Project area from North Carolina to Texas (USDOI and USFWS 2001, 2008, 2009a). Some piping plovers migrate to the Bahamas and West Indies from mid-September to March. Although precise routes of migration are not firmly established, it is possible that piping plovers could be present in the Project area during migration.

Rufa Red Knot (79 FR 73705)

The *rufa* red knot (*Calidris canutus rufa*) is a medium-sized shorebird that was added to the list of threatened species under the ESA in December of 2014 (USDOI and USFWS 2014). Its listing became effective on January 15, 2015. Large flocks of red knot migrate long distances between breeding grounds in the mid- and high-arctic and wintering grounds in southern South America (USDOI and USFWS 2013). Their northward migration through the contiguous United States occurs April-June, and their southward migration occurs July-October.

Delaware Bay is the most important spring migration stopover in the eastern U.S., because it is the final place at which the birds can refuel in preparation for their nonstop journey to the Arctic (Baker et al. 2013). Red knots arriving at Delaware Bay depend on readily-available and easily digestible foods such as juvenile clams and mussels and horseshoe crab eggs to restore their depleted energy reserves (USDOI and USFWS 2013). Up to 90 percent of the entire red knot population can be present in Delaware Bay in a single day (Cornell University 2017). Although their precise migration route has not been firmly established (Niles et al. 2010), it is possible that these birds could be present in the Project area during spring and fall migrations. Due to challenges with the species' migratory habits and differing survey methods across the red knots' range, a range-wide population estimate does not exist; however, survey counts in the mid-Atlantic estimate 48,955 knots stopping in Delaware Bay (2013) and 5,547 to 8,482 knots annually stopping in Virginia (2011-2014) (USDOI and USFWS 2014).

Along the mid-Atlantic coast, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks (USDOI and USFWS 2014). In Delaware Bay, they feed primarily on horseshoe crab eggs, and the timing of their arrival at Indian River Bay typically coincides with the annual peak of the horseshoe crab spawning period in May and June. (USDOI and USFWS 2014; The Nature Conservancy 2021). Red knots are also known to occur in Maryland (USDOI and USFWS 2014), although they were not observed in the MABS surveys (Williams et al. 2015b, 2015a).

Surveys of wintering red knots along the coasts of southern Chile and Argentina and during spring migration along the U.S. coast indicate that a serious population decline occurred in the 2000s (USDOI and USFWS 2013). This population decline has been attributed to a reduction in horseshoe crabs (Cornell University 2017; USDOI and USFWS 2013), which are harvested primarily for use as bait and secondarily to support the biomedical industry (USDOI and USFWS 2003), but serve as an essential food source for red knot. Other threats to red knot include habitat destruction resulting from beach erosion and shoreline protection and stabilization projects, the inadequacy of existing regulatory mechanisms, human disturbance, and competition with other species for limited food resources.

Eastern Black Rail (85 FR 63764)

The threatened eastern black rail (*Laterallus jamaicensis jamaicensis*), a subspecies of the black rail, is a small marsh bird that occurs in salt, brackish, and freshwater wetlands in the eastern United States (USFWS 2019b). It was listed as threatened on October 8, 2020, with the rule becoming effective on November 9, 2020 (USDOI and USFWS 2020). Both Maryland and Delaware list this species as a black rail in their records and classify the species as endangered (DEDFW 2015; MDNR 2016a).

Eastern black rail wetland habitat requires dense overhead cover, moist to saturated soils, and nearby shallow water for foraging (USFWS 2019b). The species lives across the elevation gradient between the lower wetland area and the higher upland area of estuarine and palustrine marshes. The upland area serves as a refuge from predation and as a means to escape flooding. Due to their nests being built in moist soil or shallow water, flooding is a frequent cause of nest failure for eastern black rails (USDOI and USFWS 2020). This species rarely flies and runs to escape predators through the vegetation present in the wetland. Eastern black rails feed on a variety of small aquatic and terrestrial invertebrates and seeds (USFWS 2019b).

The eastern black rail has declined in numbers throughout the entirety of its range. Historically, Chesapeake Bay was considered an important breeding area, but the distribution and counts of the species has declined in recent studies, with study areas in Maryland experiencing a 13.8% annual rate of decline (Watts 2016). Past stressors include habitat degradation and fragmentation, mainly due to past conversion of marshes and wetlands into agricultural and urban areas and ditching due to mosquito control (USDOI and USFWS 2020). Current stressors include continued development in marsh and wetland areas, sea level rise due to climate change, and incompatible land management (i.e. poorly timed fires, grazing, or mechanical treatment) (USDOI and USFWS 2020).

Seabeach Amaranth

The threatened seabeach amaranth (*Amaranthus pumilus*) is an annual plant species typically found in the lower foredunes of sandy beaches on the Atlantic coast (USDOI and USFWS 2018d). Seeds germinate as early as May, and plants flower as early as June and occasionally as late as December (USDOI and USFWS 2018d). Seabeach amaranth was historically found on barrier islands throughout the Atlantic coast from South Carolina to Massachusetts (USDOI and USFWS 1993). When all known populations were lost outside of New York and the Carolinas, the species was proposed and accepted for ESA listing in 1993. (USDOI and USFWS 1993).

Populations in Sussex County, Delaware have since been identified, although they are declining. Hundreds of seedlings have been planted north of the Project area at Delaware Seashore State Park to help restore a self-sustaining population (USDOI and USFWS 2018e). The area around the Barrier Beach Landfalls also provides suitable habitat for this species. Recent numbers in Delaware have fluctuated between a few dozen and a few hundred plants per year since 2000 (USDOI and USFWS 2018e).

The species is highly sensitive to habitat alteration and fragmentation, but because all known populations occurred on private lands at the time of listing, critical habitat has not been designated for this species (USDOI and USFWS 1993). Beach maintenance activities, including grooming and shoreline stabilization, threaten the continued existence of seabeach amaranth. Erosion, flooding, herbivory, competition, and all-terrain vehicle use during the plant’s flowering and fruiting also stress seabeach amaranth populations.

Bethany Beach Firefly

The Bethany Beach firefly (*Photuris bethaniensis*) is found only in Delaware and is listed on Delaware’s Endangered Species List. It is restricted to the interdunal wetlands along Atlantic Ocean beaches near Bethany Beach (Figure 6-5). There is a strong habitat association between the Bethany Beach firefly and the rare interdunal wetland habitat found along oceanfront beaches (DEDFW 2015).

Evergreen Bayberry

The evergreen bayberry (*Morella caroliniensis*) is listed as endangered by the state of Maryland. It is a shrub or small tree found in coastal habitats, such as dunes and wetlands (Native Plant Trust 2021). The plant produces fruits along its stem that are attractive to birds (Native Plant Trust 2021).

Swamp Pink

Swamp pink (*Helonias bullata*) is a federally threatened plant species and is listed as endangered in the state of Maryland (USFWS 2022). It has smooth, oblong, dark green leaves that form an evergreen rosette with a flowering stalk that can grow over 3 feet tall (USFWS 2022). The stalk is topped by a 1- to 3-in cluster of pink flowers dotted with blue anthers (USFWS 2022).

Swamp pink is found in perennially saturated, spring-fed, nutrient-poor, shrub swamps and forested wetlands (Virginia DCR n.d.). It requires stable water levels and can tolerate only brief or infrequent flooding (Virginia DCR n.d.). Swamp pink is found in New Jersey, Delaware, Maryland, Virginia, the Carolinas, and Georgia and is found primarily in coastal plains and mountains (Virginia DCR n.d.).

Swamp pink reproduces primarily by vegetative means. Relatively few plants reach the flowering stage and reproduce via seeds, and very few seeds and seedlings survive (Virginia DCR 2022), Seed dispersal is limited, although high fat content allows the seeds to float which may contribute to higher dispersal (Virginia DCR n.d.).

Swamp pink is wetland-dependent and activities which have impacts on water quality and quantity may impact swamp pink survival (Virginia DCR n.d.). Activities that increase sedimentation, pollutant runoff, or flooding may negatively impact the species (Virginia DCR n.d.).

Figure 6-5. Bethany Beach Firefly Locations (USFWS 2019a; The Center for Biological Diversity and The Xerces Society for Invertebrate Conservation 2019)

6.2 Onshore Export Cable Corridors

From the Barrier Beach Landfall at 3 R's Beach, Onshore Export Cable Corridor 1 continues westward across Indian River Bay. The benthos of Indian River Bay are discussed in Volume II, Section 7.0. Indian River Bay does not currently host submerged aquatic vegetation (DCIB 2017). Hummocks, areas of higher elevation that provide coastal habitat for wildlife, are dispersed throughout Indian River Bay. The locations of these hummocks shift over time due to sediment transport and deposition in Indian River Bay. Terns nest on the hummocks in Indian River Bay between May and August (DNREC 2017b). Terns are discussed in greater detail in Volume II, Section 12.0.

Potential land-based Onshore Export Cable Corridors (see Figure 11-1) under consideration are within existing rights of way or rights of way currently under development, primarily roads in previously disturbed lands.

6.2.1 Substation Landfall

After crossing Indian River Bay, Onshore Export Cable 1 would travel up the Indian River and under a tidal salt marsh and uplands before connecting to the proposed Interconnection Facilities. A 0.18 km^2 (45 acre) estuarine intertidal high marsh (E2EM1Pd (USDOI and USFWS 2018b)) has established in the low-energy environment on the inside of a meander bend about 2.7 km (1.7 mi) from the confluence of Indian River and Pepper Creek at Indian River Bay (Figure 6-6). The marsh is partially ditched or drained, indicating that it has a history of human impact. See the description of tidal salt marsh in Volume II, Section 6.1.1 for more information about the ecology of tidal salt marshes.

A relatively small freshwater mixed (needle-leaved evergreen and broad-leaved deciduous) forested wetland has been mapped just inland from the salt marsh and northeast of the Indian River Substation (PFO4/1Cd, Figure 6-6 (USDOI and USFWS 2018b)). This wetland type is considered a habitat of conservation concern because it is rare in the state and has the potential to harbor a high diversity of uncommon species.

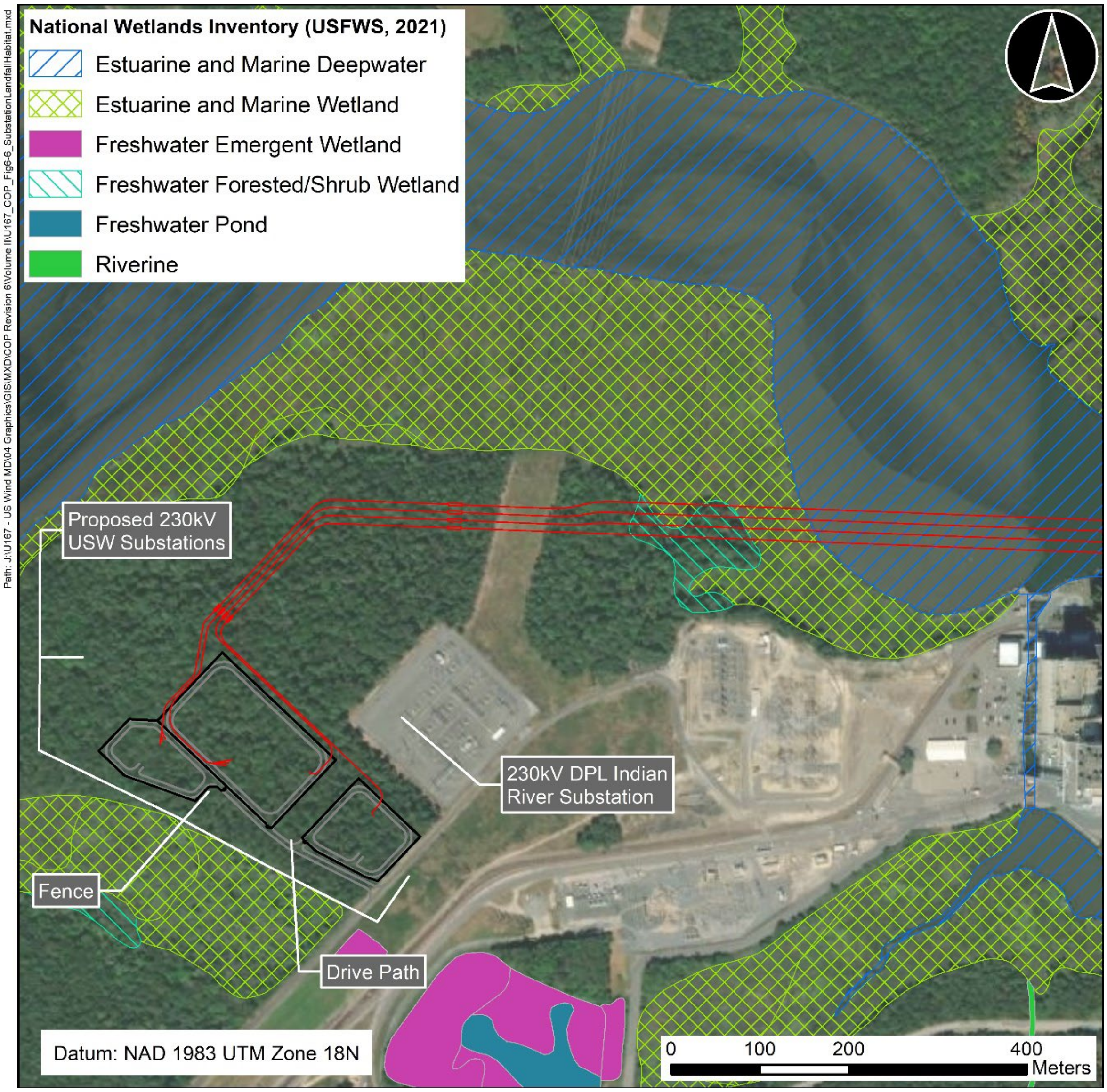


Figure 6-6. Substation Landfall Coastal Habitat

In May 2021, Landmark Science & Engineering (Landmark) performed a wetland field delineation in the area around the proposed US Wind substations and substation landfall, seen in Figure 6-7 below. Investigation of the study area concluded that vegetated tidal wetlands and non-tidal wetland fringe were present in relation to Indian River and Indian Creek. In addition to tidally influenced areas, the upland portion of the study area contains scrub-shrub vegetation and saplings. Based on this field delineation, the upland area is mostly mixed forest vegetation, mainly deciduous and coniferous species. There is a large emergent tidal wetland with a non-tidal wetland fringe along the border with the Indian River. North of the existing substation there is an emergent forested non-tidal wetland, which may be of conservation concern, as noted above. On the westernmost side of the study area, there is an emergent scrub/shrub tidal wetland with a non-tidal wetland fringe. The detailed results can be found in Appendix II-G1.

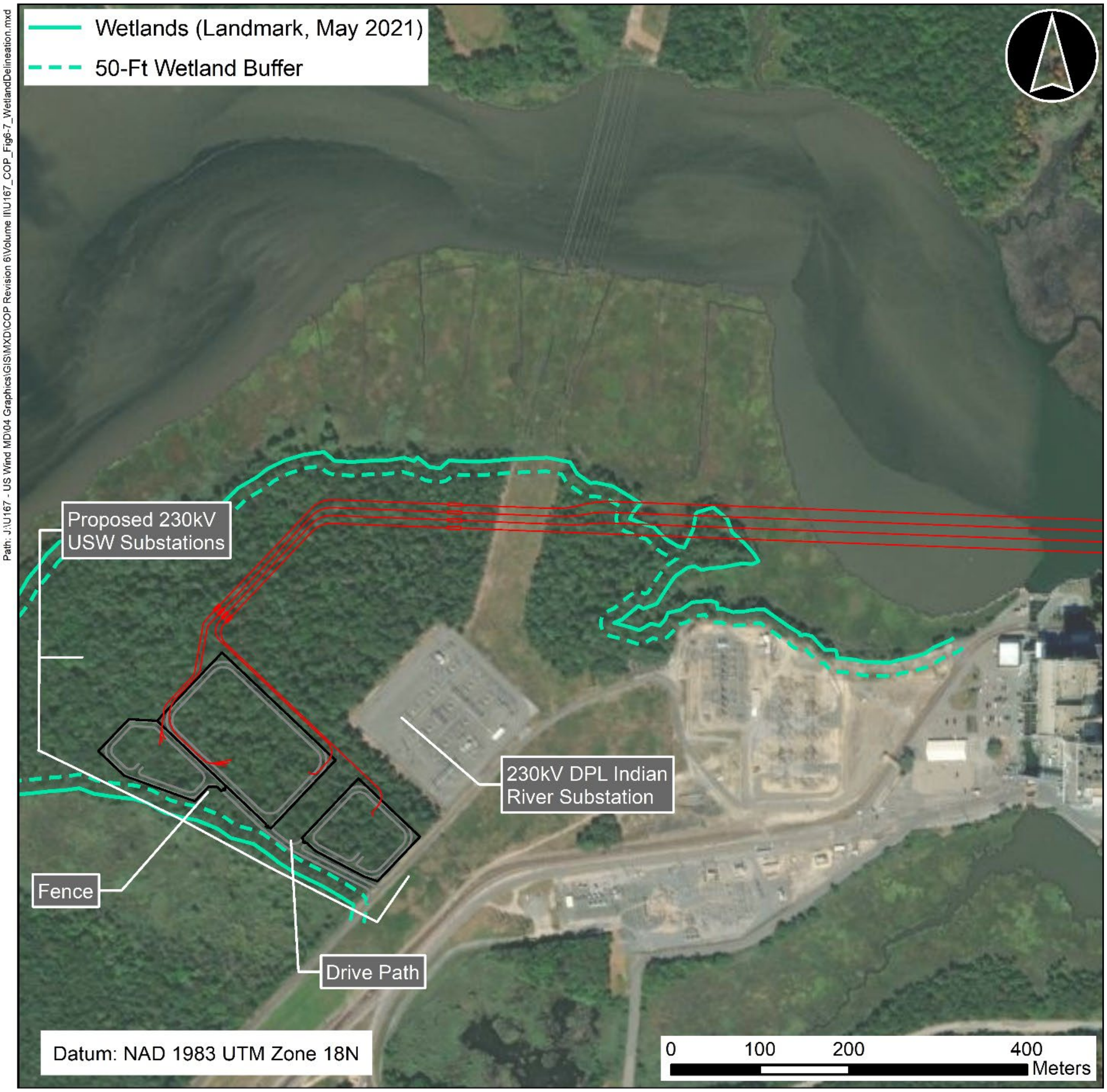


Figure 6-7. Substation Landfall Wetlands Delineation

6.2.2 O&M Facility

There are no wetlands on the O&M Facility site. The site is adjacent to estuarine wetlands mapped by the National Wetlands Inventory and Maryland Department of Natural Resources (MDNR).

6.3 Potential Impacts of the Project

6.3.1 Construction

Habitat Alteration and Species Avoidance

The Barrier Beach Landfalls are planned in parking lots that have already been disturbed and are expected to have negligible habitat alteration impacts. The transition vault box will be installed and HDD operations will occur in the proposed landfall location at the existing 3 R's Beach parking lot or Tower Road parking lot, which are already disturbed. Any material from land-based excavations will be stockpiled in accordance with a storm water management plan and used for backfill or repurposed as required. Limiting ground disturbance to the parking lot also avoids impacting the hydrology of the site since the parking lot is already a compacted surface.

The offshore export cables and Onshore Export Cable 1 will be installed using HDD. The HDD operations will only disturb the ground at the bore entry and exit for each cable. By minimizing ground disturbance, the Project minimizes the area in which complex vegetation re-establishment may be needed. Minimizing ground and vegetation disturbance also avoids impacts to coastal birds.

The Project has been designed to avoid impacts to coastal dunes and interdunal wetlands because they provide critical habitat for rare, threatened, and endangered species for much of the year. DNREC recommends specific protections for these species and habitats, listed below (DNREC 2023b):

- DNREC recommends minimizing disturbance to colonies by implementing 150 m (492 ft) buffers for small colonies (less than 30 nests), 300 m (984 ft) buffers for large colonies (more than 30 nests) and to avoid staging equipment on sensitive wetland habitat. US Wind has avoided known colonial bird nesting sites and would construct outside nesting season.
- In order to minimize impacts to marsh nesting birds, US Wind plans to install cables and conduct associated maintenance and monitoring outside of breeding season, April 1 to July 31.
- DNREC recommends that from November 15 to March 1, in water work between Hickory Cove and the US Wind substation, i.e., in Indian River, be restricted to avoid impacts to hibernating terrapins in this area, per DNREC recommendation. Should work be necessary prior to March 1, DNREC suggests BMPs be implemented such as diver surveys to look for hibernating terrapins.
- Although work is not planned in the immediate vicinity (within 660 feet) of a known bald eagle nest, US Wind will complete the Northeast Bald Eagle Screening Form prior to the start of construction.
- In order to minimize impact to seabeach amaranth, DNREC recommends not conducting work or staging activities on undeveloped beach sites from July 1 to September 30. Additionally, to conduct surveys during August to document any presence of this species. US Wind would contain construction activities within the disturbed footprint of the Barrier Beach Landfall parking lot and therefore would not disturb seabeach amaranth.

- Due to the proximity of interdunal swales in the proximity of the Barrier Beach Landfall, DNREC recommends a time of year restriction for all artificial lighting at night from June 1 to September 1 to minimize impacts to Bethany Beach Firefly. Additionally, no alternations to dune topography or woody vegetation during this time period within 100 feet of interdunal swales to minimize light pollution to these sensitive species.
- DNREC recommends that installation of cables underneath sensitive tidal marshes not be conducted during nesting season between April 1 to July 31.

Because ground disturbance will be minimized using the proposed construction approach, it is anticipated that alteration of coastal habitat in the Project area will be negligible.

Routine and Accidental Releases

Vessel traffic associated with construction activities is expected to produce routine and accidental releases of pollutants that will have negligible impacts on coastal habitat. Construction-related impacts from routine and accidental releases, including drilling fluid that could be released in the event of a frac-out during HDD, are discussed in detail in Volume II, Section 4.2.1. Spills of oil and hazardous chemicals can inhibit the growth of aquatic plants and harm or kill aquatic animals. Litter and other marine debris can also injure or suffocate aquatic animals. However, since the routine releases associated with this Project are anticipated to be small quantities of clean discharge and accidental releases associated with this Project are unlikely, the impacts of routine and accidental releases associated with the Project are anticipated to be negligible.

6.3.2 Operations

US Wind plans to use a suitable preexisting facility located pier side in the Ocean City, Maryland area for an O&M Facility and associated warehouse and crew support facility. Construction would occur in previously developed areas.

Habitat Alteration and Species Benefits

If beneficial reuse of dredge material at degraded marsh sites is later pursued and approved it would potentially benefit important bird species by increasing habitat space after construction, specifically the black rail, saltmarsh sparrow, American oystercatcher, and colonial waterbirds. Beneficial reuse of dredge material, however, is not proposed for the Project.

Routine and Accidental Releases

Potential impacts to coastal habitat due to routine and accidental releases associated with Project operations and maintenance are anticipated to be less than impacts associated with construction. Potential impacts of routine and accidental releases during operations and maintenance are discussed in detail in Volume II, Section 4.2.2. Vessels may be used to transport maintenance materials and personnel to the Project in the event that the WTGs, OSS or submarine cables are in need of repair. Vessels may release sanitary waste and engine emissions as part of their routine operations and may inadvertently release trash, oil, or other chemicals that could impact coastal habitats; however, the impact of these releases is anticipated to be negligible due to the anticipated low frequency of maintenance and the low likelihood of accidental discharge.

6.3.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline.

Potential impacts of decommissioning the Project would likely be less than impacts of constructing the Project. Removing OSSs and WTGs would have negligible impact on coastal habitats. It is difficult to assess what the potential impact of removing the cables would be without developing a project plan but impacts on coastal habitat could be minor to moderate depending on how much land disturbance is required in specialized coastal habitats. Habitat restoration or replication could be warranted as mitigation. However, as the decommissioning process is currently conceived, it is anticipated that coastal habitats would be able to fully recover from any impacts associated with decommissioning the Project.

6.4 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on coastal habitat and birds.

- US Wind will install cables using HDD to avoid impacts to coastal dunes and interdunal wetlands and to minimize bottom disturbance.
- US Wind will minimize ground disturbance by confining cable infrastructure, such as transition vaults and HDD operations, to previously disturbed lands as much as practicable. Construction activities and ground disturbance at the Barrier Beach Landfall would occur in the previously disturbed parking lot.
- Onshore construction activities will be scheduled to avoid impacting sensitive coastal habitats, where practicable.
- Between May 1 and August 1, construction activities will not occur within 100 m (328 ft) of hummocks in Indian River Bay in order to avoid impacts to nesting terns.
- Based on consultation with DNREC, the following habitat protection measures would be implemented to avoid and minimize impacts to species:
  - Installation of cables underneath tidal marshes will not be conducted during nesting season between April 1 through July 31.
  - Restrict nighttime artificial lighting restriction from June 1 through September 1 at Barrier Beach Landfall.
  - Avoid colonial waterbird nesting sites and avoid construction at the Barrier Beach Landfall and in-water work in Indian River Bay outside the nesting season.
  - US Wind would implement best practices such as diver surveys in Indian River for work between November 15 and March 1 to protect hibernating terrapins.
  - US Wind plans to install cables and conduct associated maintenance and monitoring outside of breeding season, April 1 to July 31, which would minimize impacts to marsh nesting birds.
- US Wind will minimize impacts on submerged aquatic vegetation where practicable. No submerged aquatic vegetation has been identified in areas proposed for permanent or temporary disturbance.
- US Wind will establish and maintain buffers around wetlands, implement best management practices (BMPs) to minimize erosion and control sediments and maintain natural surface drainage patterns, as practicable.

- US Wind will locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches, where feasible. The use of HDD for cable installation under the Barrier Beach Landfalls will avoid impacts on beaches.
- Construction is anticipated to occur outside of turtle nesting season. Agency consultation and monitoring will be conducted as needed to mitigate disturbances.
- Project-specific SPCC Plan will be prepared prior to construction and for operations activities.
- US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate.
- Agency consultation and monitoring regarding coastal habitats and species will be conducted as needed to mitigate disturbances, as practicable.
- US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.

7.0 Benthic Resources

7.1 Description of Affected Environment

In developing earlier versions of its benthic habitat assessment and mapping approach, US Wind relied on guidance from the BOEM June 2019 “Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585” (BOEM 2019). However, following issuance of the Greater Atlantic Regional Fisheries Office’s (GARFO) May 27, 2020 “Updated Recommendations of Mapping Fish Habitat,” (NOAA Fisheries 2021g) subsequent consultations with BOEM and GARFO on June 15, 2020, and GARFO’s March 29, 2021 “Updated Recommendations for Mapping Fish Habitat,” US Wind revised its habitat mapping approach for surveys that were undertaken in 2021.

This approach commenced with the review of earlier Lease area geophysical and seafloor sampling surveys by US Wind and others, which were used to provide initial context for coarse-scale identification of potentially complex seafloor habitat locations. Following this, US Wind initiated acoustic surveys, the preliminary results of which were then used in tandem with previously existing data to select locations for targeted seafloor sampling in the Lease area. Data products used to support the benthic habitat survey and mapping work include multibeam echosounder bathymetry and backscatter, as well as sidescan sonar mosaics, reflectivity, high-relief targets, and identification of bedforms (e.g., sand ripples).

In the Offshore Export Cable Corridors, preliminary acoustic survey results were not available prior to initiating selection of the benthic sample locations. Therefore, benthic sample locations were selected at discrete intervals of approximately 1 km to provide geographic coverage for characterization of benthic habitats.

The 2021 benthic habitat survey program was conducted in July and August of 2021. It included collection of 0.04 m^2 benthic grabs, still imagery, and video transects. Separate benthic grab samples were collected and processed for bulk physical and macrofaunal analysis at each sampling location. Still planview imagery was collected at each benthic grab location using a grab-mounted camera. Video transects were approximately 180 m in length and included collection of both oblique and planview imagery.

The results of the fully processed acoustic mapping and targeted seafloor sampling have been integrated to produce final data products that include both characterization and delineation of benthic habitat according to the NOAA Fisheries-modified Coastal and Marine Ecological Classification System (CMECS) taxonomic framework identified in GARFO’s March 29, 2021 “Updated Recommendations for Mapping Fish Habitat.”

7.1.1 Lease Area

Benthic habitat in the Lease area is generally characterized by mobile sandy substrates on gentle slopes, with shell hash frequently accompanying mineral substrates (Guida et al. 2017). Although sand is the dominant sediment type in the area, gravel is common as a minor component, particularly in northern portions of the Lease area (Guida et al. 2017). Muddy sands are also present in areas protected from strong currents, including portions of the central Lease area. Variations in sediment have been observed to occur over small spatial scales within the Lease area, and though few hard bottom patches are believed to be present, scattered cobble areas have been observed (Guida et al. 2017).

The benthic macrofaunal community in the Lease area appears to be dominated by polychaetes, which were the most abundant taxonomic group observed during benthic sampling conducted within the Maryland WEA in 2013 (Guida et al. 2017). Polychaetes representing 26 distinct taxonomic families contributed more than 50% of the observed total macroinvertebrate abundance. Oligochaete worms were the second-most abundant group observed, followed (in descending order) by mollusks, crustaceans, and other organisms (Guida et al. 2017).

Video surveys and survey trawls of the Lease area suggest that the primary benthic epifaunal taxa include common sand dollar (Clypeasteroida, *Echinarachnius parma*), sea stars (*Asterias* spp.), tube anemones (*Cerianthus sp.*), hermit crab (*Pagurus* sp.), rock crab (*Cancer* spp.), moon snails (Naticidae), and nassa snails (*Ilyanassa* [*Nassarius*] spp.). Surf clams (*Spisula solidissima*), sea scallops (*Placopecten magellanicus*), penaeid shrimp (Penaeidae), sand shrimp (*Crangon septemspinosa*), horseshoe crab (*Limulus polyphemus*), and ocean quahog (*Arctica islandica*) were also occasionally recorded in survey trawl data (Guida et al. 2017).

7.1.1.1 2015 Benthic Field Survey

A survey of benthic resources was conducted in July 2015 in the initial proposed location of the Met Tower (Appendix II-D3). Sampling was conducted in accordance with *Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* issued November 4, 2013 by BOEM (BOEM 2019). The benthic field survey was composed of two elements, including 1) collection of still images and video of the seafloor and 2) collection of benthic grab samples for laboratory analysis of taxonomic composition. The benthic field survey focused on six locations as seen in Figure 7-1.

Qualitative analysis of the benthic imagery obtained indicated the presence of at least eight macrofaunal taxa overall (Table 7-1). Most of the observed taxa were epifaunal species, such as hermit crabs and sand dollars.

Table 7-1. Summary of Macroinvertebrate Taxa Observed in Benthic Field Survey Imagery

Common Name	Scientific Name
Sea stars	Asteroidea
Rock crabs	*Cancer* spp.
Tube anemones	Cerianthidae
Sand dollars	Clypeasteroida
Hydrozoans	Hydrozoa
Moon snails (includes egg collars)	Naticidae
Hermit crabs	Paguridae
Bristle worms	Polychaeta

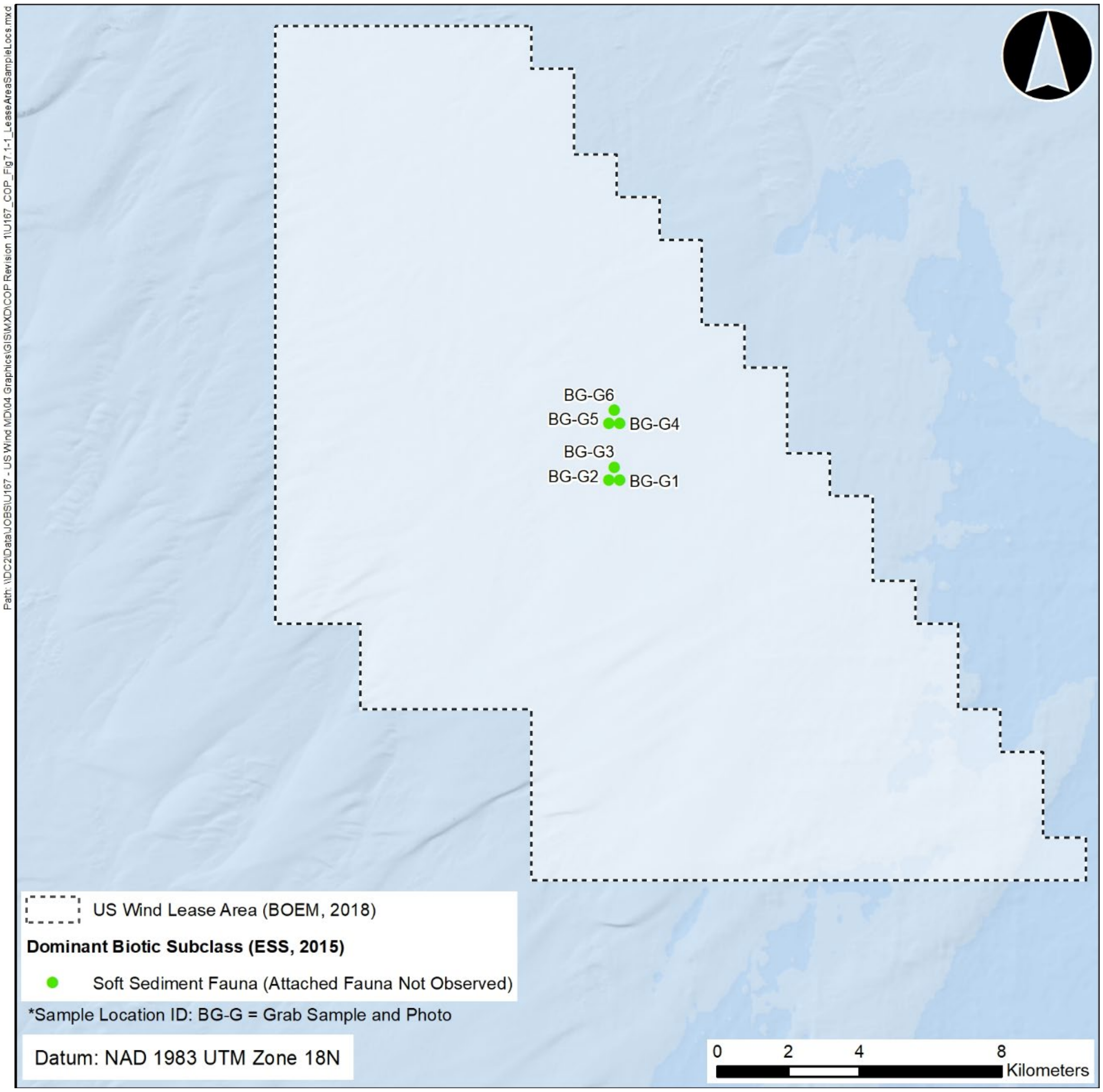


Figure 7-1. Benthic Field Survey Samples CMECS Biotic Subclass Classification and Attached Organism Presence

Grab samples provided additional information on the benthic community, especially infaunal taxa. Overall, nineteen species of benthic fauna were observed from the six grab samples. Taxa richness averaged eight per sample (Table 7-2). Polychaete worms were the most taxonomically rich group, contributing over 47% of the taxa richness in the study area. Mollusks represented 26% of observed taxa. Crustaceans, oligochaete worms, and “other” taxonomic groups were observed to be the least taxonomically rich, contributing just of one or two taxa each (5.3% or 10.5% of taxonomic richness).

Overall macrofaunal density averaged close to 3,500 organisms/m^2 (Table 7-2). Nematode worms (primary constituent of the “other” taxonomic group) were the most abundant organism encountered in the benthic grab sampling program, accounting for almost 40% of macrofaunal density (Table 7-3). Polychaete worms were the second-most abundant benthic organism observed, followed by oligochaete worms, crustaceans, and mollusks (Table 7-2).

Table 7-2. Summary of Key Statistics from the Benthic Field Survey Community Assessment

Statistic	Value
Number of Samples	6
Mean Density per Square Meter (±1 SD)	3,433 ± 501
Mean Taxa Richness (±1 SD)	8 ± 1
Total Number of Taxa	19
Percent of Taxa Observed by Taxonomic Group	
Polychaetes	47.4
Crustaceans	10.5
Mollusks	26.3
Oligochaetes	5.3
Other	10.5
Percent of Total Abundance by Taxonomic Group	
Polychaetes	35.4
Crustaceans	9.2
Mollusks	3.9
Oligochaetes	9.7
Other	41.7

Table 7-3. Relative Abundance of Taxa Observed in Benthic Field Survey Benthic Grabs

Taxon	Common Name	Percent Relative Abundance
Nematoda	Nematode Roundworm	37
Polygordius sp.	Primitive Bristleworm	16
Tubificidae	Oligochaete Worm	10
Lumbrinerides acuta	Opal Worm	8
Tanaissus psammophilus	Tanaid Shrimp	8
Glycinde solitaria	Chevron Worm	6
Turbellaria	Flatworm	4

Table 7-3. Relative Abundance of Taxa Observed in Benthic Field Survey Benthic Grabs

Taxon	Common Name	Percent Relative Abundance
Paraonis sp.	Paraonid Worm	2
Ensis directus	Razor Clam	1
Trichophoxus epistomus	Hooded Amphipod	1
Capitellidae	Capitellid Threadworm	1
Sigalion arenicola	Sigalionid Scaleworm	1
Spisula solidissima	Surf Clam	1

* Includes taxa accounting for at least 1% of total abundance.

Most of the benthic macrofaunal taxa observed in the benthic grab samples were small burrowing or tube-building taxa. The most commonly observed polychaete taxa include *Polygordius* sp. and *Lumbrinerides acuta*, both typical of sandy shelf habitats (Solis-Weiss et al. 1995; P. Ramey 2008a). The most abundant crustacean (the tanaid [*Tanaissus psammophilus*]) and mollusk (the razor clam [*Ensis directus*]) are also shallow burrowers (Weiss 1995). Although not abundant, surf clam juveniles were present in two samples.

Larger nematode worms (longer than 500 microns) were included in the data analysis. However, nematodes are often treated entirely as meiofauna and not included in analyses of the benthic macroinvertebrate community. When nematodes are removed from the dataset, polychaete worms become the dominant taxonomic group, contributing over 50% of the total benthic abundance. These community composition results are consistent with previous grab sampling of the benthic community in the Lease area, in which polychaetes contributed approximately 57% of total abundance (Guida et al. 2017).

Previous studies have also not documented the presence of live-bottom benthic habitats in the area (Guida et al. 2017; NOS 2015). Other potentially sensitive or unique benthic habitat types, such as hard bottom, were not directly documented during the benthic or geophysical and geotechnical survey program within the Lease area (Alpine 2015). Although localized areas of hard bottom cobble habitat are known to occur in the Lease area, these are anticipated to be localized (Guida et al. 2017). These findings align with previous studies, which indicate that hard bottom benthic habitats are rare in the Lease area and primarily occur as gravel- or cobble-dominated substrates (Guida et al. 2017; NOS 2015).

More detailed summaries of the methodology used and the results of the benthic field survey are presented in Appendix II-D3.

Taxonomic Classification of Benthic Habitat in the Lease Area

Based on previous grab sampling in the area conducted by Guida et al. (2017) and investigations for this Project, a preliminary classification of the benthic habitat in the Lease area has been completed under the CMECS (Table 7-4). The classification will be updated with the results of the 2021 Benthic Survey.

To identify potentially sensitive habitat areas, the dominant biotic subclass under the CMECS framework was determined for each benthic sample site within the Lease area. All six sites were characterized by soft sediment fauna, and no attached fauna or sensitive or unique benthic habitats, such as hard bottom, live bottom, or submerged aquatic vegetation (SAV), were observed.

Table 7-4. Taxonomic Classification of Benthic Habitat in the Lease Area

CMECS Level		Classification
Biogeographic Setting	Realm	Temperate North Atlantic
	Province	Cold Temperate Northwest Atlantic
	Ecoregion	Virginian
Aquatic Setting	System	Marine
	Subsystem	Nearshore to Offshore
	Tidal Zone	Subtidal
Water Column Component	Water Column Layer*	Marine Nearshore Lower Water Column to Offshore Subtidal Water Column
	Salinity Regime	Euhaline Water
	Temperature Regime	Moderate Water (Seasonal Variation from Cold to Warm)
Geoform Component	Tectonic Setting	Passive Continental Margin
	Physiographic Setting	Continental Shelf
	Geoform Origin	Geologic
Substrate Component	Substrate Origin	Geologic Substrate
	Substrate Class	Unconsolidated Mineral Substrate
	Substrate Subclass*	Coarse to Fine Unconsolidated Substrate
	Substrate Group*	Patchy, Mobile Gravel Mixes to Muddy Sand
Biotic Component	Biotic Setting	Benthic Biota
	Biotic Class	Faunal Bed
	Biotic Subclass	Soft Sediment Fauna

*Indicates multiple classifications within this level of the CMECS hierarchy in the Lease area.

Shellfish

Although not abundant, surf clam juveniles were present in two of the samples collected during the 2015 benthic field survey. This species appears to occur throughout the Lease area, and juveniles were described as prevalent in benthic grab samples collected from the area in 2013 (Guida et al. 2017).

Although no other shellfish of commercial importance were observed in samples collected during surveys within the Lease area, both sea scallops, and ocean quahog were documented in samples collected by the NEFSC LMRCSC cruise in 2013 (Guida et al. 2017).

Although horseshoe crabs were not observed during the benthic field survey, this species is known to be present in the Lease area. Horseshoe crabs congregate at sandy beaches in springtime to spawn (notably in Delaware Bay) and overwinter in deeper bay and offshore waters (USFWS 2006; MDDNR 2021b). DNREC indicated in its Environmental Review December 21, 2023, that spawning season for horseshoe crabs is April 15 to June 30. Approximately 108.6 km^2 (41.9 mi^2) of the Lease area is located within the southwestern portion of the Carl N. Shuster, Jr. Horseshoe Crab Reserve (Figure 7-2). The Shuster Reserve occupies the area extending 48 km (30 mi) east of the eastern boundary of state-regulated waters off the coast of Delaware Bay, and was designated as a no-harvest zone for horseshoe crabs, effective March 7, 2001, in an effort to maintain sufficient numbers of horseshoe crab eggs to feed migratory shorebirds (Marine Conservation Institute 2019).

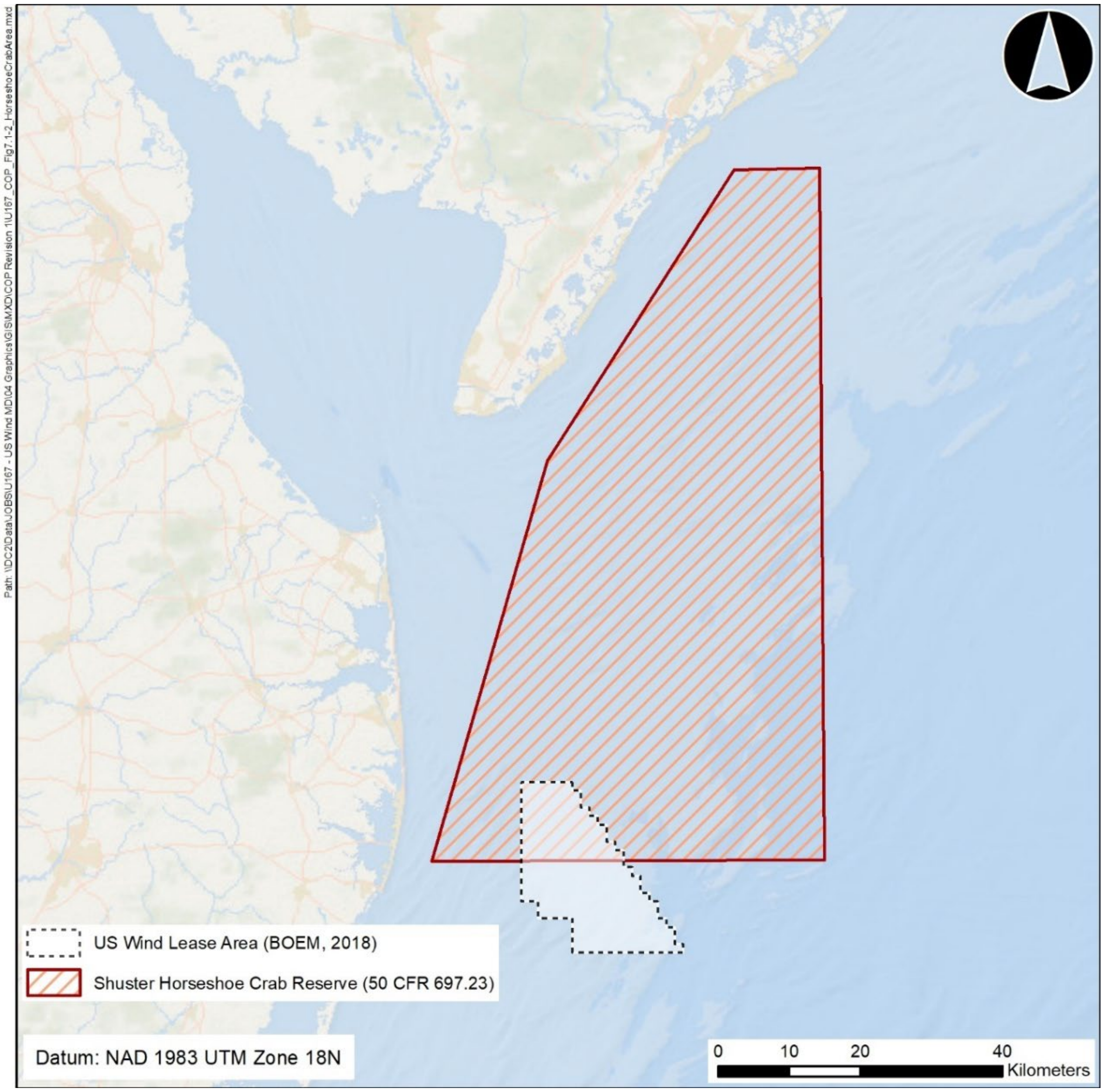


Figure 7-2. Carl N. Shuster, Jr Horseshoe Crab Reserve

See Volume II, Section 17.5 for a discussion of the commercial and recreational value of shellfishing in the Lease area.

7.1.1.2 2021 Benthic Field Survey

A field survey of benthic resources in the Lease area was conducted in July and August of 2021. This survey involved the collection of benthic grabs at 120 locations across the Lease area, as well as collection of video transects via remotely operated vehicle (ROV) at 70 locations.

Of the 120 benthic grab sample locations selected in the Lease area, 60 were fixed locations co-located with proposed WTG or OSS locations. These locations were selected to ensure broad geographic characterization of portions of the Lease area that may be directly impacted by Project construction. The other 60 locations were selected to characterize potential complex habitat, as identified by preliminary interpretation of the 2021 HRG acoustic data and supplemented by other existing sources of data (CB&I 2014; Alpine 2015; Guida et al. 2017). Areas targeted as potential complex habitat were mapped by one or more of these sources as more likely to contain unconsolidated hard bottom, such as gravel, gravel mixes, and gravelly substrates (Figure 7-3).

Of the 70 benthic imagery transects completed in the Lease area, 10 were fixed locations co-located with proposed WTG or OSS locations. The remaining 60 imagery transects were selected to characterize the areas of potential complex habitat. The axes of these transects were aligned to capture features of interest (e.g., high-relief objects, areas of higher reflectivity or rugosity) based on preliminary interpretation of the 2021 HRG acoustic data.

The results of the 2021 Benthic Survey are provided as Appendix II-D4. The benthic report delineates complex seafloor features using NOAA Fisheries modified CMECS classifications.

A total of 99 marine invertebrate taxa, including polychaete worms, crustaceans, mollusks, oligochaete worms, nemertean ribbon worms, sand dollars, ascidians, lancelets, sea anemones, flatworms, and sipunculids were found in the 120 macrofaunal grab samples collected within the Lease area during the 2021 benthic survey program (Table 7-5[10]). Average organism density was 788 ± 738 (mean ± SD), ranging from a high of 3,950 individuals/m^2 at BG-LA-Z028/USW065 to a low of 25 individuals/m^2 at BG-LA-B03/USW009. Of the 120 samples analyzed, 36 were characterized by densities of 1000 individuals/m^2 or more (30% of samples). Total taxa richness per sample ranged from 1 to 25, with an average of 11 ± 5.7 (Table 7-5). Taxa richness was greatest in the northeastern and southeastern portions of the Lease area, and density was greatest in the northeastern region and in sections along the eastern and southern borders of the Lease area.

The most speciose taxonomic group was polychaete worms, which contributed over 37% of the taxa documented in the analyzed samples (Table 7-5). Crustaceans and mollusks each accounted for approximately 25-26% of taxa in the Lease area samples (Table 7-5). Polychaetes accounted for the greatest percentage of total organism abundance of any taxa group (over 56%), followed by oligochaete worms and crustaceans (over 19% and over 11%) (Table 7-5).

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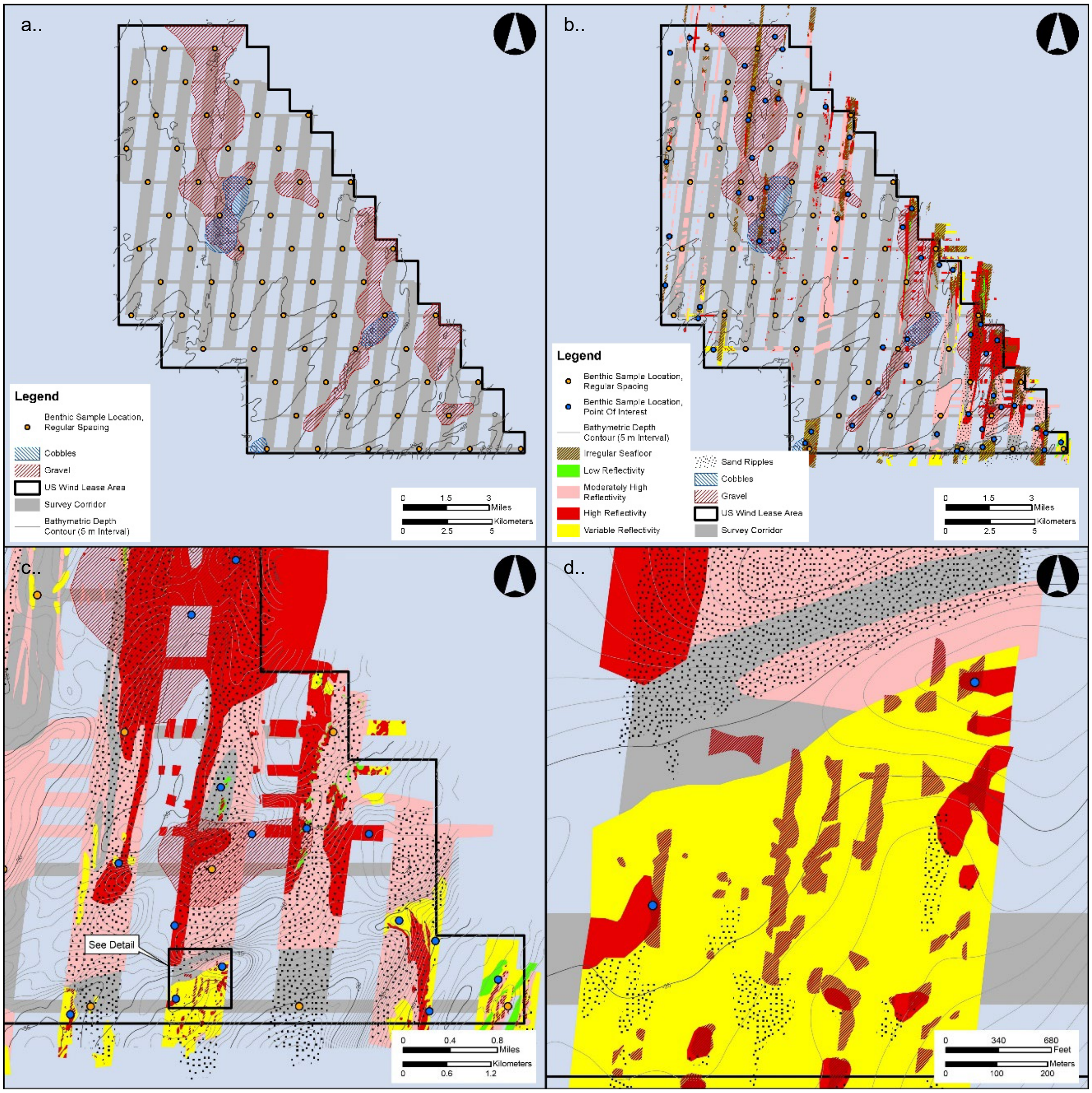
[10] Note that nematode round worms, meiofaunal organisms that dwell in the spaces between sand grains, were not included in analyses of the benthic macroinvertebrate community.



Panel a: Coarse-scale identification of areas with higher frequency of cobble and gravel based on existing data sources. Panel b: Preliminary 2021 acoustic data overlaid on existing data.
Panel c: Same as top right map but scale and extent adjusted to show additional detail in southeastern portion of Lease area, including sand ripples (stippled areas) and more detailed bathymetry.
Panel d: Detail of inset from bottom left map.

Figure 7-3. Example of Selection Process For Seafloor Sampling Locations. Blue Points Represent Locations Selected for Sampling Based on Habitat.

Table 7-5. Summary of Key Statistics from the 2021 Lease Area Benthic Sample Analysis

Statistic	Value
Number of Samples	120
Mean Density per Square Meter (±1 SD)	788 ± 738
Mean Taxa Richness (±1 SD)	11 ± 5.7

Table 7-5. Summary of Key Statistics from the 2021 Lease Area Benthic Sample Analysis

Statistic	Value
Total Number of Taxa	99
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	37
Crustaceans	26
Mollusks	25
Oligochaete worms	3
Other	8
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	56.7%
Crustaceans	11.9%
Mollusks	9.8%
Oligochaete worms	19.3%
Other	2.3%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

The most abundant taxon in Lease area samples was naidid oligochaete worms without hair chaetae, which accounted for over 10% of all individuals identified (Table 7-6). Cirratulid polychaetes, enchytraeid oligochaete worms, polygordiid polychaetes, and phyllodocid polychaetes were the next most abundant taxa, each accounting for more than 5% of all organisms (Table 7-6).

Common and widespread organisms in Lease area samples, including numerous polychaetes *(Polygordius*, cirratulids, *Scoletoma* sp., *Spio* sp., *Exogone* sp.) and tellin clams, are typical of mobile soft sediment habitats. *Polygordius* polychaetes are often dominant members of macrofaunal communities on inner continental shelf waters along the east coast of the United States and are associated with coarse sandy sediments (P. A. Ramey, Fiege, and Leander 2006; P.A. Ramey 2008b). Cirratulid worms are deposit feeders that reside in soft sediment habitats, and *Scoletoma* sp. are predatory worms which burrow in mud and mixed-bottom debris (Gosner 1978). Other common taxa like *Spio* sp. worms build tubes from sediment and are associated with sandy substrates (Gosner 1978). *Exogone* sp. worms can be found in a variety of habitats ranging from muddy sand to coarse gravel (Pettibone 1963). Similarly, tellin clams occur in a variety of soft sediment habitats (Mikkelsen and Bieler 2021), and *Scalibregma* sp. are associated with muddy sand (Gosner 1978).

Table 7-6. Relative Abundance of Taxa Encountered in 2021 Lease Area Samples

Scientific Name	Common Name	Relative Abundance (%)
Naididae w/out hair chaetae	Oligochaete Worm	10.7
Cirratulidae	Cirratulid Polychaete	8.3

Table 7-6. Relative Abundance of Taxa Encountered in 2021 Lease Area Samples

Scientific Name	Common Name	Relative Abundance (%)
Enchytraeidae	Oligochaete Worm	8.3
Polygordius sp.	Polygordiid Polychaete	6.7
Phyllodocidae	Phyllodocid Polychaete	5.5
Spio sp.	Spionid Polychaete	4.6
Scoletoma sp.	Lumbrinerid Polychaete	3.3
Goniadella gracilis	Goniadid Polychaete	3.1
Exogone sp.	Syllid Polychaete	3.1
Tanaidacea	Tanaid Crustacean	2.7
Scalibregma inflatum	Scalibregmatid Polychaete	2.7
Glycera sp.	Bloodworm (Glycerid Polychaete)	2.5
*Includes taxa accounting for ≥ 2.5% of total abundance		

Taxonomic Classification of Benthic Habitat in the Lease Area

Results of the benthic transect imagery analysis and benthic grab NMFS-modified CMECS classifications from within the Lease area are summarized in Tables 7-7 and 7-8 below. The resulting substrate classifications are presented in greater detail in Appendix II-D4.

Table 7-7. Lease Area Benthic Imagery Transect Substrate Group Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Transects	% of Transects
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	56	82%
Gravelly	Gravelly Sand	12	18%
Gravel Mixes	Sandy Gravel	0	0%
Gravel	Pebble/Granule	0	0%
Total		**68***	**100%**
* Total does not include those that could not be fully classified due to environmental conditions (e.g., poor visibility).			

Table 7-8. Lease Area Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Locations
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	47	39%
Gravelly	Gravelly Sand	48	40%
Gravel Mixes	Sandy Gravel	25	21%
Gravel	Pebble/Granule	0	0%
Total		**120**	**100%**

The infaunal sampling results for Lease area samples aligns with the CMECS habitat classifications for the area; of the 120 samples collected in the Lease area, 39% (47 samples) were classified as fine unconsolidated substrates under the CMECS framework, and 61% (73 samples) were classified as coarse unconsolidated substrates. Consequently, most of the taxa observed in grab samples collected from the Lease area are typical of soft-sediment habitats.

Shellfish

Soft-shell clams (*Mya arenaria*), a shellfish species of potential commercial importance, were observed in low densities at 12 sites within the Lease Area during the 2021 Benthic Survey. No taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed in benthic grab samples collected within the Lease area.

Though horseshoe crabs were not observed during the 2021 benthic survey, this species is known to occur in the Lease area (see above 2015 Benthic Field Survey Shellfish section).

7.1.2 Offshore Export Cable Corridors

The deeper waters of the offshore export cable corridors are euhaline and similar in many ways to those of the Lease area, with vertical thermal and salinity gradients during the summer months. Shallower coastal waters near the offshore landfall are typically well-mixed throughout the year and subject to more variable temperatures, as described in Volume II, Section 4.0.

Benthic habitats in nearshore shelf and offshore areas of Delaware are primarily composed of reworked Holocene deposits with sand as the dominant grain size in most areas (Reid et al. 2005; Coastal Planning & Engineering 2014). The area is generally shaped by sedimentary processes from high wave energy in the Atlantic Ocean. The intense wave action has generated sandy ridges interspersed with depressions, the spacing of which vary substantially with distance from shore. These features tend to become larger and more widely spaced toward the southeast, where they may be spaced 2 to 4 km (1.2 to 2.4 mi) apart and extend tens of kilometers (tens of miles) from end to end. The ridges and adjacent depressions are generally oriented along a southwest to northeast axis with a maximum relief of 5 to 10 m (16 to 32 ft) from trough to crest (Coastal Planning & Engineering 2014). The Offshore Export Cable Corridors traverse the northern periphery of these ridges where the relief is generally less pronounced and takes the form of broad flats in some areas.

Benthic habitats in Delaware coastal waters are variable, but are often dominated by sandy substrates with varying levels of gravel and/or silt, and shell hash (Cutter et al. 2000). A prior study of the benthic community in Delaware coastal waters suggests dominance of fine-grained benthic habitats by polychaete worms, followed by mollusks and crustaceans (Cutter et al. 2000). Among polychaetes, the ampharetid worm *Asabellides oculata*, the mud worm *Spio setosa*, and the bee worm *Spiophanes bombyx* were common. The majority of mollusks observed were bivalves, though gastropods were also present at lower densities. The crustacean assemblage was dominated by amphipods, although crabs, cumaceans, and other taxa were also present. On coarser substrates, mollusks and crustaceans comprised a larger portion of the benthic community, with Astarte clams (*Astarte* spp.), the crenella bean mussel (*Crenella glandula*), blue mussel (*Mytilus edulis*), and the amphipod *Byblis serrata* most common. Infaunal organism abundance varied greatly, ranging from 90/m^2 to 70,600/m^2. Likewise, taxa richness varied from three to 40 taxa per sample.

7.1.2.1 2016 Benthic Field Survey – Formerly Planned Offshore Export Cable Route

A field survey of benthic resources along the formerly planned offshore export cable route was conducted in September 2016. Although this offshore export cable corridor is no longer being considered for the Project, the data is provided as indicative of the general area where the offshore export cables will be installed. This information will be updated with the results of the 2021 Benthic Survey. The 2016 benthic field survey was composed of two elements, including 1) collection of still images and video of the seafloor and 2) collection of benthic grab samples for laboratory analysis of taxonomic composition. Benthic imagery was collected at 22 locations along the formerly planned offshore export cable route, including eight locations that were identified as potential hard bottom habitats based on associated geophysical survey results. Benthic grab samples were collected at fourteen locations, including seven locations within the Old Grounds fishing area (Figure 7-4).

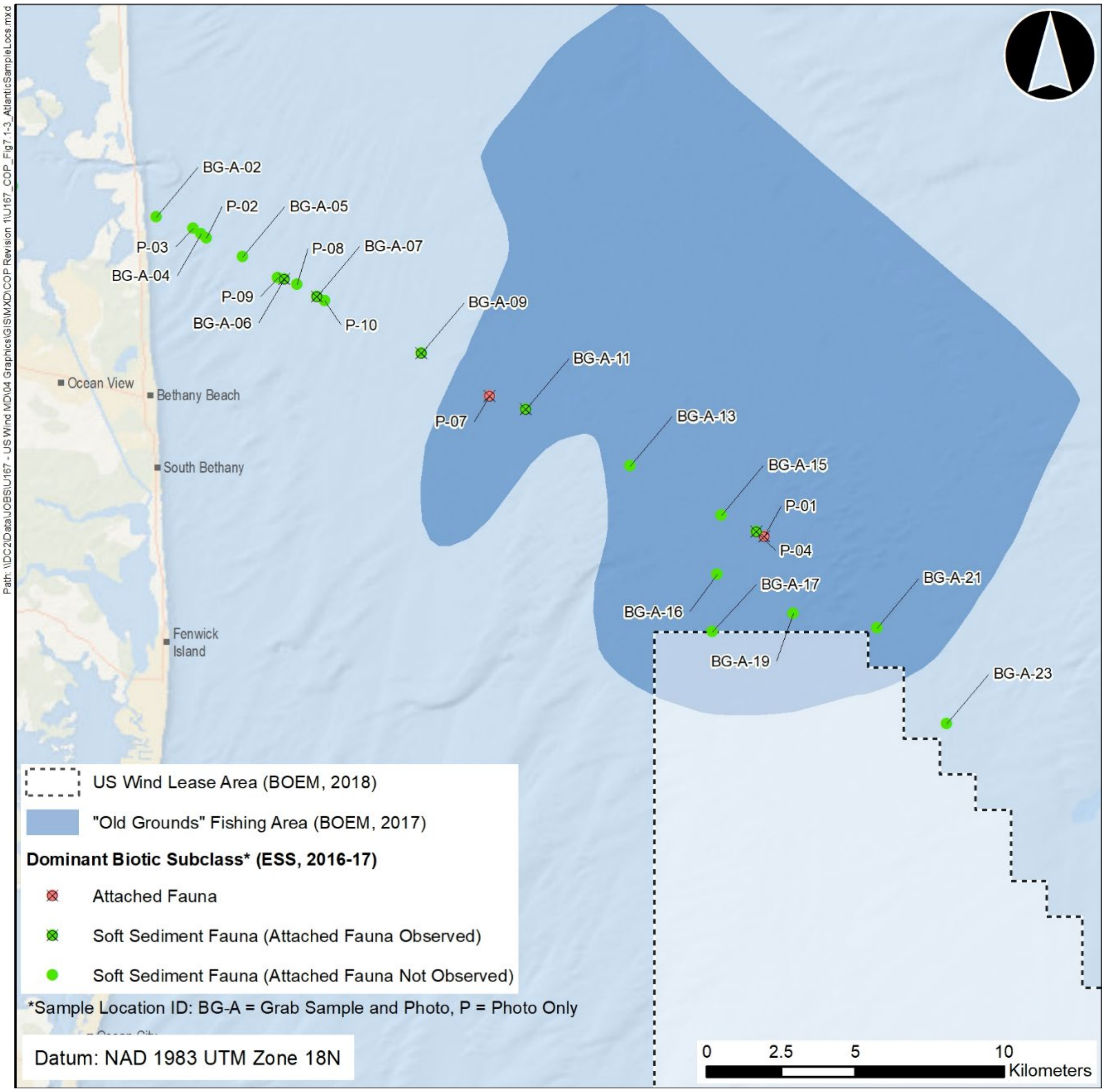


Figure 7-4. Formerly Planned Offshore Export Cable Route Benthic Samples CMECS Biotic Subclass Classification and Attached Organism Presence

Qualitative analysis of the benthic imagery indicated the presence of at least fourteen macrofaunal taxa (Table 7-9). Most of the observed taxa were primarily epifaunal species, such as hermit crabs, sand dollars, and slipper snails (*Crepidula* spp.).

Table 7-9. Summary of Macroinvertebrate Taxa Observed in Formerly Planned Offshore Export Cable Route Benthic Imagery

Common Name	Scientific Name
Tunicates*	Ascidiacea
Astarte clams	Astartidae
Stony coral*	*Astrangia* sp.
Bryozoans*	Bryozoa
Whelks	Busyconidae
Rock crabs*	*Cancer* spp.
Tube anemones	Cerianthidae
Sand dollars	Clypeasteroida
Slipper snails	*Crepidula* spp.
Shrimps	Decapoda
Sea whip*	*Leptogorgia* sp.
Moon snails (includes egg collars)	Naticidae
Hermit crabs	Paguridae
Bristle worms	Polychaeta
Sponges	Porifera

**Only observed in areas of hard bottom*

Grab samples provided additional information on the benthic community, especially infaunal taxa. Seventy-three marine invertebrate taxa, including polychaete worms, oligochaete worms, bivalves, gastropods, amphipods, isopods, cumacean shrimp, crabs, sand dollars, sea stars, sea cucumbers, nemertean ribbon worms, nematode round worms, and lancelets, were observed in the fourteen samples analyzed. Mean macroinvertebrate density was 813 organisms/m^2, and taxa richness averaged eight taxa per site, with individual samples ranging between two and twenty-two taxa (Table 7-10). The benthic community observed in the samples was dominated by nematode roundworms (primary constituent of the "other" taxonomic group), which accounted for nearly 67% of all organisms (Table 7-11). Although the nematode roundworms encountered in this study were large enough to be considered macrofauna, this group is often included with smaller meiofauna. When nematode roundworms were excluded, mollusks (including bivalves and gastropods) and polychaetes were co-dominant, constituting 45% and 31% of all non-nematode organisms.

Table 7-10. Summary of Key Statistics from the Formerly Planned Offshore Export Cable Route Benthic Community Assessment

Statistic	Value
Number of Samples	14
Mean Density per Square Meter (±1 SD)	813 ± 1241
Mean Taxa Richness (±1 SD)	8.0 ± 5.5
Total Number of Taxa	73
Percent of Taxa Observed by Taxonomic Group	
Polychaete worms	35.6
Crustaceans	35.6
Mollusks	16.4
Oligochaete worms	4.1
Other	8.2
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	10.5
Crustaceans	6.7
Mollusks	15.2
Oligochaete worms	0.8
Other	66.9

The most abundant non-nematode organism was the common slipper shell *Crepidula fornicata*, which accounted for 12% of all individuals (Table 7-11). The most widely distributed taxa were nematodes and decorator worms (*Diopatra cuprea*), which were observed in nine and five samples, respectively. Polychaete worms and crustaceans were the most taxonomically diverse groups, each accounting for about 36% of all documented taxa.

Table 7-11. Relative Abundance of Taxa Observed in Formerly Planned Offshore Export Cable Route Benthic Grabs*

Taxon	Common Name	Percent Relative Abundance
Nematoda	Nematode Roundworm	66
Crepidula fornicata	Common Slipper Shell	12
Exogone sp.	Syllid Polychaete	3
Mediomastus ambiseta	Capitellid Polychaete	2
Diopatra cuprea	Decorator Worm	2
Unciola sp.	Aorid Amphipod	1
Scoletoma sp.	Lumbrinerid Worm	1

Table 7-11. Relative Abundance of Taxa Observed in Formerly Planned Offshore Export Cable Route Benthic Grabs*

Taxon	Common Name	Percent Relative Abundance
Crepidula plana	Eastern White Slippersnail	1
*Includes taxa accounting for at least 1% of total abundance		

The benthic taxa found in this study are common and representative of coastal shelf habitats of the mid-Atlantic U.S. coast, and have been previously reported from the region (*Diopatra sp., Unciola sp., Mediomastus sp.*) (Cutter et al. 2000). Average benthic organism abundance and taxa richness per sample for the formerly planned offshore export cable route was lower than what was observed in the region by Cutter et al. (2000). Community composition also differed somewhat from previously reported results from the region. The ampharetid worm *Asabellides oculata*, the mud worm *Spio setosa*, and the bee worm (*Spiophanes bombyx*) were commonly observed by Cutter et al. (2000), but were not observed during the present study. However, in agreement with previous surveys, images of coarser substrates along the formerly planned offshore export cable route revealed the presence of Astarte clams (*Astarte* spp.) and blue mussels (Cutter et al. 2000).

The benthic community from samples collected within the Old Grounds differed somewhat from those encountered along the formerly planned offshore export cable route as a whole. Both average organism density (109 ± 106 individuals/m^2) and average taxa richness (4.7 ± 2.3) of the seven benthic samples collected within the Old Grounds were notably lower than at all of the sampling locations considered together. Crustaceans accounted for a greater percentage of the total specimens collected within the Old Grounds than along the formerly planned offshore export cable route (36% in the Old Grounds, compared to 6.7% along the formerly planned offshore export cable route). The most abundant taxa from samples collected within the Old Grounds were nematode roundworms, Aorid amphipods (*Pseudunciola obliguua* and *Unciola spp.*), the tanaid *Leptognathia caeca*, the pea crab *Dissodactylus melliate*, and bean mussels *(Crenella sp.*).

The survey indicated that hard bottom habitats occur in a few areas along the formerly planned offshore export cable route, primarily as localized gravel or cobble beds with varying degrees of exposure above sand and shell hash deposits. Most of these habitats were of limited extent and observed in Delaware coastal waters, although occasional areas of gravel or cobble were also observed in federal waters north and northwest of the Lease area. Analysis of benthic imagery indicated that hard bottom areas host occasional invertebrate epifauna such as moss animals (Bryozoa), colonial tunicates (Ascidiacea), sea whips *(Leptogorgia* sp.), stony corals (*Astrangia* sp.), and rock crabs. These observations generally align with those reported in the literature (NOS 2015). These hard bottom communities are sparsely distributed throughout the region, and NOAA predictive habitat maps indicate that the formerly planned offshore export cable route is "low suitability" habitat for both soft corals (Alcyonacea) and hard corals (Scleractinia), which are more commonly found along the continental slope (Kinlan et al. 2016).

More detailed methodology and results of the formerly planned offshore export cable route benthic field survey are presented in Appendix II-D2.

Taxonomic Classification of Benthic Habitat

The survey found that benthic habitats along the formerly planned offshore export cable route are somewhat variable, though typical of mid-Atlantic nearshore shelf habitats, and included areas of silt, fine, medium, and coarse sand with interspersed shell hash, gravel, and cobble. Water depths along the formerly planned offshore export cable route ranged from 2.8 to 31.1 m (9.2 ft to 102.7 ft).

Based on information reviewed in Cutter et al. (2000) and the field survey, benthic habitat in the formerly planned offshore export cable route was classified under CMECS (Table 7-12). To identify potentially sensitive habitat areas along the formerly planned offshore export cable route, the dominant biotic subclass under the CMECS framework was determined for each benthic site sampled during the field survey. Of the 23 sites sampled, one location (benthic imagery only) could not be classified due to insufficient photo quality. Of the remaining 22 sites, 20 were dominated by soft sediment fauna (Figure 7-4). Attached fauna, indicative of potentially sensitive hard bottom or live bottom benthic habitats, was the dominant biotic subclass observed at the other two sites (both sampled with benthic imagery only). These two sites were characterized by the presence of occasional sea whips, arborescent bryozoans, and stony corals growing attached to cobbles. Other attached organisms, including slipper shells, were also observed through imagery or grab sample analysis at five sites otherwise dominated by soft sediment fauna (Figure 7-4). No evidence of SAV was observed at any of the benthic sample locations.

Table 7-12. CMECS Classification of Benthic Sample Sites Along the Formerly Planned Offshore Export Cable Route

CMECS Level		Classification
Biogeographic Setting	Realm	Temperate North Atlantic
	Province	Cold Temperate Northwest Atlantic
	Ecoregion	Virginian
Aquatic Setting	System	Marine
	Subsystem	Nearshore
	Tidal Zone	Subtidal
Water Column Component	Water Column Layer	Marine Nearshore Lower Water Column
	Salinity Regime	Euhaline Water
	Temperature Regime	Moderate Water (Seasonal Variation from Cold to Warm)
Geoform Component	Tectonic Setting	Passive Continental Margin
	Physiographic Setting	Continental Shelf
	Geoform Origin	Geologic
Substrate Component	Substrate Origin	Geologic Substrate
	Substrate Class	Unconsolidated Mineral Substrate
	Substrate Subclass*	Fine Unconsolidated Substrate, Coarse Unconsolidated Substrate
	Substrate Group*	Sand, Gravel, Mud

Table 7-12. CMECS Classification of Benthic Sample Sites Along the Formerly Planned Offshore Export Cable Route

CMECS Level		Classification
	Substrate Subgroup*	Coarse Sand, Fine Sand, Medium Sand, Pebble, Silty Clay, Cobble
Biotic Component	Biotic Setting	Benthic Biota
	Biotic Class	Faunal Bed
	Biotic Subclass*	Soft Sediment Fauna, Attached Fauna
*Indicates multiple classifications within this level of the CMECS hierarchy among sample sites		

Shellfish

The only shellfish observed in samples collected along the formerly planned offshore export cable route were razor clam, softshell clam (*Mya arenaria*), and blue mussel, none of which was observed to be widespread or abundant in the samples.

Other recent surveys have found surf clams to be present at low densities in sandy to gravelly sediments off the coast of Delaware. Scott (2001) encountered a single adult surf clam in sixteen commercial dredge tows from potential sand borrow areas. More recently, Scott and Wong (2012) documented few juvenile surf clams in a proposed sand borrow area north of the Indian River Bay inlet; out of 34 grab samples, only one contained more than a single surf clam.

Horseshoe crabs were not observed during benthic field studies but are known to be present in the Project area along the Offshore Export Cable Corridors, which transits approximately 40 – 52 km (25 - 33 mi) of the southwestern portion of the Carl N. Shuster, Jr. Horseshoe Crab Reserve, depending on the final corridor selection. Horseshoe crabs likely utilize areas in the vicinity of the Offshore Export Cable Corridors for overwintering habitat (USFWS 2006; MDDNR 2021b), and individuals may cross the Offshore Export Cable Corridors during annual migrations between breeding beaches and offshore areas.

Chemosynthetic Communities

Chemosynthetic communities exist where there is not enough light or oxygen for photosynthesis to occur, usually in deep sea environments (FSU Brooke Laboratory 2021). This process is carried out by bacteria, which convert carbon (usually carbon dioxide or methane) into organic matter by using inorganic molecules or methane as an energy source (FSU Brooke Laboratory 2021). In the Atlantic Ocean, chemosynthetic communities exist along methane seeps that occur near or on the continental shelf break or within deep sea canyons (USGS 2016). The closest seeps to the Project Area occur between the Norfolk Canyon and Baltimore Canyon at depths from the shelf-break to 600 m (1,968 ft), approximately 60 kilometers (37 miles) from the Project Area. Therefore, chemosynthetic communities will not be impacted by the proposed Project activities.

7.1.2.2 2021 Benthic Field Survey

A field survey of benthic resources along the Common Export Cable Corridor and Offshore Export Cable Corridors 1 and 2 was conducted in July and August of 2021 (Figure 7-5). This survey involved collection of benthic grabs at 69 locations along the Offshore Export Cable Corridors as well as the collection of 29 video transects via ROV. The results of the 2021 Benthic Survey are summarized below and provided as Appendix II-D4. This benthic report delineates complex seafloor features using NOAA Fisheries modified CMEC classifications.

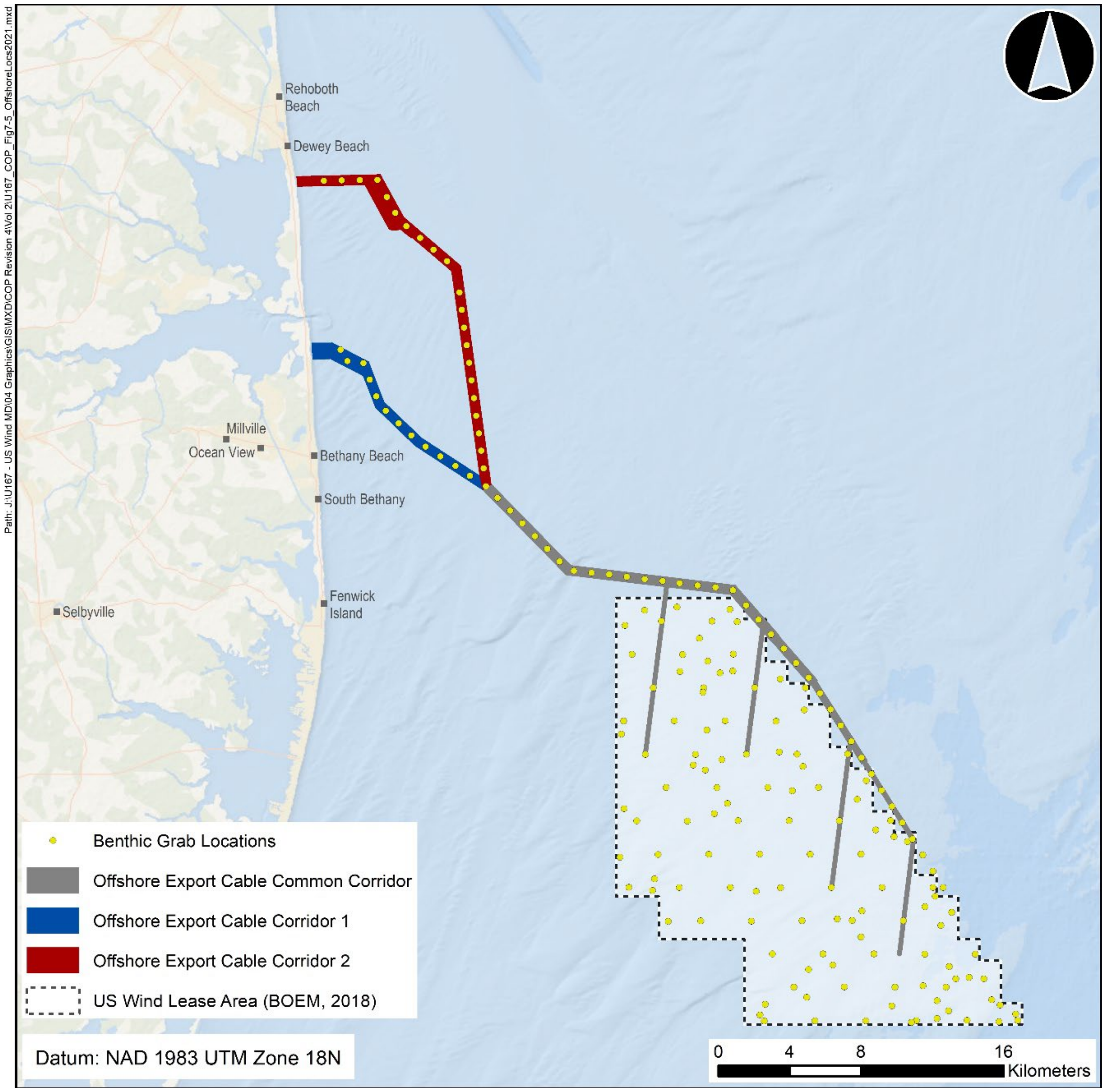


Figure 7-5. 2021 Benthic Field Survey Sample Locations

Common Export Cable Corridor

A total of 75 marine invertebrate taxa, including polychaete worms, crustaceans, oligochaete worms, mollusks, nemertean ribbon worms, lancelets, ascidians, and sand dollars were found in the 36 macrofaunal grab samples collected from the Common Export Cable Corridor during the 2021 benthic survey program (Table 7-13). Average organism density was 1,082 ± 774 (mean ± SD), ranging from a high of 3,225 individuals/m^2 at BG-AC-20/USW123 to a low of 125 individuals/m^2 at BG-AC-18/USW121 (Table 7-13). Total taxa richness per sample ranged from 2 to 26, with an average of 13 ± 5.9 (Table 7-13). Taxa richness and total organism density were generally greatest in the portion of the Common Export Cable Corridor located along the eastern border of the Lease area.

Table 7-13. Summary of Key Statistics from the Common Export Cable Corridor Benthic Sample Analysis

Statistic	Value
Number of Samples	36
Mean Density per Square Meter (±1 SD)	1,082 ± 774
Mean Taxa Richness (±1 SD)	13 ± 5.9
Total Number of Taxa	75
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	35
Crustaceans	18
Mollusks	14
Oligochaete worms	3
Other	5
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	50.5%
Crustaceans	19.5%
Mollusks	5.6%
Oligochaete worms	21.2%
Other	3.1%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

The most speciose taxonomic group was polychaete worms, which contributed over 46% of the taxa documented in the analyzed samples (Table 7-14). Crustaceans and mollusks accounted for approximately 24% and 19% of taxa in the Common Export Cable Corridor samples, respectively (Table 7-14). Polychaetes accounted for the greatest percentage of total organism abundance of any taxa group (over 50%), followed by mollusks and oligochaete worms (approximately 20% and 21%, respectively) (Table 7-14).

Table 7-14. Relative Abundance of Taxa Encountered in Common Export Cable Corridor Area Samples

Scientific Name	Common Name	Relative Abundance (%)
Naididae w/out hair chaetae	Oligochaete Worm	12.4
Byblis serrata	Ampeliscid Amphipod	10.4
Enchytraeidae	Oligochaete Worm	8.5
Phyllodocidae	Phyllodocid Polychaete	8.4
Polygordius sp.	Polygordiid Polychaete	6.2
Dorvilleidae	Dorvilleid Polychaete	4.0

Table 7-14. Relative Abundance of Taxa Encountered in Common Export Cable Corridor Area Samples

Scientific Name	Common Name	Relative Abundance (%)
Exogone sp.	Syllid Polychaete	3.1
Cirratulidae	Cirratulid Polychaete	3.0
Syllidae	Syllid Polychaete	2.7
Tellininae	Tellin Clam	2.6
*Includes taxa accounting for ≥ 2.5% of total abundance		

The most abundant taxon in Lease area samples was naidid oligochaete worms without hair chaetae, which accounted for over 12% of all individuals identified (Table 7-14). The ampeliscid amphipod *Byblis serrata*, enchytraeid oligochaete worms, and phyllodocid polychaetes, were the next most abundant taxa, each accounting for more than 8% of all organisms (Table 7-14).

Most of the taxa observed in the grab samples collected from the Common Export Cable Corridor were similar to those found in samples collected from the Lease area and are typical of soft-sediment habitats (e.g., *Polygordius*, cirratulids, *Exogone* sp., *Scoletoma* sp., *Spio* sp.). In addition to the taxa described above, other soft sediment fauna present in Common Export Cable Corridor samples included *Byblis serrata* amphipods, which build tubes in medium to coarse sand (Bousfield 1973). Dorvilleidae polychaete worms, which create temporary mucus tubes, are also typical of unconsolidated substrates (Pettibone 1963).

Shellfish

Soft-shell clams, a shellfish species of potential commercial importance, were observed in low densities at two sites along the Common Export Cable Corridor. Common Atlantic slippersnails, which are potentially indicative of hard bottom habitat, were observed in two benthic grab samples. However, no other taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed in the benthic grab samples collected from the Common Export Cable Corridor.

Taxonomic Classification of Benthic Habitat in the Common Export Cable Corridor

Results of the benthic transect imagery analysis and benthic grab NMFS-modified CMECS classifications from within the Common Export Cable Corridor are summarized in Tables 7-15 and 7-16 below. The resulting substrate classifications are presented in greater detail in Appendix II-D4.

Table 7-15. Common Export Cable Corridor Benthic Imagery Transect Substrate Group Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Transects	% of Transects
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	16	84%
Gravelly	Gravelly Sand	2	11%
Gravel Mixes	Sandy Gravel	1	5%

Table 7-15. Common Export Cable Corridor Benthic Imagery Transect Substrate Group Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Transects	% of Transects
Gravel	Pebble/Granule	0	0%
Total		**19***	**100%**
* Total does not include those that could not be classified due to environmental conditions (e.g., poor visibility).			

Table 7-16. Common Export Cable Corridor Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Transects
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	12	33%
Gravelly	Gravelly Sand/ Gravelly Muddy Sand	19	53%
Gravel Mixes	Sandy Gravel	5	14%
Gravel	Pebble/Granule	0	0%
Total		**36**	**100%**

The infaunal sampling results align with expectations, given the CMECS habitat classifications for samples collected within the Common Export Cable Corridor; of the 36 samples collected in the Common Export Cable Corridor, 33% (12 samples) were classified as fine unconsolidated substrates under the CMECS framework, and 67% (24 samples) were classified as coarse unconsolidated substrates. This breakdown of fine and coarse substrates is similar to that observed in samples collected from the Lease area and from Offshore Export Cable Corridor 2.

Offshore Export Cable Corridor 1

A total of 64 marine invertebrate taxa, including mollusks, polychaete worms, oligochaete worms, crustaceans, lancelets, nemertean ribbon worms, and ascidians were found in the 12 macrofaunal grab samples collected from Offshore Export Cable Corridor 1 during the 2021 benthic survey program (Table 7-17). Average organism density was 2,314 ± 1,359 (mean ± SD), ranging from a high of 5,100 individuals/m^2 at BG-AC-41/USW183 to a low of 650 individuals/m^2 at BG-AC-42/USW184 (Table 7-17). Total taxa richness per sample ranged from 7 to 23, with an average of 16 ± 5.4 (Table 7-17). No consistent spatial patterns in taxa richness or total organism density were observed in samples collected along Offshore Export Cable Corridor 1.

Table 7-17. Summary of Key Statistics from the Offshore Export Cable Corridor 1 Benthic Sample Analysis

Statistic	Value
Number of Samples	12
Mean Density per Square Meter (±1 SD)	2,314 ± 1,359

Table 7-17. Summary of Key Statistics from the Offshore Export Cable Corridor 1 Benthic Sample Analysis

Statistic	Value
Mean Taxa Richness (±1 SD)	16 ± 5.4
Total Number of Taxa	64
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	29
Crustaceans	15
Mollusks	14
Oligochaete worms	3
Other	3
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	23.9%
Crustaceans	11.1%
Mollusks	36.9%
Oligochaete worms	21.9%
Other	6.3%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

The most speciose taxonomic group in Offshore Export Cable Corridor 1 samples was polychaete worms, which contributed over 45% of the taxa documented in the analyzed samples (Table 7-18). Crustaceans and mollusks each accounted for approximately 23% and 22% of taxa in the Offshore Export Cable Corridor 1 samples, respectively (Table 7-18). Mollusks accounted for the greatest percentage of total organism abundance of any taxa group (over 36%), followed by polychaete worms (approximately 24%) and oligochaete worms (approximately 22%) (Table 7-18).

Table 7-18. Relative Abundance of Taxa Encountered in Offshore Export Cable Corridor 1 Samples

Scientific Name	Common Name	Relative Abundance (%)
Crepidula fornicata	Common Atlantic Slippersnail	24.9
Enchytraeidae	Oligochaete Worm	11.1
Naididae w/out hair chaetae	Oligochaete Worm	10.7
Syllidae	Syllid Polychaete	8.0
Tellininae	Tellin Clam	4.6
Branchiostoma caribaeum	Lancelet	3.7

Table 7-18. Relative Abundance of Taxa Encountered in Offshore Export Cable Corridor 1 Samples

Scientific Name	Common Name	Relative Abundance (%)
Crepidula plana	Eastern White Slippersnail	3.2
Rhepoxynius epistomus	Phoxocephalid Amphipod	2.9
Tanaidacea	Tanaid Crustacean	2.9
Cirratulidae	Cirratulid Polychaete	2.3
Nemertea	Ribbon Worm	1.9

*Includes taxa accounting for ≥ 1.6% of total abundance

The most abundant taxon in the Offshore Export Cable Corridor 1 samples was the common Atlantic slippersnail (*Crepidula fornicata*), which accounted for nearly 25% of all individuals identified (Table 7-18). Oligochaete worms (enchytraeid worms and naidid worms without hair chaetae), syllid polychaetes, and tellin clams were the next most abundant taxa, each accounting for more than 4% of all organisms (Table 7-18).

Most of the taxa observed in the grab samples collected from Offshore Export Cable Corridor 1 were typical of soft-sediment habitats. Common Atlantic slippersnails, which were more abundant and widespread in Offshore Export Cable Corridor 1 samples compared to Lease area and Common Offshore Export Cable Corridor samples, are often found on low energy sand or gravel sediments where biogenic substrates (shell substrates) are present (CIESM 2003). Common and widespread taxa in Offshore Export Cable Corridor 1 samples include tellin clams and cirratulid polychaetes, which were also observed in previously described Project component areas (see Lease area and Common Export Cable Corridor sections above). Additional soft sediment organisms found in Offshore Export Cable Corridor 1 samples included *Unciola* sp. amphipods, which inhabit tubes in sandy mud to coarse sand (Bousfield 1973).

Shellfish

Soft-shell clams, a shellfish species of potential commercial importance, were not present in any of the Offshore Export Cable Corridor 1 samples. However, surf clams (*Spisula solidissima*), which are another shellfish species of potential commercial importance, were found in five samples. Common Atlantic slippersnails and eastern white slippersnails are potentially indicative of hard bottom habitat. However, these species may also be found in soft sediment habitats including mud and sand (Smithsonian and SERC 2022; CIESM 2003). No other taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed in the benthic grab samples.

Taxonomic Classification of Benthic Habitat in Offshore Export Cable Corridor 1

Results of the benthic transect imagery analysis and benthic grab NMFS-modified CMECS classifications from within the Common Export Cable Corridor are summarized in Tables 7-19 and 7-20 below. The resulting substrate classifications are presented in greater detail in Appendix II-D4.

Table 7-19. Offshore Export Cable Corridor 1 Benthic Imagery Transect Substrate Group Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Transects	% of Transects
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	2	100%
Gravelly	Gravelly Sand	0	0%
Gravel Mixes	Sandy Gravel	0	0%
Gravel	Pebble/Granule	0	0%
Total		**2***	**100%**

* Total does not include those that could not be classified due to environmental conditions (e.g., poor visibility).

Table 7-20. Offshore Export Cable Corridor 1 Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Transects
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	3	25%
Gravelly	Gravelly Sand	6	50%
Gravel Mixes	Sandy Gravel	2	17%
Gravel	Pebble/Granule	1	8%
Total		**12**	**100%**

The infaunal sampling results for Offshore Export Cable Corridor 1 align with expectations based on the CMECS habitat classifications for the area; of the 12 samples collected in Offshore Export Cable Corridor 1, only 25% (3 samples) were classified as fine unconsolidated substrates under the CMECS framework, whereas 75% (9 samples) were classified as coarse unconsolidated substrates. Compared to samples collected from within the Lease area, Common Export Cable Corridor, and Offshore Export Cable Corridor 2, the percentage of coarse unconsolidated substrate habitats in Offshore Export Cable Corridor 1 samples was greater. This difference in habitat was most notably reflected by the greater abundance and more frequent occurrence of common Atlantic slippersnails and Eastern white slippersnails in Offshore Export Cable Corridor 1 samples. These species can occur on a variety of substrates, including coarse substrates. However, these species also prefer shallower waters; therefore, water depth, which is deeper in the Common Export Cable Corridor and Lease area, may also influence their distribution in the Survey Area.

Offshore Export Cable Corridor 2

A total of 75 marine invertebrate taxa, including oligochaete worms, polychaete worms, mollusks, crustaceans, nemertean ribbon worms, lancelets, sea anemones, ascidians, and sipunculids were found in the 21 macrofaunal grab samples collected from Offshore Export Cable Corridor 2 during the 2021 benthic survey program (Table 7-21). Average organism density was 1,213 ± 775 (mean ± SD), ranging from a high of 2,925 individuals/m^2 at BG-AC-67/USW162 to a low of 300 individuals/m^2 at BG-AC-78/USW176 (Table 7-21). Total taxa richness per sample ranged from 6 to 23, with an average of 13 ± 5.0 (Table 7-21). Taxa richness and total organism density were generally greatest in the southern portion of Offshore Export Cable Corridor 2.

Table 7-21. Summary of Key Statistics from the Offshore Export Cable Corridor 2 Benthic Sample Analysis

Statistic	Value
Number of Samples	21
Mean Density per Square Meter (±1 SD)	1,213 ± 775
Mean Taxa Richness (±1 SD)	13 ± 5.0
Total Number of Taxa	75
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	34
Crustaceans	13
Mollusks	20
Oligochaete worms	3
Other	5
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	33.7%
Crustaceans	7.3%
Mollusks	19.2%
Oligochaete worms	34.0%
Other	5.9%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

The most speciose taxonomic group in Offshore Export Cable Corridor 2 samples was polychaete worms, which contributed over 45% of the taxa documented (Table 7-22). Mollusks and crustaceans each accounted for approximately 27% and 17% of taxa in the Offshore Export Cable Corridor 2 samples, respectively (Table 7-22). Oligochaete worms and polychaete worms accounted for the greatest percentages of total organism abundance (approximately 34% each), followed by mollusks (approximately 19%) (Table 7-22).

Table 7-22. Relative Abundance of Taxa Encountered in Offshore Export Cable Corridor 2 Samples

Scientific Name	Common Name	Relative Abundance (%)
Enchytraeidae	Oligochaete Worm	17.8
Naididae w/out hair chaetae	Oligochaete Worm	13.4

Table 7-22. Relative Abundance of Taxa Encountered in Offshore Export Cable Corridor 2 Samples

Scientific Name	Common Name	Relative Abundance (%)
Tellininae	Tellin Clam	9.3
Crepidula fornicata	Common Atlantic Slippersnail	4.3
Syllidae	Syllid Polychaete	4.0
Nemertea	Ribbon Worm	3.8
Mediomastus sp.	Capitellid Polychaete	3.7
Aricidea sp.	Paraonid Polychaete	3.3
Naididae w/ hair chaetae	Oligochaete Worm	2.7
Polygordius sp.	Polygordiid Polychaete	2.6
Clymenella zonalis	Maldanid Polychaete	2.5
Phyllodocidae	Phyllodocid Polychaete	2.2

*Includes taxa accounting for ≥ 2% of total abundance

The most abundant taxa in Offshore Export Cable Corridor 2 samples were enchytraeid oligochaete worms and naidid oligochaete worms without hair chaetae, which accounted for nearly 18% and over 13% of all individuals identified, respectively (Table 7-22). Tellin clams, the common Atlantic slippersnail, and syllid polychaetes, were the next most abundant taxa, each accounting for more than 4% of all organisms (Table 7-22).

Most of the taxa observed in the grab samples collected from Offshore Export Cable Corridor 2 are typical of soft-sediment habitats. Widespread and abundant taxa including tellin clams, common Atlantic slippersnails, *Polygordius* sp. and dorvilleid polychaetes, and *Unciola* sp. amphipods were similarly common in previously described areas (see above).

Shellfish

Soft-shell clams, a shellfish species of potential commercial importance, were observed at low densities at three sites along Offshore Export Cable Corridor 2. Common Atlantic slippersnails, which are potentially indicative of hard bottom habitat, were observed in the benthic grab samples. However, these species may also be found in soft sediment habitats including mud and sand (Smithsonian and SERC 2022; CIESM 2003)). No other taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed.

Taxonomic Classification of Benthic Habitat in Offshore Export Cable Corridor 2

Results of the benthic transect imagery analysis and benthic grab NMFS-modified CMECS classifications from within Offshore Export Cable Corridor 2 are summarized in Tables 7-23 and 7-24 below. The resulting substrate classifications are presented in greater detail in Appendix II-D4.

Table 7-23. Offshore Export Cable Corridor 2 Benthic Imagery Transect Substrate Group Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Transects	% of Transects
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	4	50%
Gravelly	Gravelly Sand	4	50%
Gravel Mixes	Sandy Gravel	0	0%
Gravel	Pebble/Granule	0	0%
Total		**8***	**100%**

* Includes both original and rerun of VT-AC-79. Total does not include those transects that could not be classified due to environmental conditions (e.g., poor visibility).

Table 7-24. Offshore Export Cable Corridor 2 Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Locations
Sand	Fine/Very Fine Sand to Very Coarse/Coarse Sand	8	38%
Gravelly	Gravelly Sand	7	33%
Gravel Mixes	Sandy Gravel	5	24%
Gravel	Pebble/Granule	1	5%
Total		**21**	**100%**

The infaunal sampling results for Offshore Export Cable Corridor 2 align with expectations, given the CMECS habitat classifications for these samples; of the 21 samples collected in Offshore Export Cable Corridor 2, 38% (8 samples) were classified as fine unconsolidated substrates under the CMECS framework, and 62% (13 samples) were classified as coarse unconsolidated substrates. This breakdown of fine and coarse substrates is similar to that observed in samples collected from the Lease area and indicates a lower abundance of coarse substrate habitats than were observed in Offshore Export Cable Corridor 1. Consequently, certain species potentially indicative of coarse substrates (e.g., common Atlantic slippersnail) were less abundant and widespread in Offshore Export Cable Corridor 2 samples than in Offshore Export Cable Corridor 1 samples.

7.1.3 Onshore Export Cable Corridors

Onshore Export Cable Corridor 1 extends through Indian River Bay from 3 R's Beach landfall location to the vicinity of the Indian River Substation. Salinity and sediment composition are the major factors controlling benthic species distribution in Indian River Bay (DIBEP 1993). Indian River Bay exhibits a strong salinity gradient with salinity generally increasing from west to east, as described in Volume II, Section 4.0. Onshore Export Cable Corridor 1 primarily traverses the polyhaline portion of Indian River Bay, where salinities approach marine conditions and generally remain above 18 psu (DIBEP 1993; DEMAC et al. 2017). However, the westernmost portions of Onshore Export Cable Corridor 1, including the substation landfall, are located in the mesohaline zone, where salinity tends to be lower but also highly variable, depending on the magnitude of freshwater inputs from Indian River and other watershed tributaries. Benthic habitat in Indian River Bay is diverse and consists of areas of mud, sand, and mixed substrate (Chaillou et al. 1996). Muddy substrates are more prevalent than sand, especially in the upper portion of Indian River Bay. The overall silt-clay content in the Indian River Bay system is estimated to be 60% (Chaillou et al. 1996).

A review of historical data (for the period 1974-1976) characterized the benthic community structure of each salinity region within Indian River Bay (DIBEP 1993). Samples from the mesohaline region, which includes the area near the substation landfall, contained an average of nineteen species and had an average density of 6,776 individuals/m^2. Polychaetes accounted for 49% of all taxa in this salinity segment, with the disturbance-tolerant spionid worm *Streblospio benedicti* comprising the majority of individuals. Crustaceans accounted for 34% of all taxa, with the aorid amphipod *Leptocheirus plumulosis* and the ampeliscid amphipod *Ampelisca abdita* comprising the majority of individuals. Bivalves accounted for 4% of all taxa in this salinity segment, with the amethyst gem clam (*Gemma gemma*) and dwarf surf clam (*Mulinia lateralis*) comprising the majority of individuals.

Samples from the polyhaline region of Indian River Bay were similar to those collected from mesohaline areas in both taxonomic diversity and organism density, but differed in community composition (DIBEP 1993). Polyhaline samples contained an average of eighteen species, and organism density averaged 6,484 individuals/m^2. Polychaetes accounted for 31% of all taxa in polyhaline areas of Indian River Bay. The capitellid worm *Heteromastus filiformis* was the most abundant species, followed by the spionid worm *S. benedicti.* Crustaceans also accounted for 31% of all taxa, with the amplescid amphipod *A. abdita* and the aorid amphipod *L. plumulosus* comprising the majority of individuals. Mollusks, including commercially important shellfish, were more abundant in polyhaline areas of Indian River Bay than in all other regions. Mollusks accounted for 27% of all taxa in the region, and blue mussel and the clam *Macoma tenta* were the most abundant species (DIBEP 1993). A more recent assessment of benthic communities in Indian River Bay, conducted in 1993, identified a total of 141 species from fifteen different taxonomic groups with an average of seventeen taxa per sample (Chaillou et al. 1996). Chaillou et al (1996) also reported an average density of 34,889 organisms/m^2 in Indian River Bay samples, which is much higher than reported from the earlier DIBEP (1993) survey. Community composition also differed between the two studies; the most abundant taxonomic group observed by Chaillou et al. (1996) was crustaceans (75% of total abundance), with polychaetes accounting for only 17% of the total abundance. However, polychaetes were the most taxonomically rich group with 60 species, followed by crustaceans (29 species), bivalves (fifteen species), and gastropods (twelve species). The most abundant crustacean species were the amphipods *A. abdita* and *Corophium acherusicum*. *S. benedicti* and *Mediomastus ambiseta* were the most abundant polychaetes. Of the bivalves and gastropods, the northern dwarf-tellin (*Tellina agilis*), amethyst gem clam, and the pitted baby-bubble (*Rictaxis punctostriatus)* were the most abundant species. Chaillou et al. (1996) concluded that approximately 77% of Indian River Bay is characterized by degraded benthic habitat.

7.1.3.1 2017 Benthic Field Survey – Formerly Planned Onshore Export Cable Route

A field survey of benthic resources in Indian River Bay was conducted in October 2017 along the formerly planned onshore export cable route within Onshore Export Cable Corridor 1. The benthic field survey was composed of two elements, including 1) collection of still images and video of the bay bottom and 2) collection of benthic grab samples for laboratory analysis of taxonomic composition. Twelve locations along the formerly planned onshore export cable route were sampled (Figure 7-6).

The benthic imagery obtained in Indian River Bay was of limited use due to turbid conditions during the survey. However, qualitative analysis indicated the presence of scattered patches of macroalgal growth, including sea lettuce (*Ulva lactuca*). No SAV beds or epibenthic macrofauna were discernable in the imagery reviewed.

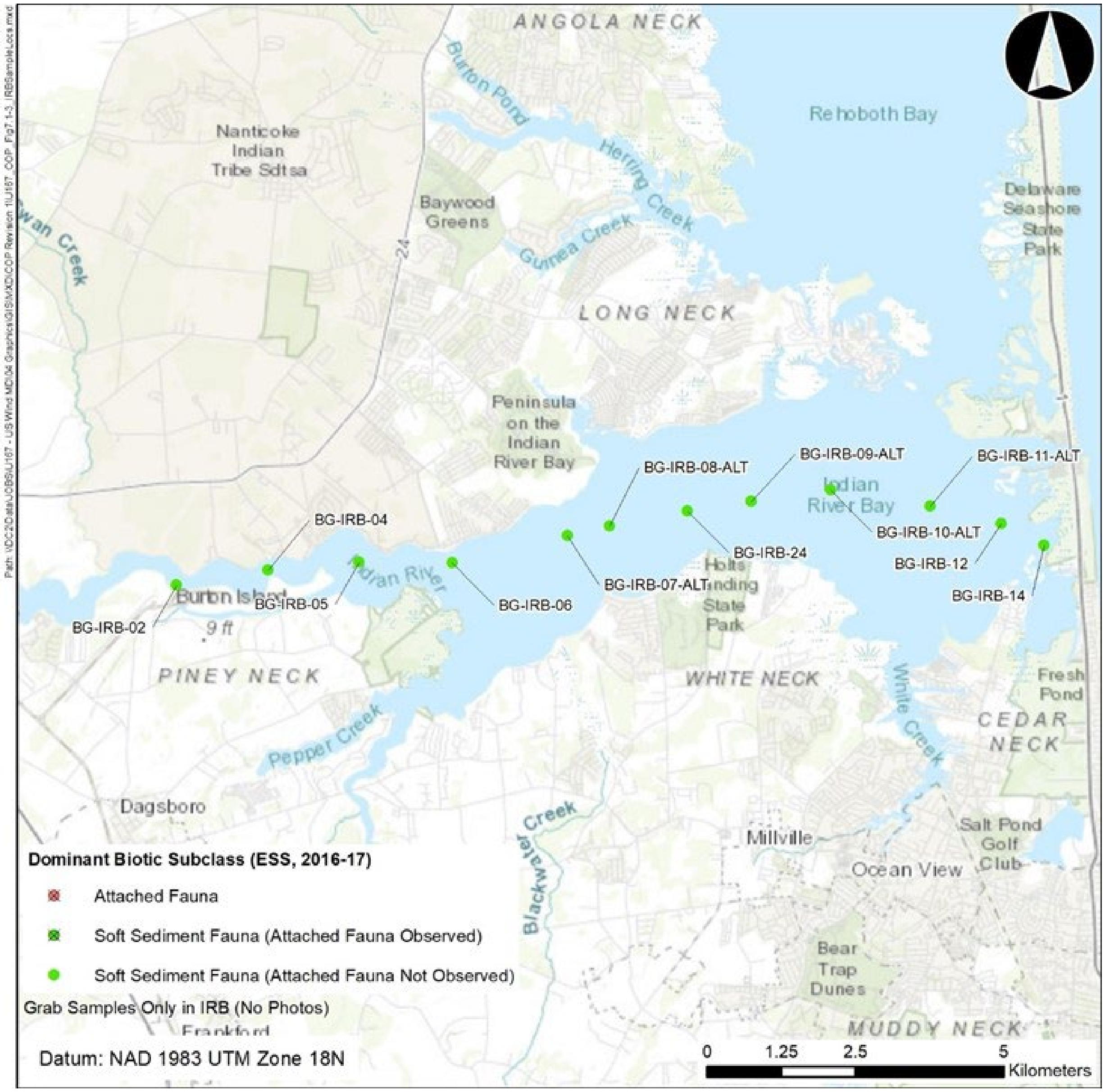


Figure 7-6. Formerly Planned Onshore Export Cable Route Benthic Samples CMECS Biotic Subclass Classification and Attached Organism Presence

Sixty-three marine invertebrate taxa were observed in the twelve grab samples analyzed from the formerly planned onshore export cable route, including polychaete worms, crustaceans, mollusks, oligochaete worms, ribbon worms, cnidarians, sea spiders, and flatworms. Mean macroinvertebrate density was close to 6,500 organisms/m^2 and taxa richness averaged sixteen taxa per site, with all samples containing at least 10 taxa (Table 7-25). The benthic community observed in the analyzed samples was dominated by polychaete worms, which constituted approximately 88% of all organisms, and 49.2% of all taxa. The most abundant and widely distributed organism was the spionid polychaete *S. benedicti*, which accounted for 71% of all organisms (Table 7-26) and was observed in all twelve samples.

Table 7-25. Summary of Key Statistics from the Formerly Planned Onshore Export Cable Route Benthic Community Assessment

Statistic	Value
Number of Samples	12
Mean Density per Square Meter (±1 SD)	6,488 ± 8,796
Mean Taxa Richness (±1 SD)	15.8 ± 3.8
Total Number of Taxa	63
Percent of Taxa Observed by Taxonomic Group	
Polychaete worms	49.2
Crustaceans	28.6
Mollusks	11.1
Oligochaete worms	4.8
Other	6.3
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	88.3
Crustaceans	9.1
Mollusks	1.0
Oligochaete worms	0.9
Other	0.8

Table 7-26. Relative Abundance of Taxa Observed in the Formerly Planned Onshore Export Cable Route Benthic Grabs

Taxon	Common Name	Percent Relative Abundance
Streblospio benedicti	Spionid polychaete	71
Mediomastus ambiseta	Capitellid polychaete	10
Ampelisca sp.	Four-eyed amphipod	4
Leucon americanus	Hooded shrimp	3
Goniadidae	Chevron worm	2
Orbiniidae	Orbiniid polychaete	1

*Includes taxa accounting for at least 1% of total abundance

Total taxa richness in the Indian River Bay samples was somewhat lower than observed in the 1993 study, although taxonomic richness per sample was similar (Chaillou et al. 1996; DIBEP 1993).

The benthic taxa found in the survey are common and representative of soft sediment estuarine habitats of the mid-Atlantic U.S. coast, and have been previously reported from Indian River Bay (Chaillou et al. 1996; DIBEP 1993). Many of the species most frequently observed in this survey are tube-building organisms, and the most common species, *S. benedicti*, is known to be pollution tolerant and abundant in this area (Chaillou et al. 1996; Dean 2008).

No rare taxa or taxa indicative of sensitive habitats (e.g., SAV, hard bottom) were observed in the benthic imagery or benthic grab samples collected from Indian River Bay. The predominant bottom type ranged from mud near the substation landfall to fine sand in the central Bay and near the onshore landfall. These observations generally align with those reported in the literature (NOS 2015; DIBEP 1993).

More detailed methodology and results of the 2017 benthic field survey are presented in Appendix II-D1.

Taxonomic Classification of Benthic Habitat

Benthic habitat in Indian River Bay is generally characterized as unconsolidated soft sediment with some areas of shell material (DIBEP 1993). The DIBEP (1993) review describes Indian River Bay as being dominated by sand and clayey silt, though a later study by Chaillou et al. (1996) reported higher percentages of silty-clay substrates, and less sand. The benthic field survey found that benthic habitat along the formerly planned onshore export cable route is typical of Indian River Bay, consisting primarily of fine sand and silty clay. Water depths at the benthic sample locations ranged from 1.2 m to 4.6 m (4 ft to 15 ft).

Based on information reviewed in DIBEP (1993) and Chaillou et al. (1996) and the survey, benthic habitat along the formerly planned onshore export cable route has been classified under the CMECS (Table 7-27). To identify potentially sensitive habitat areas, the dominant biotic subclass under the CMECS framework was determined for each benthic sample site along the formerly planned onshore export cable route (Figure 7-6). All twelve sample sites in Indian River Bay were characterized by soft sediment fauna, and no attached fauna or sensitive or unique benthic habitats, such as hard bottom, live bottom, or SAV, were observed.

Table 7-27. CMECS Classification of Benthic Sample Sites Along the Formerly Planned Onshore Export Cable Route

CMECS Level		Classification
Biogeographic Setting	Realm	Temperate North Atlantic
	Province	Cold Temperate Northwest Atlantic
	Ecoregion	Virginian
Aquatic Setting	System	Estuarine
	Subsystem	Coastal
	Tidal Zone	Subtidal
Water Column Component	Water Column Layer*	Estuarine Coastal Lower Water Column, Estuarine Open Water Lower Water Column

Table 7-27. CMECS Classification of Benthic Sample Sites Along the Formerly Planned Onshore Export Cable Route

CMECS Level		Classification
	Salinity Regime*	Upper Polyhaline Water, Lower Polyhaline Water, Mesohaline Water
	Temperature Regime*	Moderate Water (seasonal variation from cold to hot)
Geoform Component	Tectonic Setting	Passive Continental Margin
	Physiographic Setting	Embayment/Bay
	Geoform Origin	Geologic
Substrate Component	Substrate Origin	Geologic Substrate
	Substrate Class	Unconsolidated Mineral Substrate
	Substrate Subclass	Fine Unconsolidated Substrate
	Substrate Group*	Muddy Sand, Sand, Mud
	Substrate Subgroup*	Silty Sand, Fine Sand, Medium Sand, Coarse Sand, Silt-Clay
Biotic Component	Biotic Setting	Benthic Biota
	Biotic Class	Faunal Bed
	Biotic Subclass	Soft Sediment Fauna

*Indicates multiple classifications within this level of the CMECS hierarchy among sample sites

Shellfish

Hard clam is the primary shellfish species of recreational and commercial concern in Indian River Bay. Hard clams are mapped as either absent or present at low densities over most of Onshore Export Cable Corridor 1, according to maps obtained from DNREC and surveys conducted in 2011 (Bott and Wong 2012) (Figure 7-7). The formerly planned onshore export cable route does cross a narrow band mapped as moderate density hard clam beds. However, the intersection of the formerly planned onshore export cable route with these moderate density beds is unavoidable, as the beds extend from the mouth of White Creek northward across Indian River Bay to Steels Cove. Onshore Export Cable Corridor 1 will avoid areas mapped as high-density hard clam beds where feasible, and only one of the benthic samples collected during the field survey of the Corridor contained hard clams.

Horseshoe crabs were not observed during benthic field studies but are known to be present along Onshore Export Cable Corridor 1. This species is abundant in Indian River Bay during the spawning season (May – June), when they deposit large numbers of eggs on sandy beaches (DCIB 2008).

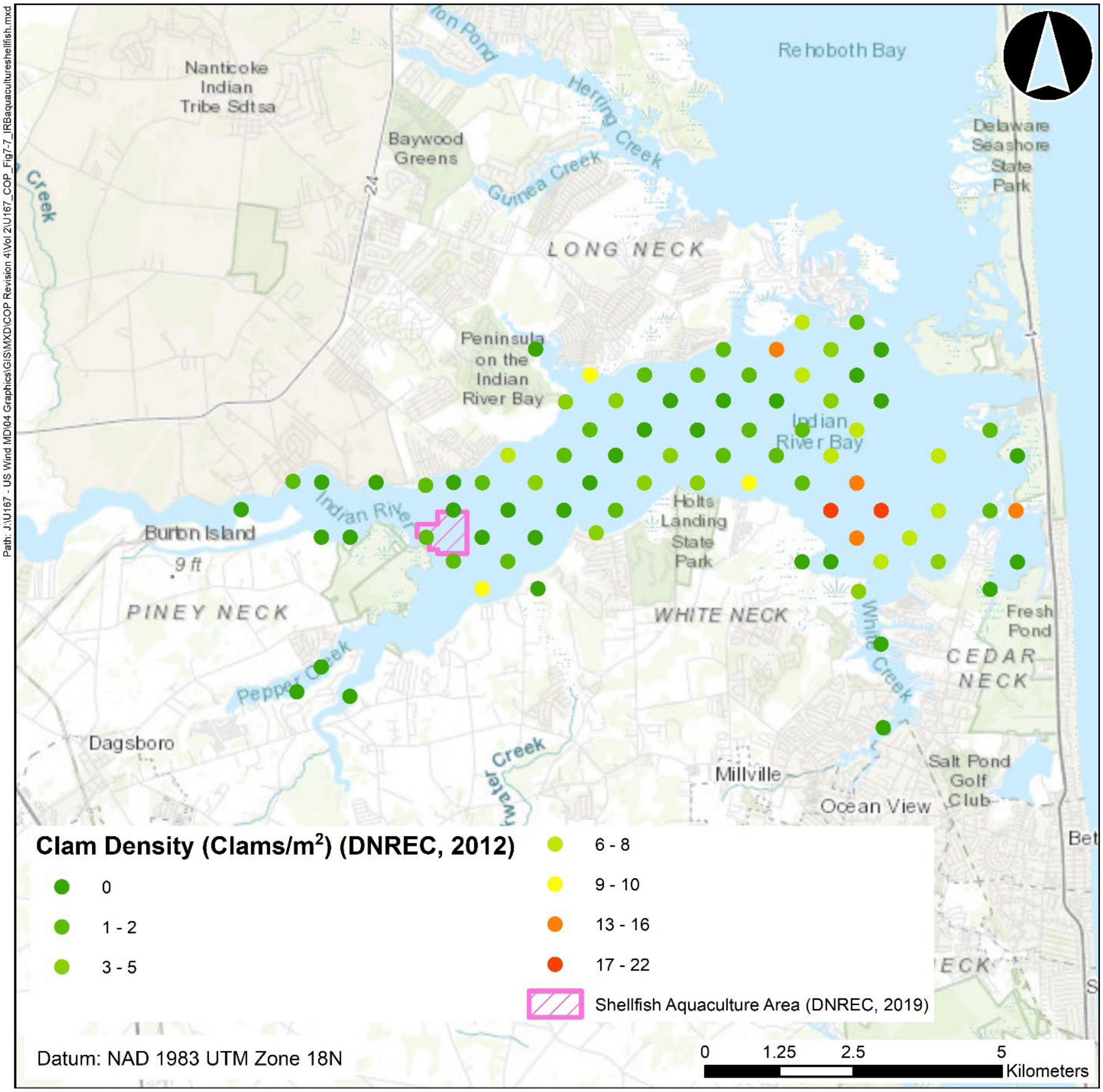


Figure 7-7. Indian River Bay Hard Clam Beds and Shellfish Aquaculture Development Areas

Although natural oyster reefs are no longer present in Indian River Bay (Ewart 2013), the state of Delaware has designated portions of Indian River Bay as shellfish aquaculture development areas (SADA) for oyster production (Figure 7-7). However, most lease blocks have either been removed due to the presence of hard clam beds or are expected to be removed due to anticipated closure of the area to shellfish harvesting. Onshore Export Cable Corridor 1 does not intersect any of the SADA lease blocks.

7.1.3.2 2022 Benthic Field Survey

A field survey of benthic resources within Indian River Bay in the area of the Onshore Export Cable Corridors (including the Onshore Export Cable Common Corridor, Onshore Export Cable North Corridor, and Onshore Export Cable South Corridor) was conducted in August of 2022 (Figures 7-8 and 7-9). This survey involved collection of benthic grabs at 35 locations. The results of the 2022 Benthic Survey are summarized below and provided as Appendix II-D4. This benthic report delineates complex seafloor features using NOAA Fisheries modified CMEC classifications.

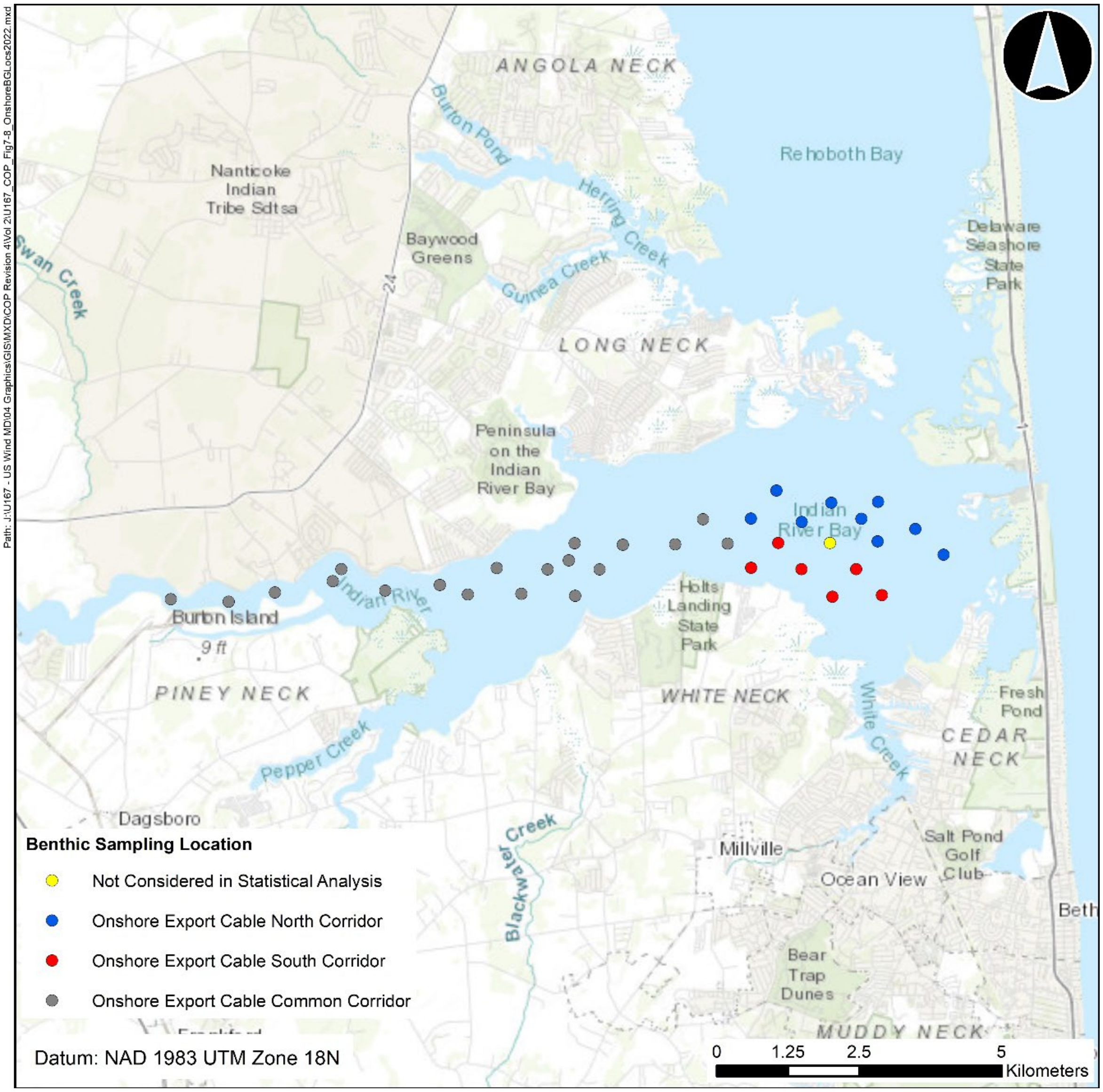


Figure 7-8. 2022 Onshore Export Cable Corridors Benthic Field Survey Sample Locations

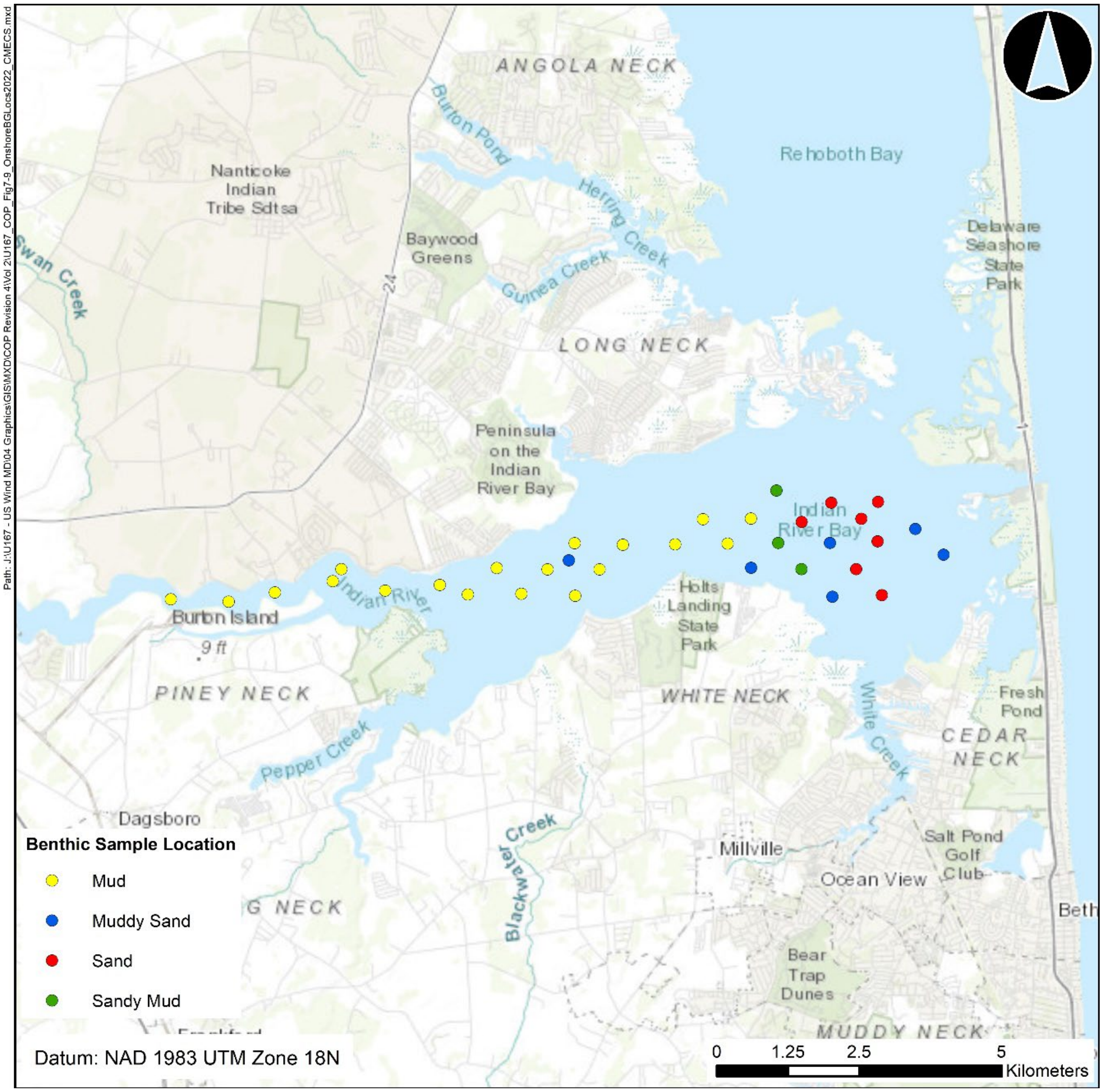


Figure 7-9. 2022 Onshore Export Cable Corridors Benthic Samples NMFS-modified CMECS Substrate Group Classification

Onshore Export Cable Common Corridor

A total of 16 marine invertebrate taxa, including polychaete worms, crustaceans, oligochaete worms, and nemertean ribbon worms were found in the 19 macrofaunal grab samples collected from the vicinity of the Onshore Export Cable Common Corridor during the 2022 benthic survey program (Table 7-28).

Table 7-28. Summary of Key Statistics from the 2022 Onshore Export Cable Common Corridor Benthic Sample Analysis

Statistic	Value
Number of Samples	19
Mean Density per Square Meter (±1 SD)	532 ± 759

Table 7-28. Summary of Key Statistics from the 2022 Onshore Export Cable Common Corridor Benthic Sample Analysis

Statistic	Value
Mean Taxa Richness (±1 SD)	2.9 ± 1.9
Total Number of Taxa	16
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	11
Crustaceans	3
Mollusks	0
Oligochaete worms	1
Other	1
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	86.8%
Crustaceans	7.2%
Mollusks	0.0%
Oligochaete worms	4.3%
Other	1.7%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

Average organism density was 532 ± 759 (mean ± SD), ranging from a high of 3,950 individuals/m^2 at IRB-BG-TRC-13, to a low of 0 individuals/m^2 at IRB-BG-TRC-28 (Table 7-28). Taxa richness per sample ranged from 0 to 7, and mean taxa richness was 2.9 ± 1.9 (mean ± SD) per site (Table 7-28). Though no consistent spatial patterns in total organism density were observed, taxa richness per sample appeared to be greatest in the eastern portion of the Onshore Export Cable Common Corridor.

The most speciose taxonomic group was polychaete worms, which contributed over 68% of the taxa documented in the analyzed samples (Table 7-28). Crustaceans accounted for approximately 18%, and oligochaete worms and nemertean ribbon worms each accounted for approximately 6%, of all taxa in Onshore Export Cable Common Corridor samples. The majority of organisms encountered were polychaete worms (over 86% of total organism abundance), followed by crustaceans and oligochaete worms (approximately 7% and 4%) (Table 7-28).

The most abundant taxon in Onshore Export Cable Common Corridor samples were the spionid polychaete *Polydora* sp., and the orbiniid polychaete *Leitoscoloplos* sp., which accounted for nearly 25% and 22% of all individuals identified, respectively. The spionid polychaete *Streblospio benedicti,* capitellid polychaete *Notomastus* sp., and the liljeborgiid amphipod *Idunella* sp. were the next most abundant taxa, each accounting for more than 5% of all organisms (Table 7-29).

Table 7-29. Relative Abundance of Taxa Encountered in 2022 Onshore Export Cable Common Corridor Samples

Scientific Name	Common Name	Relative Abundance (%)
Polydora sp.	Spionid Polychaete	24.7
Leitoscoloplos sp.	Orbiniid Polychaete	21.9
Streblospio benedicti	Spionid Polychaete	14.7
Notomastus sp.	Capitellid Polychaete	12.1
Idunella sp.	Liljeborgiid Amphipod	5.5
Mediomastus sp.	Capitellid Polychaete	4.7
Naididae w/out hair chaetae	Oligochaete Worm	4.3
Paraprionospio sp.	Spionid Polychaete	2.6

*Includes taxa accounting for ≥ 2.5% of total abundance

The taxa observed in grab samples collected from the Onshore Export Cable Common Corridor are typical of soft-sediment habitats. Orbiniid polychaetes like *Leitoscoloplos* sp. are deposit feeders commonly encountered in sandy and muddy areas throughout the world's oceans (Fauchald and Jumars 1979). Orbiniids can be found burrowing in sediments at a range of depths, from coastal salt marshes from deep offshore areas, but are most common in nearshore environments (Blake 2021, Fauchald and Jumars 1979). *Streblospio benedicti*, another common and widespread species in Onshore Export Cable Common Corridor samples, is a small tube-dwelling spionid polychaete that inhabits the top few centimeters of mudflats and soft sediments in North America estuaries (SERC 2022b). This deposit and suspension feeder is found in habitats with a wide range of temperatures and salinities (Levin and Creed 1986, Palmer et al. 2002) and is regarded as an opportunistic pioneer species that is generally tolerant of contamination and organic enrichment (Thompson and Lowe 2004) and can survive intermittent periods of hypoxia (Llansó 1991). Similarly, the capitellid polychaetes *Notomastus* sp. and *Mediomastus* sp. tolerate disturbance and excess organic content (Borja et al. 2000) and are often associated with moderate to high contamination levels (Rakocinshi et al. 2000). *Notomastus* sp. is a burrowing deposit feeder (Kikuchi 1987), frequently found in shallow soft-sediment habitats with high levels of organic debris (Pollock 1998). The liljeborgiid amphipod *Idunella* sp. is a cosmopolitan genus in shallow waters and is commensal in tubes of polychaetes (Bousfield 1973, Lazo-Wasem 1985).

Shellfish

Mollusks were not observed in Onshore Export Cable Common Corridor benthic samples, though hard clam (*Mercenaria mercenaria*), a shellfish species of potential commercial importance, were encountered at site IRB-BG-TRC-23 (see COP Volume II, Appendix II-D5, Attachment C for additional information on shellfish in Indian River Bay). No taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed in samples collected in the vicinity of the Onshore Export Cable Common Corridor, and no submerged aquatic vegetation was observed during sample collection.

As part of the 2022 Indian River Bay sampling program, a shellfish density survey was conducted at the Bott and Wong (2012) sites that were accessible via wading (less than 1.2 m [4 ft] deep). Six hard clams were collected, ranging in size from 3.7-11.0 cm (1.5-4.3 in).

Taxonomic Classification of Benthic Habitat in the Onshore Export Cable Common Corridor

Results of the benthic grab NMFS-modified CMECS classifications from the Onshore Export Cable Common Corridor are summarized in Table 7-30 below. The resulting substrate classifications are presented in greater detail in Appendix II-D5.

Table 7-30. Onshore Export Cable Common Corridor Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Locations
Mud	N/A	18	95%
Sandy Mud	N/A	0	0%
Muddy Sand	N/A	1	5%
Sand	Fine/Very Fine Sand	0	0%
Total		**19**	**100%**

The infaunal sampling results from Onshore Export Cable Common Corridor samples aligns with the habitat classifications for the area; all 19 samples were classified as fine unconsolidated substrate under the NMFS-modified CMECS framework (Table 7-30, Figure 7-9). Consequently, as described above, the taxa observed in grab samples collected from the Onshore Export Cable Common Corridor are typical of soft-sediment habitats. In contrast to Onshore Export Cable North Corridor and Onshore Export Cable South Corridor samples (see below), the substrate group for nearly all Onshore Export Cable Common Corridor samples (95%) was mud (Figure 7-9).

Onshore Export Cable North Corridor

A total of 22 marine invertebrate taxa, including polychaete worms, crustaceans, mollusks, and oligochaete worms, were found in the nine macrofaunal grab samples collected from the vicinity of the Onshore Export Cable North Corridor during the 2022 benthic survey program (Table 7-31).

Table 7-31. Summary of Key Statistics from the 2022 Onshore Export Cable North Corridor Benthic Sample Analysis

Statistic	Value
Number of Samples	9
Mean Density per Square Meter (±1 SD)	211 ± 184
Mean Taxa Richness (±1 SD)	4 ± 2.2
Total Number of Taxa	22
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	9
Crustaceans	9

Table 7-31. Summary of Key Statistics from the 2022 Onshore Export Cable North Corridor Benthic Sample Analysis

Statistic	Value
Mollusks	3
Oligochaete worms	1
Other	0
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	52.5%
Crustaceans	29.4%
Mollusks	13.6%
Oligochaete worms	4.5%
Other	0.0%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

Average organism density was 211 ± 184 (mean ± SD), ranging from a low of 43 individuals/m^2 at IRB-GB-TRC-01, to a high of 517 individuals/m^2 at IRB-BG-TRC-07 (Table 7-31). Taxa richness per sample ranged from 2 to 8, and mean taxa richness was 4 ± 2.2 (mean ± SD) per site (Table 7-31). No consistent spatial patterns in total organism density or taxa richness were observed in samples collected in the vicinity of the Onshore Export Cable North Corridor.

The most speciose taxonomic groups were polychaete worms and crustaceans, which each contributed over 40% of the taxa documented in the analyzed samples (Table 7-31). Mollusks and oligochaete worms accounted for approximately 13% and 5% of taxa in the Onshore Export Cable North Corridor samples, respectively. Polychaetes accounted for the greatest percentage of total organism abundance of any taxa group (over 52%), followed by crustaceans and mollusks (approximately 29% and 14%, respectively) (Table 7-31).

The most abundant taxon in Onshore Export Cable North Corridor samples was the spionid polychaete *Streblospio benedicti*, which accounted for over 18% of all individuals identified. Tellin clams (tellininae) and the orbiniid polychaete *Leitoscoloplos* sp. were the next most abundant taxa, each accounting for more than 11% of all organisms (Table 7-32).

Table 7-32. Relative Abundance of Taxa Encountered in 2022 Onshore Export Cable North Corridor Samples

Scientific Name	Common Name	Relative Abundance (%)
Streblospio benedicti	Spionid Polychaete	18.1
Tellininae	Tellin Clam	12.4
Leitoscoloplos sp.	Orbiniid Polychaete	11.3
Rhepoxynius epistomus	Phoxocephalid Amphipod	9.0
Idunella sp.	Liljeborgiid Amphipod	5.6

Table 7-32. Relative Abundance of Taxa Encountered in 2022 Onshore Export Cable North Corridor Samples

Scientific Name	Common Name	Relative Abundance (%)
Corophium sp.	Corophiid Amphipod	5.1
Cirratulidae	Cirratulid Polychaete	5.1
Polydora sp.	Spionid Polychaete	4.5
Naididae w/out hair chaetae	Oligochaete Worm	4.5
Notomastus sp.	Capitellid Polychaete	4.5
Nephtys bucera	Nephtyid Polychaete	4.0
Goniadidae	Goniadid Polychaete	3.4
*Includes taxa accounting for ≥ 2.5% of total abundance		

The taxa observed in grab samples collected from the vicinity of the Onshore Export Cable North Corridor were generally similar to those found in samples collected from the Onshore Export Cable Common Corridor (described above) and are typical of soft-sediment habitats. However, some taxa, including tellin clams and nephtyid polychaetes, were notably more abundant and widespread in Onshore Export Cable North Corridor samples than in Onshore Export Cable Common Corridor samples. Tellin clams are small bivalves that use long siphons to filter feed while burrowed horizontally in a variety of soft sediment habitats (Mikkelsen and Bieler 2021; Pollock 1998a). Nephtyid polychaetes like *Nephtys bucera* are also typical of soft sediment habitats (mud and sand) from the high intertidal to offshore areas (Pettibone 1963). *N. bucera* is a highly motile predator of polychaetes and crustaceans which is widely distributed along the east coast of the United States (Pettibone 1963).

Shellfish

The only mollusk taxa observed in Onshore Export Cable North Corridor samples were tellin clams (found in four samples) and razor shells (solenidae, found in one sample). Hard clam, a shellfish species of potential commercial importance, was observed as a single individual in two samples. No other taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed in the samples collected in the vicinity of the Onshore Export Cable North Corridor, and no submerged aquatic vegetation was observed during sample collection.

Taxonomic Classification of Benthic Habitat in the Onshore Export Cable Common Corridor

Results of the benthic grab NMFS-modified CMECS classifications from the Onshore Export Cable North Corridor are summarized in Table 7-33 below. The resulting substrate classifications are presented in greater detail in Appendix II-D5.

Table 7-33. Onshore Export Cable North Corridor Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Locations
Mud	N/A	1	11%

Table 7-33. Onshore Export Cable North Corridor Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Locations
Sandy Mud	N/A	1	11%
Muddy Sand	N/A	2	22%
Sand	Fine/Very Fine Sand	5	56%
	Total	**9**	**100%**

The infaunal sampling results from Onshore Export Cable North Corridor samples align with habitat classification results for these samples; all nine samples were classified as fine unconsolidated substrates under the NMFS-modified CMECS framework. The majority of samples were classified as sand habitats (5 samples, 56%), though muddy sand, sandy mud, and mud substrates were also observed (Table 7-33). This distribution of CMECS substrate group classifications differs from Onshore Export Cable Common Corridor sites, which were nearly all mud substrates (see above). However, substrate groups in Onshore Export Cable North Corridor samples were generally similar to those observed in Onshore Export Cable South Corridor samples (Figure 7-9).

Onshore Export Cable South Corridor

A total of 21 taxa of benthic fauna, including polychaete worms, mollusks, crustaceans, oligochaete worms, and nemertean ribbon worms were found in the six macrofaunal grab samples collected from the vicinity of the Onshore Export Cable South Corridor during the 2022 benthic survey program (Table 7-34).

Table 7-34. Summary of Key Statistics from the 2022 Onshore Export Cable Common South Benthic Sample Analysis

Statistic	Value
Number of Samples	6
Mean Density per Square Meter (±1 SD)	1,102 ± 1,800
Mean Taxa Richness (±1 SD)	6 ± 2.0
Total Number of Taxa	21
Number of Taxa Observed by Taxonomic Group	
Polychaete worms	11
Crustaceans	5
Mollusks	3
Oligochaete worms	1
Other	1
Percent of Total Abundance by Taxonomic Group	
Polychaete worms	85.8%
Crustaceans	4.2%
Mollusks	5.5%

Table 7-34. Summary of Key Statistics from the 2022 Onshore Export Cable Common South Benthic Sample Analysis

Statistic	Value
Oligochaete worms	4.1%
Other	0.3%
*All metrics calculated after taxonomic ambiguity in the dataset was resolved using the RPMC-G method described in Cuffney et al. (2007)	

Average organism density was 1,102 ± 1,800 (mean ± SD), ranging from a high of 4,672 individuals/m^2 at IRB-BG-TRC-17, to a low of 86 individuals/m^2 at IRB-BG-TRC-10 (Table 7-34). Taxa richness per sample ranged from 3 to 8, and mean taxa richness was 6 ± 2 (mean ± SD) per site (Table 7-34). No consistent spatial patterns in total organism density or taxa richness were observed in samples collected in the vicinity of the Onshore Export Cable South Corridor.

The most speciose taxonomic group was polychaete worms, which contributed over 52% of the taxa documented in the analyzed samples (Table 7-34). Crustaceans and mollusks each accounted for approximately 24% and 14% of taxa in the Onshore Export Cable South Corridor samples, respectively. Polychaete worms accounted for the greatest percentage of total organism abundance of any taxa group (over 85%, Table 7-34).

The most abundant taxon in the Onshore Export Cable South Corridor samples was the spionid polychaete *Streblospio benedicti*, which accounted for over 53% of all individuals identified (Table 7-35). The capitellid polychaete *Mediomastus* sp., and cirratulid polychaetes were the next most abundant taxa, each accounting for more than 11% of all organisms.

Table 7-35. Relative Abundance of Taxa Encountered in 2022 Onshore Export Cable South Corridor Samples

Scientific Name	Common Name	Relative Abundance (%)
Streblospio benedicti	Spionid Polychaete	53.3
Mediomastus sp.	Capitellid Polychaete	13.0
Cirratulidae	Cirratulid Polychaete	11.4
Naididae w/out hair chaetae	Oligochaete Worm	4.1
Goniadidae	Goniadid Polychaete	2.9
Idunella sp.	Liljeborgiid Amphipod	2.3
Astarte sp.	Chestnut Clam	2.3
Bivalvia type a	Immature Clam	2.3
*Includes taxa accounting for ≥ 2.0% of total abundance		

The taxa observed in grab samples collected from the vicinity of the Onshore Export Cable South Corridor were typical of soft sediment habitats and generally similar to those found in samples collected from the Onshore Export Cable Common Corridor and the Onshore Export Cable North Corridor (described above). Additional organisms found in Onshore Export Cable South Corridor samples included cirratulid and goniadid polychaetes. Cirratulid worms are deposit feeders that reside in soft sediment habitats (Gosner 1978) and are regarded as somewhat opportunistic taxa (Borja, Franco, and Pérez 2000). Goniadid worms are carnivores (Pettibone 1963) found in sand and mud (Pollock 1998b).

Shellfish

The mollusk taxa observed in Onshore Export Cable South Corridor samples were tellin clams (found in two samples), chestnut clams (*Astarte* sp., found in one sample), and a taxon of minute immature bivalve (bivalvia type a, found in one sample). Hard clam, a shellfish species of potential commercial importance, was observed as a single individual in one sample (see COP Volume II, Appendix II-D5, Attachment C for additional information on shellfish in Indian River Bay). No taxa indicative of sensitive habitats (hard bottom areas, cold water coral reefs, seagrass beds, etc.) were observed in the samples collected in the vicinity of the Onshore Export Cable South Corridor, and no submerged aquatic vegetation was observed during sample collection.

Taxonomic Classification of Benthic Habitat in the Onshore Export Cable Common Corridor

Results of the benthic grab NMFS-modified CMECS classifications from the Onshore Export Cable South Corridor are summarized in Table 7-36 below. The resulting substrate classifications are presented in greater detail in Appendix II-D5.

Table 7-36. Onshore Export Cable South Corridor Benthic Grab Sample Substrate Classifications

CMECS Substrate Group	CMECS Substrate Subgroup(s)	No. of Locations	% of Locations
Mud	N/A	0	0%
Sandy Mud	N/A	2	33%
Muddy Sand	N/A	2	33%
Sand	Fine/Very Fine Sand	2	33%
	Total	**6**	**100%**

The infaunal sampling results align with expectations, given the NMFS-modified CMECS habitat classifications for samples collected in the vicinity of the Onshore Export Cable South Corridor. Like Onshore Export Cable Common Corridor samples and Onshore Export Cable North Corridor Samples, all Onshore Export Cable South Corridor samples were classified as fine unconsolidated substrate. An equal distribution of sand, muddy sand, and sandy mud habitats were observed in the Onshore Export Cable South Corridor samples (Table 7-36). This is generally similar to substrates observed in Onshore Export Cable North Corridor samples (though with a smaller percentage of sand habitats) but differs from Onshore Export Cable Common Corridor samples, which were composed nearly entirely of finer mud substrates (see above, Figure 7-9).

7.1.4 O&M Facility

The O&M Facility would be located within the Ocean City Harbor which is characterized as an Intensely Developed Area under the MDNR Critical Area program. Based on a review of the

MDNR aquatic resources screening tool[11], there are no natural oyster bays or submerged aquatic vegetation (historical or within the last 5 years) identified within the location of the O&M Facility.

7.2 Impacts

7.2.1 Construction

Habitat Alteration

The primary impacts to benthic organisms from construction activities will result from the placement of the WTG, OSS, and Met Tower foundations and associated scour protection, the installation of the submarine cables, the use of gravity cells at the landfalls, dredging for barge access in Indian River Bay, and seafloor disturbance due to vessel anchoring. Slow-moving or sessile organisms inhabiting benthic sediments in areas directly within the footprint of these activities will suffer mortality from crushing or burial. Although motile organisms, including crabs, lobsters, sea scallops, and horseshoe crabs, may be able to vacate installation areas and avoid direct mortality, these organisms could be temporarily displaced by construction activities.

Summaries of maximum temporary and permanent bottom disturbance in offshore areas and Indian River Bay are presented in Tables 7-37 and 7-38 below. The values presented in Tables 7-37 and 7-38 reflect the maximum PDE scenario for each construction element (e.g. the use of monopile foundations for the OSSs, the use of a tracked vessel for installation of the entire onshore export cable, etc.).

Table 7-37. Permanent Estimated Maximum Disturbance

Disturbance Area	Project Component	Max Area of Disturbance	
		km^2	acres
Offshore Seafloor	WTGs, OSSs, and Met Tower Foundations and Scour Protection	0.13	32.14
	Cable Protection	0.29	71.17
	Total Permanent Offshore Disturbance	**0.42**	**103.30**

Permanent Disturbance

Permanent bottom disturbance will occur in the footprint of WTG, OSS and Met Tower foundations and associated scour protection. Sea floor leveling, if needed, is expected to occur within the footprint of the permanent disturbance due to the scour protection. Additional permanent seafloor impacts could occur where burial depth of the Offshore Export Cable may be insufficient, requiring the installation of scour protection in the form of rock or concrete mattresses (Table 7-37). Installation of these materials will crush or bury benthic organisms in the scour protection footprint. However, because cable laying operations will be located in areas with primarily sandy substrates,

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[11] https://maryland.maps.arcgis.com/apps/webappviewer/index.html?id=1c1095e641c541d8aa6588ef6c1b23c8

and the Project has been sited to avoid known hard bottom habitats to the extent possible, cable protection requirements are expected to be minimal.

No cable protection is proposed for the Onshore Export Cables within Indian River Bay; therefore, there would be no permanent impacts to benthic resources.

See Section 7.2.2 below for a discussion of the impacts of permanent benthic habitat alteration due to installation of cable protection, the WTGs, OSSs and the Met Tower.

Temporary Disturbance

Temporary bottom disturbance will result from installation of export cables, anchoring, the use of jack-up vessels, the installation of HDD gravity cells, and dredging for barge access in Indian River Bay (Table 7-38). Cables will be installed using a jet plow, which will minimize the area of temporary bottom disturbance compared to other installation methods (e.g. dredging). This installation method would result in maximum mortality-inducing disturbance of a corridor of seafloor along the length of the inter-array and Offshore and Onshore Export Cable Corridors. Sediment vibrations caused by movement of the cable installation equipment might elicit avoidance behaviors from certain mobile species (e.g. crabs, lobsters, amphipods), but sessile or slow-moving organisms that remain within the directly impacted portion of the cable laying area during installation will suffer mortality (USDOE and MMS 2009).

Table 7-38. Temporary Estimated Maximum Disturbance

Disturbance Area	Project Component	Max Area of Disturbance	
		km^2	acres
Offshore Seafloor	Anchoring	0.06	15.57
	Offshore Export Cable Installation	0.14	34.84
	Inter-array Export Cable Installation	0.15	36.32
	Jack-up Vessels	0.25	62.27
	Total Temporary Offshore Disturbance	**0.60**	**149.00**
Onshore Bay Bottom	Onshore export cable installation	1.56	385.48
	HDD Gravity Cell Installation - Barrier Beach Landfall	0.00	1.19
	HDD Gravity Cell Installation -Substation	0.00	0.59
	Dredging for Barge Access	0.16	39.01
	Total Temporary Bay Disturbance	**1.72**	**426.27**

WTG, OSS and Met Tower installation procedures will likely utilize Dynamic Positioning (DP) vessels, which may reduce disturbance. However, anchoring may be necessary during construction activities, which would result in disturbance caused by anchor placement and anchor chain contact. To minimize impacts, vessels will avoid anchoring in locations with sensitive habitats when possible and will utilize mid-line anchor buoys to decrease anchor line sweep impacts. Under the maximum impact scenario, areas of the sea floor are expected to be temporarily impacted by the jack-up vessels during installation of foundations and the WTG and OSS. Any depressions in the seafloor caused by the jack-up vessel legs are expected to backfill naturally.

Horizontal Directional Drilling (HDD) will be used at the offshore, onshore and substation landfalls to minimize impacts to nearshore habitats. For Onshore Export Cable Corridor 1, this operation would require the installation of eight gravity cells, up to four on the Atlantic Ocean side of the barrier beach and up to four in Indian River Bay, and up to four gravity cells at the Indian River Substation landfall, which would require the dredging of sediment from an approximately 0.01 km^2 (1.8 acres) area. Onshore Export Cable Corridors 1a-c and 2 would only require four gravity cells on the Atlantic side of the Tower Road landfall location with a disturbance of approximately 0.002 km^2 (0.59 acres). Organisms in the dredged area would suffer mortality but the gravity cells would be removed following HDD operations.

Although benthic communities will experience localized mortality and habitat disturbance during construction, these impacts are expected to be temporary and spatially limited. Organisms inhabiting soft sediment communities along the Offshore Export Cable Corridors and in the Lease area are regularly exposed to natural disturbance due to the motile nature of sandy sediments in the region (Guida et al. 2017). These recurrent disturbance events contribute to spatial heterogeneity and resource patchiness in the region (S.F. Thrush and Dayton 2002), and organisms inhabiting this region are adapted to these conditions. Similarly, the benthic community represented in samples collected from the Onshore Export Cable Corridor 1 included many pollution-tolerant and opportunistic species, characterized by rapid dispersal capabilities and high reproductive rates suited to colonization of disturbed areas (e.g., *S. benedicti*, (Levin 1986); *M. ambiseta*, (Hughes 1996)).

As the areas disturbed by construction activities would constitute only a small percentage of benthic habitats in the region, organisms are expected to rapidly recolonize these locations from surrounding undisturbed habitats. Examinations of monitoring results from the Block Island Wind Farm indicate that areas of seafloor disturbance associated with WTG installation, primarily caused by contact with lift boat spud legs and anchors, are likely to physically recover over a short time period; approximately 46% of disturbance areas had completely healed within one year of construction activities (HDR 2018). Physical seafloor recovery was more rapid in areas of fine-grained sand than in areas of medium to coarse grained sand (HDR 2018). Benthic communities in mobile sand habitats, like those of the Lease area and Offshore Export Cable Corridors, have also been observed to recover from natural sediment movement in less than a year (Lindholm, Auster, and Valentine 2004), though the rate of recovery can vary due to local species diversity and organism density. Studies examining dredging impacts have suggested benthic recovery times ranging from 3 months to 2.5 years (Brooks et al. 2006), 1.5 to 2.5 years (D. H. Wilber and Clarke 2007), or up to 3.0 years (D. H. Wilber and Clarke 2007). Recovery times are impacted by the size of the disturbed areas and the composition of the benthic community in surrounding habitats (D. H. Wilber and Clarke 2007), but community composition may not return to baseline conditions until three or more years after the disturbance event (BOEM 2016).

Installation of these structures, and the submarine cables would only disturb habitats in a small portion of the region offshore of Delaware and Maryland. Large areas of undisturbed benthic habitat will be preserved, which will allow for rapid recolonization of impacted areas.

As the Project has been sited to avoid sensitive or rare habitats, including hard bottom areas, artificial reefs, clam beds, and SAV beds, impacts to the benthic community due to installation-related habitat alterations are expected to be minor and temporary. DNREC recommends the following measures to protect benthic resources (DNREC 2023b):

- No in-water work (e.g., cable installation, HDDs, dredging) in Indian River Bay March 1 through September 30.
- No HDD activities at the Atlantic beach landfall from April 15 through September 30 (inclusive of recreational period avoidance May 15 through September 15) to avoid impacts to spawning horseshoe crabs.

Suspended Sediment/Deposition

Seafloor-disturbing activities will cause localized and temporary increases in suspended sediment levels and sediment deposition rates, primarily near the areas dredged for barge assess and the submarine cables but also near the WTG, OSS, Met Tower, and temporary gravity cell locations.

Increases in suspended sediment will occur during installation of the submarine cables and dredging for barge access in Indian River Bay. Based on sediment transport results for the Offshore Export Cable Corridors and Onshore Export Cable Corridor 1, the vast majority of sediments disturbed during jet plow operation will quickly return to the cable installation trench. A portion of disturbed sediment will leave the immediate trench area, resulting in measurable, but temporary, increases in suspended sediment levels. In the Offshore Export Cable Corridor, sediment deposition in excess of 0.2 mm (0.008 in) will occur within 91 m (300 ft) of the proposed cable path. In Onshore Export Cable Corridor 1, temporary increases in suspended sediment are anticipated to occur within 1,400 m (4,600 ft) of jet plow operations. Volume II, Section 4.0 provides details of the expected suspended sediment and deposition due to construction activities.

Elevated suspended sediment concentrations can clog the filtering organs of filter feeding benthic invertebrates, leading to decreased feeding efficiency (S. Thrush et al. 2004). However, many bivalve species, including blue mussel, surf clam, and sea scallop, are able to cope with temporarily increased suspended sediment concentrations by selectively rejecting filtered inorganic material as pseudofeces prior to ingestion (Bayne et al. 1993; Robinson, Wehling, and Morse 1984; MacDonald and Ward 1994). Sessile filter feeding organisms, including tunicates, corals, and sponges are most sensitive to elevated suspended sediment concentrations (S. Thrush et al. 2004). However, the Project has been sited to avoid hard bottom habitats where these taxa are found. Impacts to benthic communities from increased suspended sediment levels are expected to be negligible.

Resuspension of contaminated sediments due to human activities can have negative impacts on benthic communities. However, impacts of this nature are not anticipated to result from Project activities, as sediments within the Project area are not known to be highly contaminated, see Volume II, Section 4.0. Therefore, exposure of benthic organisms to harmful levels of resuspended contaminants is not expected.

In areas where deposition is highest, benthic organisms may become buried. Surface-dwelling motile organisms and actively burrowing organisms are at low risk of harm from burial, as these species will be able to vacate the affected area during disturbance or unbury themselves. However, sessile or less motile buried organisms located in the disturbed area may experience mortality or metabolic impacts due to smothering. However, these conditions are expected to be localized and result in negligible to minor impacts to benthic communities.

7.2.2 Operations

Habitat Alteration

The addition of man-made structures to the marine environment, in the form of WTG, OSS and Met Tower foundations and scour protection, will have long term impacts on the benthic community. These structures will provide new habitat, of a type previously rare within the Project area, for the duration of Project operation. Scour protection materials would provide areas of horizontal hard substrate (rocks or concrete mattresses), although depending on exact placement, these may become buried under sediments over time. The WTG, OSS and Met Tower foundations will present large areas of hard, vertical substrate. These structures are expected to act as artificial reefs, and provide additional habitat for fouling organisms including tunicates, sponges, bryozoans, algae, mussels, barnacles, and hydroids. Man-made hard surfaces can host communities that differ from those on adjacent natural substrates (Wilhelmsson and Malm 2008; Glasby 1999; Connell 2000), and WTG foundation structures have been observed to facilitate the spread of invasive species by serving as stepping stones for dispersal (De Mesel et al. 2015; Adams et al. 2014).

In addition to providing new habitat for fouling organisms, the WTGs, OSSs and the Met Tower may impact surrounding soft-sediment communities. The addition of submerged infrastructure may result in the organic enrichment of sediments locally surrounding the WTG, OSS and Met Tower foundations, as epibenthic organisms slough off of structures and fall to the seafloor. Increased carbon loading in sediments can cause local alterations in benthic community composition and sediment chemistry (Lenihan et al. 2003), (classic model from (Pearson and Rosenberg 1978)). These impacts have been observed in the vicinity of a gravity base foundation in the North Sea (Coates et al. 2014), and a jacketed pile foundation in Scotland (Schröder, Orejas, and Joschko 2006). A recent study of the Block Island Wind Farm did not document any strong localized impacts on the benthic community within the first year following WTG installation, and detected no organic enrichment in the vicinity of the foundations (HDR 2017). However, these results may change over time, with more significant fouling organism colonization of foundation structures, and the subsequent death and sloughing off of this material occurs.

Direct mortality may also be caused by contact with equipment associated with maintenance or repair. However, the area of these disturbances is expected to be limited, and community-scale impacts are not anticipated due to rapid recolonization of impacted areas from nearby habitats.

Overall, O&M impacts to benthic resources from habitat alteration are anticipated to be minor.

Suspended Sediment/ Deposition

Certain activities associated with O&M such as cable repair will result in localized disruption of seafloor sediments and associated temporary increases in suspended sediment concentration. However, these impacts are anticipated to be limited in scope and extent. Therefore, O&M impacts to benthic resources from suspended sediment and deposition are anticipated to be negligible.

EMF

The potential impacts of electromagnetic fields on benthic invertebrates are understudied, and there is little to no information available about the impacts of EMF on most organisms, especially non-commercially-important taxa (BOEM 2021c). One recent study documented subtle but statistically significant changes in the behavior of American lobster (*Homarus americanus*) when exposed to a 330 MW HVDC submarine cable (Hutchison et al. 2018). However, all non-DC types of submarine cables generate limited magnetic fields (Sharples 2011), and no biologically significant impacts on benthic resources have been reported from EMF from AC cables (CSA Ocean Sciences Inc. and Exponent 2019; Thomsen et al. 2015). No differences in the invertebrate community were noted between unburied energized and non-energized cables offshore of California (Love et al. 2016), and a review of recent studies indicates that benthic communities located along cable routes are generally similar to nearby natural habitats (A. Gill and Desender 2020). Additionally, no long-term impacts of EMF on clam habitat have been observed as a result of existing power cables connecting mainland Massachusetts and Nantucket (BOEM 2021c). The effects of EMF on most invertebrate taxa (embryonic and juvenile crustaceans and mollusks, horseshoe crabs, etc.) remain understudied (A. Gill and Desender 2020). However, although a small number of species have demonstrated responses to EMF in recent studies, these responses have been associated with EMF intensities exceeding those produced by renewable energy projects (A. Gill and Desender 2020). Due to the importance of horseshoe crabs to the region, US Wind will conduct a study of the potential EMF effects of the Project on horseshoe crabs.

EMF intensity decreases rapidly with distance from transmission cables, with potentially meaningful EMFs most likely extending less than 15.4 m (50 ft) from each transmission cable (BOEM 2021c). A site-specific study of potential impacts of EMF found electric and magnetic fields produced by the operation of project cables to be below the reported detection thresholds for electrosensitive marine organisms (Exponent 2023). The maximum magnetic and electric fields at peak loading of the Project cables rapidly decrease with horizontal distance from the cables and is shown in Table 7-39 (Exponent 2023). EMF is unlikely to impact benthic organisms in the Project area, as all electrical transmission cables will be buried at a minimum depth of 1 meter (3.2 ft) beneath the substrate, or covered in scour protection. Therefore, impacts to benthic resources from EMF are expected to be negligible.

Table 7-39. Summary of Calculated Magnetic- and Induced Electric-Field Levels[1]

Cable Configuration	Evaluation Height for Magnetic- or Electric-Field	Magnetic Field (mG)			Electric Field (mV/m) [2]		
		Max	Horizontal Distance from Cable		Max	Horizontal Distance from Cable	
			1.5 m (5 ft)	3 m (10 ft)		1.5 m (5 ft)	3 m (10 ft)
Inter-array Cable	At the seabed	49	4.0	0.1	0.7	0.1	< 0.1
	1 m (3.3 ft) above the seabed	2.1	0.5	< 0.1	< 0.1	< 0.1	< 0.1
Offshore Export Cable	At the seabed	148	21	0.9	2.5	0.4	< 0.1
	1 m (3.3 ft) above the seabed	12	3.7	0.3	0.2	0.1	< 0.1
	At the seabed	148	21	0.9	2.5	0.4	< 0.1

Table 7-39. Summary of Calculated Magnetic- and Induced Electric-Field Levels[1]

Cable Configuration	Evaluation Height for Magnetic- or Electric-Field	Magnetic Field (mG)			Electric Field (mV/m) [2]		
		Max	Horizontal Distance from Cable		Max	Horizontal Distance from Cable	
			1.5 m (5 ft)	3 m (10 ft)		1.5 m (5 ft)	3 m (10 ft)
Export Cables in Indian River Bay [3,4]	1 m (3.3 ft) above the seabed	12	3.8	0.3	0.2	0.1	< 0.1

Adapted from Exponent 2023

[1] The horizontal distance is measured from the centerline of the individual inter-array or offshore export cable.

[2] Induced electric fields in representative marine species of interest are lower than those presented here for induced electric fields in seawater.

3 For HDD, cables will be installed approximately 6.6 ft (2 m) or greater. As a result, the maximum calculated field levels will be lower than those presented here.

[4] For Indian River Bay Export Cables, the results at horizonal distances > 0 were provided relative to the cable with the higher current (1,200 A and 480 A for peak and average loading, respectively). Calculated fields near cables carrying lower currents will be lower.

7.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Removal of the WTGs and OSSs would alter the benthic environment by removing hard substrate habitats. This change would result in mortality to organisms attached to these structures but would reestablish soft-bottom habitats similar to baseline pre-construction conditions. Decommissioning would result in additional impacts to the benthic community due to interactions with bottom-contacting equipment (e.g. jack-up vessel pads, vessel anchors) and the temporary resuspension of sediments due to equipment removal. Impacts from these activities would be similar to those described above for construction.

7.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on benthic resources.

- Based on consultation with DNREC, the following habitat protection measures would be implemented to avoid and minimize impacts to species:
    - No in-water work (e.g., cable installation, HDDs, dredging) in Indian River Bay March 1 through September 30.
    - No HDD activities at the Atlantic beach landfall from April 15 through September 30 (inclusive of recreational period avoidance May 15 through September 15) to avoid impacts to spawning horseshoe crabs.
- The Project has been sited to avoid sensitive or rare habitats (such as high-density clam beds) where feasible, and habitat disturbance will be minimized to the extent practicable.
- Shellfish relocation/restoration in Onshore Export Cable Corridor 1 will be evaluated pre- and post- installation if warranted.

- Cables will be installed using a jet plow to the greatest extent possible. Any dredging needed at HDD locations is expected to be limited to the gravity cells.
- Horizontal Directional Drilling (HDD) will be used at landfall locations.
- Potential impacts from anchoring will be minimized by avoiding locations with sensitive habitats and utilizing mid-line anchor buoys.
- Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable.
- Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.

8.0 Finfish and Essential Fish Habitat

8.1 Existing Conditions

8.1.1 Description of Affected Environment

The Project area includes finfish and essential fish habitat in Indian River Bay and the western Atlantic Ocean. Invertebrates, such as shellfish and horseshoe crabs are discussed in Volume II, Section 7.0. The benthic habitat in the Project area is dominantly sandy sediment type and is almost homogenous in that the variations in sediment type observed only occur in small spatial scale (see Volume II, Section 7.0). Benthic habitat is important for fish habitat and influences site fidelity in fish species. The most notable benthic community of the area called the Old Grounds was observed to have the same sediment type but revealed low taxa richness comparatively to the rest of the Project area (Volume II, Section 7.0, Figure 7-4).

The waters along the Atlantic Coast are home to a wide variety of fish species, and the number and types of species present depend on differences in habitat conditions. Fish species richness and biomass data in the Project area are shown in Figure 8-1 through Figure 8-4. These figures were developed by the Marine-Life Data and Analysis Team (Curtice et al. 2018; Fogarty and Perretti 2016), using data from the National Oceanic and Atmospheric Administration’s (NOAA) Northeast Fisheries Science Center’s (NEFSC) fall trawl surveys. These figures present the expected species richness and biomass of survey trawls which are dependent upon vessel and gear type. Therefore, these data do not reflect absolute fish biomass or species richness hotspots, but rather serve as fishery descriptors. As reflected by NEFSC data, fish species richness in the Lease area is around 35-40 species per tow (Figure 8-1), which is above average for the northeastern U.S. coast as a whole (not pictured). The total biomass is somewhat higher than the surrounding areas at 85-230 kilograms (187-507 pounds) per tow, but these numbers are still low for the northeastern U.S. coast where a single tow can yield thousands of kilograms of fish (Figure 8-2). Demersal fish biomass in the Lease area ranges from 7-14 kg (15-31 lbs) per tow, and forage fish biomass ranges from 5 to 58 kg (11 to 128 lbs) per tow in a hotspot on the western side of the Lease area (Figure 8-3 and Figure 8-4). The low biomass of demersal and forage fish suggests that large predatory fish are common in the Lease area.

Fish assemblages include pelagic, demersal, highly migratory and estuarine fishes. Pelagic fishes are those that generally occur throughout the water column being neither close to the bottom or near the shore, and in contrast demersal fishes (groundfish) are those that occur on or near the ocean bottom. Highly migratory species are those that travel great distances for resources or reproduction, often from the South Atlantic to as far north as the Gulf of Maine. Estuarine fishes are those that occur in brackish water between marine and river environments, such as in Indian River Bay. Fish species of commercial and recreational importance are discussed in Volume II, Section 17.0 and fish species that are protected under a federal fishery management plan are discussed in further detail in Appendix II-E1. Table 8-1 lists fish species that may be present in the Project area.

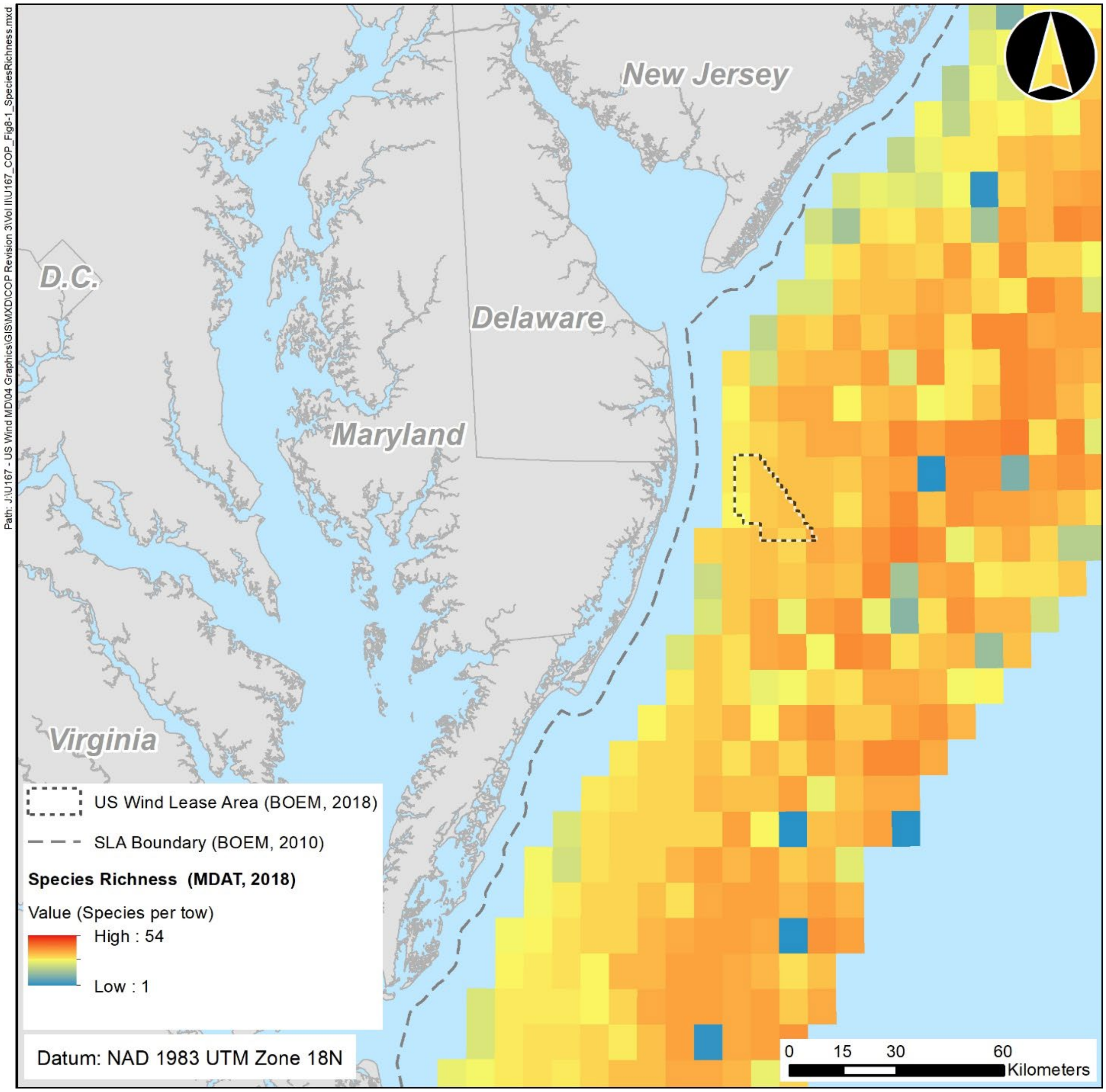

Figure 8-1. Fish Species Richness in the Project Area

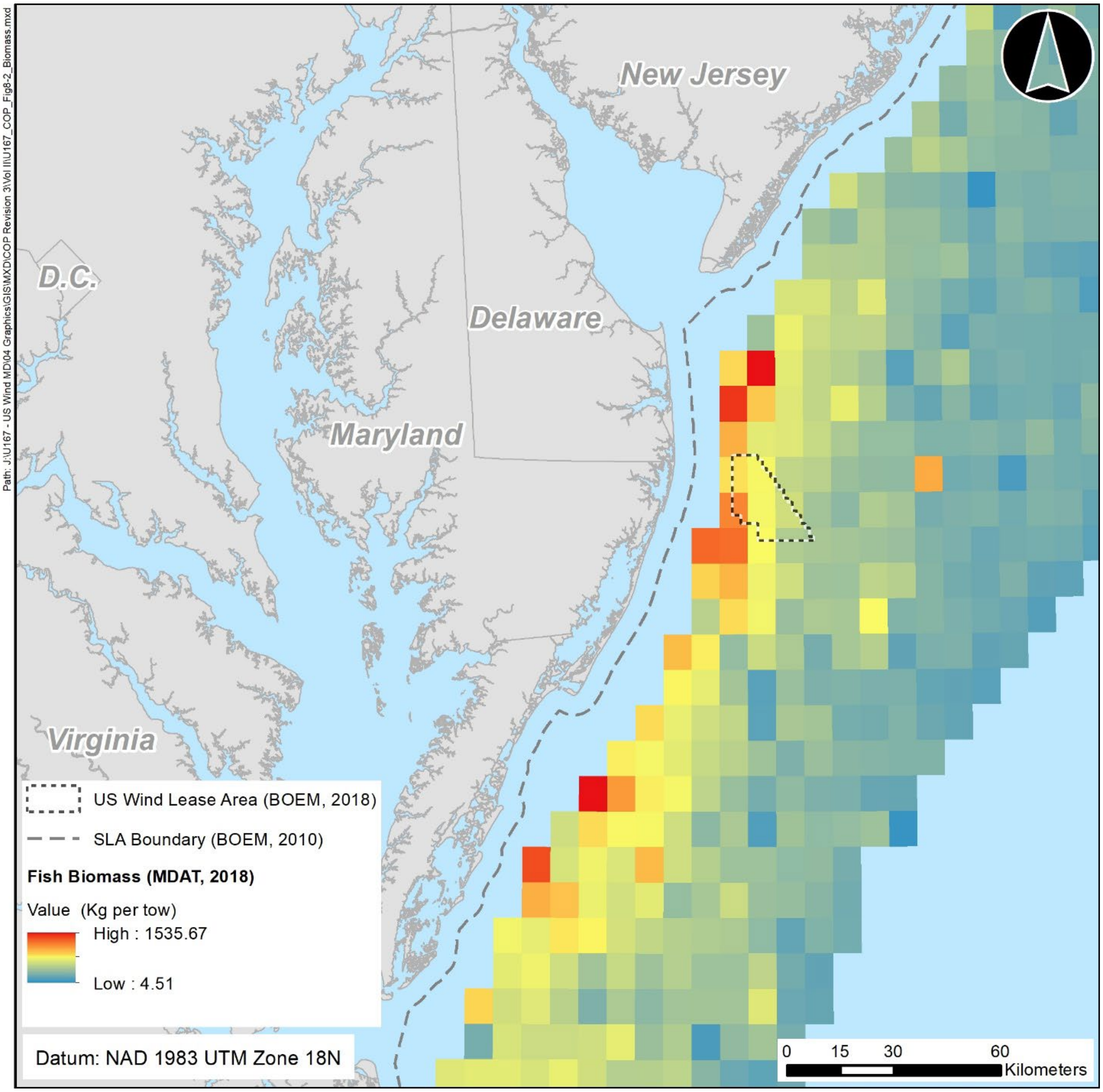

Figure 8-2. Fish Biomass in the Project Area

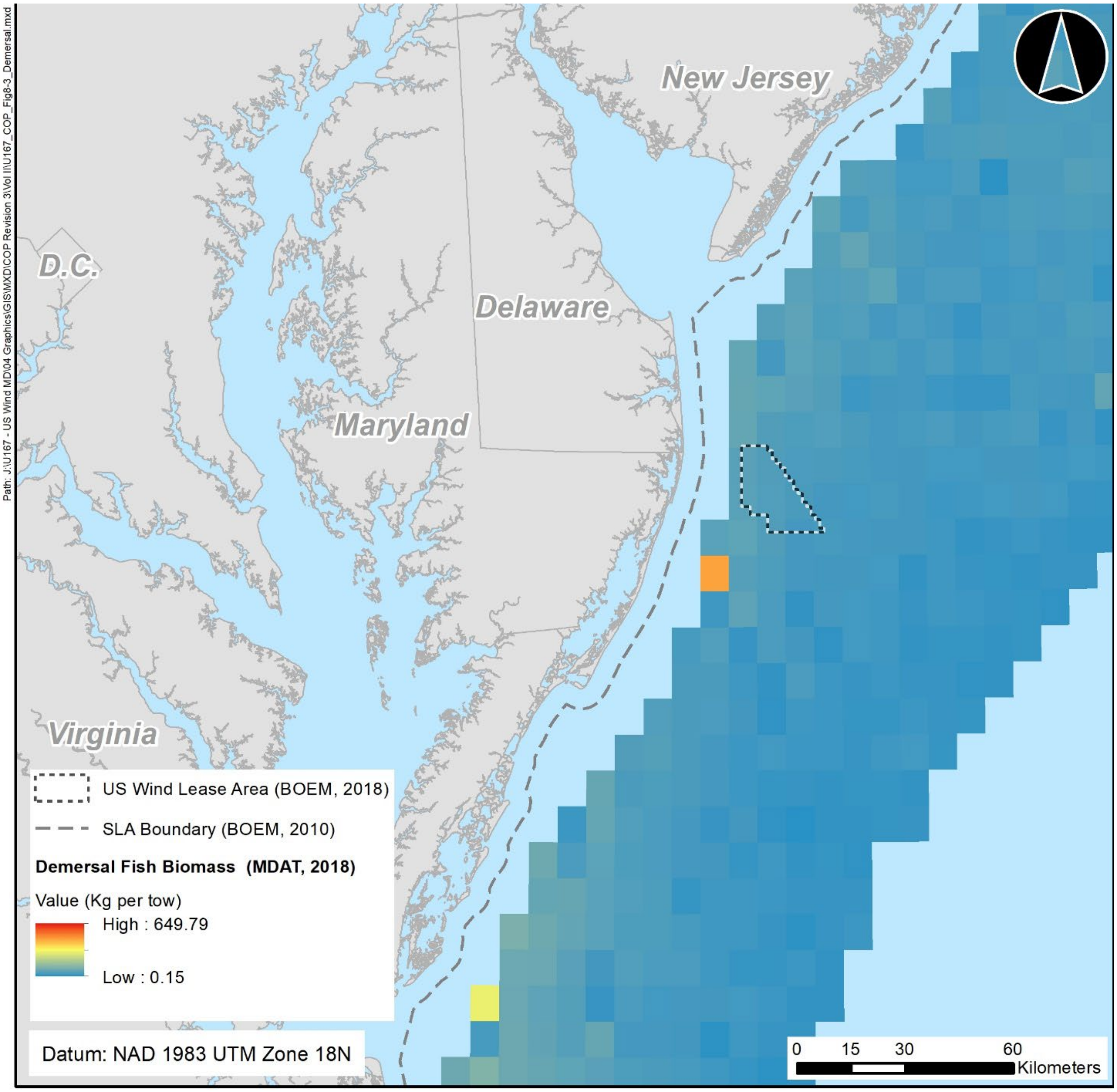

Figure 8-3. Demersal Fish Biomass in the Project Area

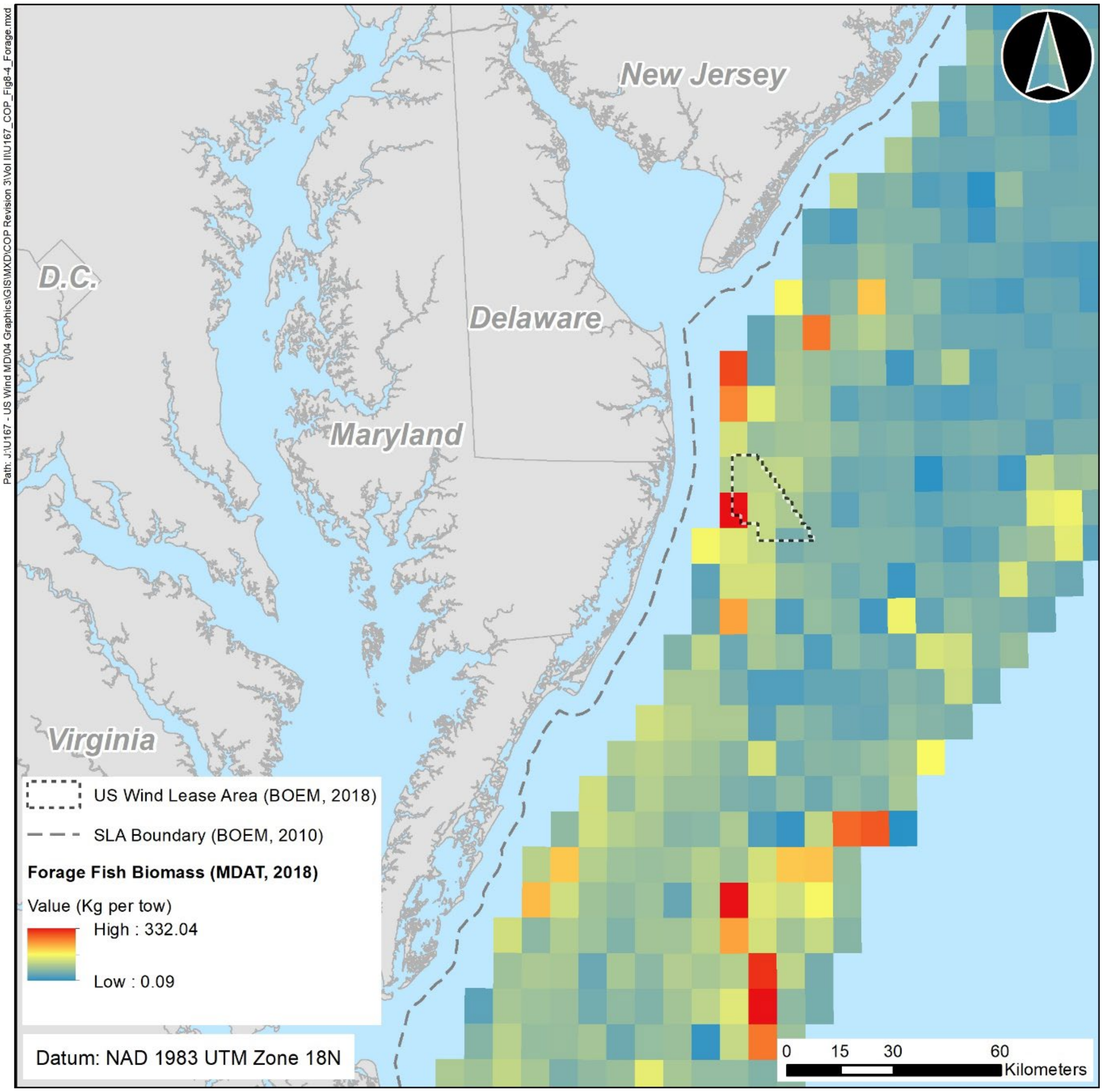

Figure 8-4. Forage Fish Biomass in the Project Area

Metocean Buoy Monitoring

US Wind deployed the Metocean Buoy within the Lease area for a planned 2-year metocean data collection campaign during the site assessment term of the Lease. The Metocean Buoy and its associated seabed mounted Trawl Resistant Bottom Mount (TRBM) have been equipped with a suite of wildlife monitoring sensors as provided in the related Metocean Buoy SAP approved May 5, 2021. This includes a fish telemetry receiver within the TRBM that records detections of previously tagged fish species within the Lease area.

Pelagic Fishes

Pelagic fish fill important roles in coastal food webs, both feeding on zooplankton and providing a source of food for birds, mammals, and larger fish (Able and Fahay 2010). Atlantic silverside (*Menidia menidia*) and bay anchovy (*Anchoa mitchilli*) dominate the pelagic community in the Delaware Inland Bays, which is further discussed under Estuarine Fishes (D.M. Nelson and Monaco 2000). Pelagic community composition can shift when some species migrate inland to estuarine habitats to spawn, primarily from spring to summer. Atlantic menhaden (*Brevoortia tyrannus*) is the only migratory pelagic species that is common in the mid-Atlantic Bight and Delaware Inland Bays (Able and Fahay 2010). Some mid-Atlantic pelagic species, including silver hake (*Merluccius bilinearis*) and bluefish (*Pomatomus saltatrix*), are considered predatory fish.

Demersal Fishes

Demersal fish are often found in mixed species aggregations that differ depending upon the specific area and time of year. Some demersal fish species have pelagic eggs or larvae that are sometimes carried long distances by oceanic surface currents. Many demersal species are sought by commercial and recreational anglers and are managed by multispecies groundfish fishery management plans and single-species management plans.

Summer flounder (*Paralichthys dentatus*) is particularly abundant in the Delaware Inland Bays. Summer flounder can be found in estuaries, marsh creeks, lagoons, coastal or offshore and live on the sea floor, often burrowing in sand for camouflage while hunting or hiding from predators (DNREC 2023b). Sumer flounder has designated Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC) (D.M. Nelson and Monaco 2000). All native aquatic vegetation, including macroalgae, macrophytes, and seagrasses, within summer flounder EFH is designated as HAPC (MAFMC 1998). Vegetated areas provide important feeding grounds for summer flounder (MAFMC 1998). Submerged aquatic vegetation has been observed to be sparse in Indian River Bay (DCIB 2016), but the presence/absence of vegetation has not been mapped for the Project area. Larvae are present at a concentration of approximately 0.568 per every 100 cubic m (130 cubic yards) in the Delaware Inland Bays, and summer flounder frequently return to the same estuaries to feed during the summer months (Able and Fahay 2010). Because they can live in both marine and estuarine environments, summer flounder often react to adverse environmental conditions, such as the onset of severe weather or anoxia, by migrating away from the stressor, either inshore or offshore (Able and Fahay 2010). Offshore NEFSC bottom trawl survey results from the western half of the Lease area from 2003 to 2012 demonstrate a large seasonal shift in demersal species.[12] Catches in the fall (September to October) primarily consisted of seasonally migratory species including Atlantic croaker (*Micropogonias undulates*), weakfish (*Cynoscion regalis*), spot (*Leiostomus xanthurus*), and northern sea robin (*Prionotus carolinus*). Spring catches (March) were dominated by little skate (*Leucoraja erinacea*),

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[12] NEFSC trawl data are not available for the eastern half of the Lease area as this area falls within a more diffusely sampled stratum in NEFSC's scheme for stratified random trawl sampling.

smallmouth flounder (*Etropus microstomus*), and spotted hake (*Urophycis regia*). Most of the spring catch species were also present in the fall, and therefore represent a year-round resident fauna. Additionally, the fall catches were much larger and more diverse (Guida et al. 2017).

Highly Migratory Fishes

Fish that migrate in waters across multiple state boundaries and even different national boundaries require specialized management in order to ensure that policies implemented by different governing bodies do not conflict. The 2006 Atlantic Highly Migratory Species Fishery Management Plan (HMS FMP) combines and supersedes two fishery management plans for highly migratory fish in the Atlantic Ocean: one for Atlantic tunas, swordfishes, and sharks, and one for Atlantic billfishes (NOAA Fisheries 2006). Swordfish and highly migratory billfish are warm-water species that are not known to exist in the Project area, so only sharks and tunas are discussed.

Highly migratory fish include game fish species and shark species that are sought by commercial and recreational anglers. Exploitation of albacore (*Thunnus alalunga*), skipjack (*Katsuwonus pelamis*), and yellowfin tuna (*Thunnus albacares*) took off in the 1950's, when commercial purse seining and recreational vessels turned their attention toward these species. Because tuna spawn in tropical and subtropical waters in winter or spring, juveniles and adults are most likely to be found in the Project area in summer and fall. By contrast, sharks of all life stages may be found in the Project area depending on the species. Pelagic species such as blue shark, common thresher shark, and shortfin mako make use of estuaries and shallow coastal waters to birth pups. Coastal species, such as Atlantic sharpnose, sandbar, and tiger sharks, remain in coastal areas through maturity. The HMS FMP establishes quotas, bycatch release requirements, and other measures designed to promote recovery from finning and other unsustainable fisheries practices that have strained shark populations since the 1970's (NOAA Fisheries 2006).

Estuarine Fishes

The Inland Bays of Delaware, including Indian River Bay, support more than one hundred species of fish. In a 2015 open water trawl survey, the most abundant species were found to be bay anchovy (*Anchoa mitchilli*), Atlantic silverside (*Menidia menidia*), silver perch (*Bairdiella chrysoura*), and weakfish (*Cynoscion regalis*). Bay anchovy and weakfish abundance have been declining, while silver perch abundance has been increasing. Both weakfish and silver perch spawn in the Inland Bays. Shore-zone surveys from 2011 to 2015 found mummichog (*Fundulus heteroclitus*), Atlantic silverside, striped killifish (*Fundulus majalis*), and spot (*Leiostomus xanthurus*) to be the most abundant species. The abundance of mummichog and striped killifish, which are tolerant of low oxygen levels, indicates poor water quality. However, numbers of spot (*Leiostomus xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), and bay anchovy are increasing, and may indicate improving conditions. The Inland Bays also support a number of fisheries, including striped bass (*Morone saxatilis*), weakfish, and summer flounder (*Paralichthys dentatus*) (DCIB 2016). Historically, the Inland Bays supported large spawning runs of anadromous fish. However, freshwater habitat decreased significantly with the deepening and widening of the Indian River Inlet, as well as with the dredging and deepening of navigational channels. Today, few anadromous fish are found in the Inland Bays (DCIB 1995).

Table 8-1. Fish Species Potentially Occurring in the Project Area

Species	Habitat Association	EFH in Project Area	Commercial / Recreational Importance	Atlantic Ocean	Indian River Bay
Albacore tuna *(Thunnus alalunga)*	Pelagic	●	●	●	
Alewife (*Alosa pseudoharengus*)	Pelagic		●	●	●
American conger (*Conger oceanicus*)	Benthic				●
American eel (*Anguilla rostrata*)	Demersal			●	●
American sand lance (*Ammodytes americanus*)	Demersal				●
American shad (*Alosa sapidissima*)	Pelagic		●	●	●
Atlantic angel shark *(Squantina dumeril)*	Demersal	●		●	
Atlantic butterfish *(Peprilus triacanthus)*	Demersal / Pelagic (spring to fall)	●	●	●	●
Atlantic cod *(Gadus morhua)*	Demersal	●	●	●	●
Atlantic croaker *(Micropogonias undulates)*	Demersal		●	●	●
Atlantic herring *(Clupea harengus)*	Pelagic	●	●	●	●
Atlantic mackerel *(Scomber scombrus)*	Pelagic	●	●	●	
Atlantic menhaden (*Brevoortia tyrannus*)	Pelagic		●		●
Atlantic needlefish (*Stongylura marina*)	Demersal				●
Atlantic sea scallop (*Placopecten magellanicus*)	Benthic	●	●		●
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Pelagic	●		●	●
Atlantic silverside (*Menidia menidia*)	Pelagic		●		●
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)	Demersal			●	

Table 8-1. Fish Species Potentially Occurring in the Project Area

Species	Habitat Association	EFH in Project Area	Commercial / Recreational Importance	Atlantic Ocean	Indian River Bay
Atlantic surf clam (*Spisula solidissima*)	Benthic	●		●	
Bay anchovy (*Anchoa mitchilli*)	Pelagic		●	●	●
Bergall (*Tautogolabrus adspersus*)	Demersal		●		●
Black drum (*Pogonias cromis*)	Demersal		●		●
Black sea bass *(Centropristis striata)*	Demersal	●	●	●	●
Blueback herring (*Alosa aestivalis*)	Pelagic			●	●
Bluefin tuna *(Thunnus thynnus)*	Pelagic	●	●	●	●
Bluefish *(Pomatomus saltatrix)*	Pelagic	●	●	●	●
Blue shark (*Prionace glauca*)	Pelagic	●		●	
Broad striped anchovy (*Anchoa hepsetus*)	Pelagic			●	●
Clearnose skate *(Raja eglanteria)*	Demersal	●		●	●
Common thresher shark (*Alopias vulpinus*)	Pelagic	●		●	
Crevalle jack (*Caranx hippos*)	Pelagic		●	●	●
Dusky shark *(Carcharhinus obscurus)*	Pelagic	●	●	●	
Feather blenny (*Hypsoblennius hentz*)	Demersal				●
Flathead grey mullet (*Mugil cephalus*)	Demersal		●		●
Fourspine stickleback (*Apeltes quadracus*)	Demersal			●	●
Giant manta ray *(Mobula birostris)*	Pelagic			●	
Gray snapper (*Lutjanus griseus*)	Demersal / Pelagic		●	●	●
Hogchoker (*Trinectes maculatus*)	Demersal				●

Table 8-1. Fish Species Potentially Occurring in the Project Area

Species	Habitat Association	EFH in Project Area	Commercial / Recreational Importance	Atlantic Ocean	Indian River Bay
Inland silverside (*Menidia beryllina*)	Pelagic				●
Inshore lizardfish (*Synodus foetens*)	Pelagic				●
Little skate *(Leucoraja erinacea)*	Demersal	●		●	
Little sculpin (*Myoxocephalus aenaeus*)	Demersal				●
Longfin inshore squid (*Doryteuthis pealeii*)	Pelagic		●	●	●
Monkfish (*Lophius americanus*)	Demersal	●	●	●	
Mummichog (*Fundulus heteroclitus*)	Demersal			●	●
Naked goby (*Gobiosoma bosc*)	Demersal				●
Northern kingfish (*Menticirrhus saxatilis*)	Demersal			●	●
Northern pipefish (*Syngnathus fuscus*)	Demersal			●	●
Northern puffer (*Sphoeroides maculatus*)	Demersal			●	●
Northern seahorse (*Hippocampus erectus*)	Demersal			●	●
Northern sea robin *(Prionotus carolinus)*	Demersal			●	●
Northern sennet (*Sphyraena borealis*)	Demersal				●
Northern shortfin squid (*Illex illecebrosus*)	Demersal	●		●	●
Northern stargazer (*Astroscopus guttatus*)	Demersal			●	●
Ocean quahog (*Artica islandica*)	Benthic	●		●	
Oyster toadfish (*Opsanus tau*)	Demersal				●
Pinfish *(Lagodon rhomboides)*	Demersal		●		●

Table 8-1. Fish Species Potentially Occurring in the Project Area

Species	Habitat Association	EFH in Project Area	Commercial / Recreational Importance	Atlantic Ocean	Indian River Bay
Pollock *(Pollachius virens)*	Demersal	●	●		●
Rainwater killifish (*Lucania parva*)	Pelagic				●
Red drum (*Sciaenops ocellatus)*	Demersal		●		●
Red hake *(Urophycis chuss)*	Demersal	●	●	●	●
Rough silverside (*Membras martinica*)	Pelagic				●
Sand tiger shark *(Carcharias taurus)*	Pelagic	●	●	●	●
Sandbar shark *(Carcharhinus plumbeus)*	Pelagic	●	●	●	
Scup *(Stenotomus chrysops)*	Demersal (fall) / Pelagic	●	●	●	●
Seaboard goby (*Gobiosoma ginsburgi)*	Demersal				●
Sheepshead minnow (*Cyprinodon variegatus variegatus*)	Demersal				●
Shortfin mako *(Isurus oxyrinchus)*	Pelagic	●	●	●	
Shortnose sturgeon (*Acipenser brevirostrum*)	Demersal				
Silver hake (*Merluccius bilinearis*)	Demersal (night) / Pelagic (day)	●	●	●	
Silver perch (*Bairdiella chrysoura*)	Demersal				●
Skipjack tuna *(Katsuwonus pelamis)*	Pelagic	●	●	●	
Smallmouth flounder (*Etropus microstomus*)	Demersal			●	●
Smoothhound shark *(Mustelus canis)*	Demersal	●		●	●
Spiny dogfish *(Squalus acanthias)*	Demersal	●	●	●	
Spot *(Leiostomus xanthurus)*	Demersal		●	●	●

Table 8-1. Fish Species Potentially Occurring in the Project Area

Species	Habitat Association	EFH in Project Area	Commercial / Recreational Importance	Atlantic Ocean	Indian River Bay
Spotfin butterflyfish (*Chaetodon ocellatus*)	Demersal				●
Spotfin killifish (*Fundulus luciae*)	Demersal				●
Spotted hake *(Urophycis regia)*	Demersal			●	●
Spotted seatrout (*Cynoscion nebulosus*)	Demersal		●		●
Striped bass (*Morone saxatilis*)	Demersal		●		●
Striped cusk-eel (*Ophidion marginatum*)	Demersal				●
Striped sea robin (*Prionotus evolans*)	Demersal		●		●
Summer flounder *(Paralichthys dentatus)*	Demersal	●	●	●	●
Striped killifish (*Fundulus majalis*)	Demersal				●
Tautog (*Tautoga onitis*)	Demersal			●	
Three-spined stickleback *(Gasterosteus aculeatus)*	Benthopelagic				●
Tiger shark (*Galeocerdo cuvier)*	Pelagic	●		●	
Weakfish *(Cynoscion regalis)*	Demersal			●	●
White mullet (*Mugil curema*)	Demersal				●
White perch (*Morone americana*)	Demersal		●		●
Windowpane flounder *(Scopthalmus aquosus)*	Demersal	●		●	●
Winter flounder (*Pseudopleuronectes americanus*)	Demersal	●	●	●	
Winter skate *(Leucoraja ocellata)*	Demersal	●		●	●
Witch flounder (*Glytocephalus cynoglossus*)	Demersal	●		●	●
Yellowfin tuna *(Thunnus albacares)*	Pelagic	●	●	●	●

Table 8-1. Fish Species Potentially Occurring in the Project Area

Species	Habitat Association	EFH in Project Area	Commercial / Recreational Importance	Atlantic Ocean	Indian River Bay
Yellowtail flounder *(limanda ferruginea)*	Demersal	●	●	●	

(Sources: (Able and Fahay 2010); NOAA Fisheries "Essential Fish Habitat Mapper" ; (USDOI and BOEM 2012); (D.M. Nelson and Monaco 2000);("FishBase" 2018)

Ichthyoplankton

Ichthyoplankton refers to fish eggs and larvae that occur throughout the water column after spawning aggregations or events. Oceanographic processes and fish species specific life history strategies dictate larval distribution patterns. Ichthyoplankton found in the mid-Atlantic Bight come from warm temperate to cold temperate waters and are generally distributed in an onshore/offshore pattern (Doyle, Morse, and Kendall 1993; Hare, Fahay, and Cowen 2001).

Seasonal occurrence and geographic distribution of ichthyoplankton varies for each fish species. In general, the most abundant fish eggs and larvae found during winter months are those of cold temperate fish species originating in more northerly waters. During spring, summer, and fall months, ichthyoplankton is dominated by warm temperate species originating from more southerly waters. Depending on where spawning takes place on the continental shelf margin, the ichthyoplankton is transported either southwestward or northeastward by currents or frontal zones (Hare et al. 2002).

Ichthyoplankton data is often used to indicate spawning stock biomass and spawning locations for ecologically important fish species in the area. Review of scientific literature, including larval fish recruitment and coastal nursery habitats, suggest that only the outer limits of the Project area contain ichthyoplankton assemblages. No significant data was found on the abundance and duration of ichthyoplankton assemblages within the Project area. Hydrodynamic modeling shows that local fish populations in the Project area are likely to be recruited from southern ichthyoplankton assemblages (Hare et al. 2002). Since the marine connectivity of ichthyoplankton is on a broad scale on the Northeast coast of the U.S., the implications on impacts to larval fish species that contribute to the adult population would be hard to identify.

8.1.2 Threatened or Endangered Fish

Two fish species listed as endangered under the Endangered Species Act (ESA) may occur in the Project area: Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*), see Table 8-2. Both are anadromous species, meaning they spawn in rivers and spend their adult lives in the open ocean. The Giant manta ray is listed as threatened under the ESA and may also occur in the Project area.

Table 8-2. Federally and State-Listed Fish Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Federal Status	DE State Status	MD State Status
Giant manta ray	*Mobula birostris*	T	-	-
Atlantic shortnose sturgeon	*Acipenser oxyrinchus*	E	E	E
Shortnose sturgeon	*Acipenser brevirostrum*	E	E	E
Source: (NOAA 2021a) E = Endangered; T = Threatened				

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

The Atlantic sturgeon is an estuarine-dependent, anadromous species that is found along the eastern coast of North America from Canada to Florida. They spend the majority of their lives in the marine environment, but spawn in freshwater. They are present in 36 coastal rivers in the United States, and spawning takes place in at least 20 of these rivers. Larvae and juveniles remain in riverine or estuarine areas where they were spawned and move to higher salinity waters as subadults. Subadults and adults migrate seasonally throughout marine waters. In the summer, they are found in shallow waters of about 10 to 20 m (32.8 to 65.6 ft), and in the winter they move to deeper waters of about 20 to 50 m (65.6 to 164.0 ft). Current threats to Atlantic sturgeon include ship strikes, bycatch, habitat degradation/loss, climate change and habitat impediments such as dams (BOEM 2013; NOAA Fisheries 2017a). Critical habitat for the New York Bight Distinct Population Segment (DPS) of Atlantic sturgeon includes approximately 547 km (340 mi) of aquatic habitat in the Hudson, Connecticut, Housatonic, and Delaware Rivers (82 FR 39160), and does not coincide with the Project area.

In 2011, telemetered Atlantic sturgeon were detected in nearshore waters off the coast of Maryland, along the southern end of the Delmarva Peninsula. Atlantic sturgeon were observed in shallow, well-mixed, relatively warm freshwater near the 25 m (82 ft) isobath and appeared to be associated with a water mass tied to Delaware Bay (Oliver et al. 2013). Additionally, matching telemetry records with derived seascapes indicate that Atlantic sturgeon prefer a seascape that is associated with the coastline of Delaware Bay and the Atlantic Ocean, with a mean temperature of 19.8°C (68°F) and a mean reflectance of 0.0073 sr^{-1} at 443 mm (1.45 ft) (Breece et al. 2016). Based on these studies, Atlantic sturgeon would be more likely to occur near the coast rather than further offshore in the Lease area. The Delaware Division of Fish and Wildlife has not reported occurrences of Atlantic sturgeon within the Inland Bays (USACE 2015). Marine-phase Atlantic Sturgeon migrate through Delaware's coastal waters in mid-late March through mid-May and early September through mid-December (DNREC 2017b).

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

Shortnose Sturgeon (Acipenser brevirostrum)

The shortnose sturgeon is an anadromous species found in large rivers and estuaries of the North America eastern seaboard from the Indian River in Florida to the St. John River in Canada. Shortnose sturgeon can be found in 41 bays and rivers along the east coast, of which only 19 are known spawning grounds. The population of shortnose sturgeon are split into three distinct metapopulations, rarely interacting due to their distance, Carolinian (southern), Virginian (mid Atlantic), and Acadian (northern). Unlike the Atlantic sturgeon, shortnose sturgeon spend the majority of their time in freshwater or estuarine environments. While they do travel into marine environments, they generally stay close to shore and return shortly to estuaries, rivers or lagoons. The shortnose sturgeon is not found in any of the Delaware Inland Bays systems which include Rehoboth Bay, Indian River Bay, and Little Assawoman Bay, but is found in the Delaware River. Adults migrate downstream in the fall and upstream in the spring to spawn. Larvae and juveniles are found in deep channels of rivers with strong currents. Shortnose sturgeon are most commonly found in the estuary of their respective river. While they do occasionally enter the marine environment, they generally remain close to shore, and are not likely to be present in the Lease area (Moser and Ross 1995; Collins and Smith 1997; Dadswell et al. 1984). Current threats to shortnose sturgeon include dams, pollution, and habitat alteration (NOAA Fisheries 2015). Shortnose sturgeon is not known to occur within the Delaware Inland Bays (USACE 2015).

Giant Manta Ray (*Mobula birostris)*

Giant Manta ray are large bodied, pelagic planktivores that are broadly spread in tropical and temperate waters of the Pacific, Atlantic and Indian oceans. This species is not regularly encountered in large numbers and overall encountered with far less frequency than any other manta species despite having a larger distribution across the globe (IUCN 2011). While manta rays feed typically in shallow waters, they can dive as deep as 3,300 feet (1,000 meters) (Miller and Klimovich 2016). Giant manta rays are observed to migrate by following prey abundance (Farmer et al. 2021). It is understood that the population of this species is in decline and it is ESA threatened throughout its range, which includes New England/Mid-Atlantic, the Pacific Islands, and the Southeast. Giant mantas are slow growing and long-lived with low fecundity and reproductive output with a gestation period up to one year. These biological traits make them prone to overexploitation, with their most direct threats being by-catch and intentional hunting for gill rakers by the Asian market (White, Giles, and Dharmadi 2006).

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

8.1.3 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires fishery management councils to: (1) describe and identify EFH in their respective regions; (2) specify actions to conserve and enhance that EFH; and (3) minimize the adverse impacts of fishing on EFH. The Magnuson-Stevens Act requires Federal agencies to consult on activities that may adversely affect EFH designated in fishery management plans. Additionally, fishery management councils identify habitat areas of particular concern (HAPCs) within fishery management plans. HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. A HAPC has been identified for the sand tiger shark in a portion of the nearshore area off the Delaware coast and into Delaware Bay, north of the Project area (Figure 8-5). All vegetated areas of summer flounder EFH are considered HAPCs.

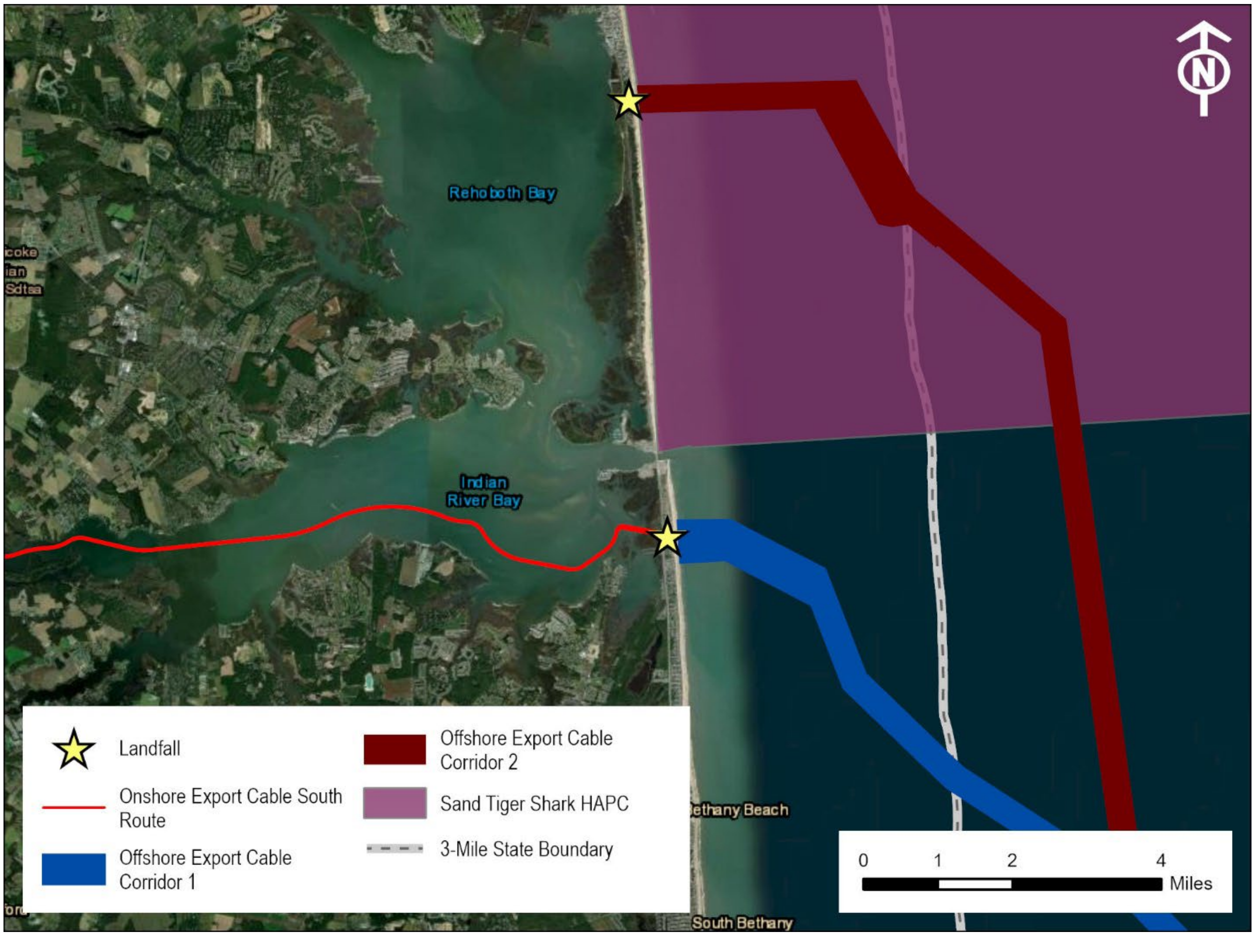

Figure 8-5. Sand Tiger HAPC for Delaware Bay Area

EFH has been designated for the following species for one or more life stages in the Project area. A detailed assessment of the specific EFH habitat requirements, descriptions of species with EFH designated in the Project area, and discussion of potential Project-related impacts to these species are included in Appendix II-E1. Table 8-3 provides a summary of the Regional Fishery Management Plan Species.

Table 8-3. Regional Fishery Management Plan Species

New England Fishery Management Plan Species	Mid-Atlantic Fishery Management Plan Species	Atlantic Highly Migratory Species Fishery Management Plan Species
Atlantic herring	Atlantic mackerel	Albacore tuna
Atlantic sea scallop	Atlantic surf clam	Atlantic angel shark
Atlantic cod	Black sea bass	Atlantic bluefin tuna
Clearnose skate	Bluefish	Atlantic sharpnose
Little skate	Long-finned squid	Blue shark
Monkfish	Ocean quahog	Common thresher shark
Pollock	Scup	Dusky shark
Red hake	Spiny dogfish	Sand tiger shark
Silver hake	Summer flounder	Sandbar shark
Yellowtail flounder		Shortfin mako
Windowpane flounder		Skipjack tuna
Winter skate		Smooth dogfish
Witch flounder		Tiger shark
		Yellowfin tuna

8.2 Impacts

8.2.1 Construction

Habitat Alteration

As discussed in Volume II, Section 7.0, the installation of submarine cables, foundations, and scour protection, dredging for barge access, and the operation of jack-up and anchored vessels during construction, would alter benthic habitat in Indian River Bay and the Atlantic Ocean. Immobile and slow-moving benthos may be lost during these installations, temporarily reducing the potential food supply for demersal fish until these species recover to pre-construction population levels.

It is anticipated that habitat alteration would have a negligible to minor impact on finfish. The reduction in benthic food supply would be temporary and localized, and the loss of soft-bottom habitat associated with the Project would be small relative to the overall extent of benthic habitat available within and around the Project area. Impacts to summer flounder HAPC will be minimized by using dynamic positioning to minimize the need for construction vessels to anchor to the seafloor and by using midline buoys to reduce seafloor scarring when construction vessels need to anchor for offshore construction activities The cable routes through Onshore Export Cable Corridor 1 will be planned to avoid submerged aquatic vegetation to the extent feasible. No seagrass beds have been documented in the Project area.

The Project was sited to avoid EFH and HAPC and minimize impacts to finfish. DNREC recommended the following measures (DNREC 2023b):

- No in-water work in Indian River Bay from March 1 through September 30 to avoid impacts to young of year summer flounder.

- No in-water work in Indian River from March 1 to May 15 to protect the American eel and allow passage of elvers upstream.
- No drilling (e.g., HDD) under water crossings along the terrestrial cable routes (Onshore Export Cable Corridor 1a, 1b, 1c, and 2) from March 1 to September 30.
- No Offshore Export Cable burial activities from June 1 to October 31 to protect sandbar and sand tiger sharks.

Use of the 3R's Beach landing location associated with Offshore Export Cable Corridor 1 avoids sand tiger shark HAPC.

DNREC's suggested time of year restriction along Onshore Export Cable Corridor 1a, 1b, 1c, and 2 would likely render installation of cables along the terrestrial routes impracticable during the restricted 5-month construction window.

Turbidity/Suspended Sediment

Increases in turbidity and TSS are expected to occur during foundation construction, submarine cable laying, and dredging for barge access in Indian River Bay, but will be minimized by using installation techniques such as jet plow and hydraulic dredging, when possible. It is anticipated that suspended sediment and sedimentation would have a negligible to minor impact on finfish and EFH. As discussed in Volume II, Section 4.0, turbidity levels along the Offshore Export Cable Corridors and Onshore Export Cable Corridor 1 could be significantly elevated for a period of less than 24 hours during cable installation activities. Dredging for barge access in the Indian River Bay would also result in temporarily increased suspended sediment levels in the vicinity of project activities. While some fish may struggle to navigate during this time due to reduced visibility and alterations in water chemistry, others may benefit from the increased turbidity because it will help conceal them from predators (D.H. Wilber and Clarke 2001). Gilled fish may also experience increased respiration during periods of increased turbidity in order to maintain sufficient oxygen intake (Newcombe and Jensen 1996). As suspended sediment settles out of the water column, fish eggs could be buried, and demersal fish that feed on benthic organisms may experience difficulty finding food (USDOI and MMS 2007). However, it is expected that most fish will seek food and shelter outside of the Project area when vessel traffic and other construction noises begin. Construction of onshore and nearshore export cables will be planned to occur outside the spring spawning season, and all construction activities within Indian River Bay will occur between October and March in observance of the general time of year restrictions for summer flounder and other species. Additionally, gravity cells will be placed around the HDD bore holes to contain sediment at the landfalls. As suspended sediment concentrations are expected to return to background levels quickly after construction ceases, it is anticipated that the impact of increased turbidity and suspended sediment on finfish would be negligible to minor depending on the species.

Noise

Pile driving, dredging for barge access in Indian River Bay, and vessel traffic would produce noise during construction. The impacts of construction noises on fish are not as well understood as the impacts of noises on marine mammals. Like marine mammals, fish responses to sounds are species-specific, but all fish are expected to exhibit behavioral responses to sounds at larger distances than those at which they would exhibit physiological responses. Historically, 150 decibels (dB) has been used as the threshold above which fish may modify their behavior, although recent work suggests that this number may be conservative (California Department of Transportation (Caltrans) 2009). The most likely behavior change in fish is avoiding the source of noise, but some species may be attracted to noises (Normandeau Associates 2012). In either case, the most severe impact would be that fish may be deterred from annual migration routes, which could interfere with their feeding and reproductive success.

Potential physiological impacts to fish exposed to construction noise include stress, injury, and death. While fish may experience minor loss of hearing as a result of exposure to intense sounds, the loss would not be permanent as fish have the ability to repair or replace damaged sensory hairs (Lombarte et al. 1993). However, exposure to continuous boat noise over a period of half an hour can increase cortisol levels in fish (Wysocki, Dittami, and Ladich 2006). Continuous noise exposure over multiple hours can reduce fishes' sensitivity to sound, which may make them less likely to notice predators and prey, physical hazards, and communication from other fish (Normandeau Associates 2012). Most of the scientific literatures discusses noise impacts to mature fish, but a study of sole (*Soleidae* spp.) found no response in larvae to sounds as loud as 206 dB (Bolle et al. 2012).

Exposure to pile driving noise has been shown to cause internal bleeding and organ damage (Halvorsen et al. 2012) and even death in some cases (California Department of Transportation (Caltrans) 2009). A study on Black sea bass auditory detection bandwidth and thresholds done by Stanley et al. (2020) revealed juvenile Black sea bass have low thresholds. In comparison, adult Black sea bass have decreased auditory sensitivity as compared to juveniles but are more sensitive to sound relative to other species (Stanley et al. 2020). The results also show that the most sensitive range of sound detection capabilities directly overlaps with the highest sound energy created from pile driving activity. This suggests that Black sea bass will be able to hear noise from pile driving in many circumstances (Stanley et al. 2020).

An underwater acoustic assessment was conducted to evaluate the potential for pile driving noise to impact fish populations (Appendix II-H1). US Wind will implement sound attenuation and other mitigation measures during pile driving to reduce the impact of pile driving noise. See Volume II, Section 9.3 for additional mitigation and monitoring measures to minimize noise impacts.

It is anticipated that construction noise will have a negligible to minor impact on finfish. The most sensitive of fish species do not present physiological impacts at cumulative sound exposures less than 203 dB relative to 1 microPascal squared per second (re 1 $\mu Pa^2 s$) of pressure, and species that do not have swim bladders (i.e. flatfish, sharks and rays) present no physiological impacts at sound exposures as high as 216 dB re 1 µPa (Normandeau Associates 2012). Pile driving source levels as high as 235 dB re 1 µPa have been reported as close as 1 m (3.3 foot) away from the pile (Jakob Tougaard et al. 2009), so fish eggs and any fish that do not have an avoidance response to the noise may be negatively impacted by noise from the pile being installed via driving. However, since fish can restore their own hearing loss, and fish such as Chinook salmon exposed to sounds as loud as 213 dB re 1 µPa have recovered from physical injury in a matter of days (Casper et al. 2012), it is expected that most species of fish will experience temporary impacts from which both the individual and its population will be able to recover. Best practices such as soft-start procedures, will be used to initiate pile driving throughout the course of Project construction in order to allow fish to vacate the affected area before they are exposed to more severe noise impacts. Additionally, sound attenuation technologies designed to minimize underwater sound would reduce the number of fish exposed to potentially injurious noise levels.

Vessel Traffic

There is a risk that construction vessels may hit aquatic organisms, potentially causing injury or death. It is anticipated that vessel traffic will have a negligible impact on finfish. Fish may differ their spatial distribution patterns in the presence of construction vessels. For example, skipjack tunas have shown attraction responses to floating objects (NOAA Fisheries 2006) which may draw them toward construction vessels. However, avoidance or attraction responses to construction vessels are not expected to have a net impact on fish, either positive or negative. In the event of collision with a construction vessel, fish are unlikely to be harmed due to their small size relative to the vessel, which allows the vessel to absorb the fish's momentum with no real impact to the fish or the vessel.

Lighting

If Project construction activities extend before sunrise or after sunset, artificial lighting may be used. It is anticipated that such construction lighting would have a negligible impact on finfish and EFH. While it is possible that fish may alter their movement toward or away from the light (Orr, Herz, and Oakley 2013), this reaction is not well-studied, and it is not expected that this behavior would have a net impact on fish, either positive or negative. Lighting will be limited to areas of active construction, which will leave most of the Project area unaffected at any given time.

Hydraulic Entrainment

Operation of the jet plow (for cable installation) and the hydraulic dredge (during dredging for barge access in Indian River Bay) would result in bycatch of fish eggs, larvae, and other plankton, due to hydraulic entrainment. The jet plow intakes water via a surface-oriented intake. Therefore, naturally occurring surface plankton could be entrained in the system. The hydraulic dredge would uptake water, along with sediments, from the bottom of Indian River Bay, entraining plankton present in this area. Fish eggs and larvae entrained during jet plowing and hydraulic dredging would likely experience mortality (reviewed in Wenger et al. (2017)). In addition to direct uptake of plankton, water movement caused by jet plowing and hydraulic dredging may indirectly impact fish eggs and larvae due to mixing of the water column.

Water volumes entrained by the hydraulic dredge and jet plow would be low in relation to the volume of water present in surrounding mid-Atlantic Bight and Indian River Bay habitats. Therefore, as the duration and extent of hydraulic entrainment impacts would be limited and short-term, planktonic assemblages will recover from the disturbance (BOEM 2021c).

Routine/Accidental Releases

As discussed in Volume II, Section 4.0, wastes from Project construction vessels may be released into Indian River Bay or the Atlantic Ocean either as part of their allowed operations or during an accidental spill. Because permissible releases are relatively clean and accidental releases would be infrequent and dilute quickly in these large bodies of water, it is anticipated that routine and accidental releases will have a negligible impact on finfish.

8.2.2 Operations

Habitat Alteration

As discussed in Volume II, Section 7.0, loss of soft-bottom habitat at the locations of the WTGs, OSSs, Met Tower and any scour protection that is installed during construction would be a permanent alteration for the lifetime of the Project. Conversion of natural soft-bottom habitat to artificial hard substrate would result in a loss of spawning habitat for fish species that prefer to lay eggs in sandy areas and a long-term change in the composition of the benthic community that supports the demersal fish population in the Project area. The WTGs, OSSs and Met Tower themselves would also create new hard-surface habitat within the water column, which could attract finfish seeking to feed on algae and crustaceans that may colonize these surfaces. In this way, the Project could create a “reef effect,” in which the WTGs, OSSs and Met Tower will provide new hard-surface habitat similar to the way in which artificial reef structures do, and, consequently, become hotspots of fish diversity and density relative to the surrounding area because of the different food sources they are able to support (Reubens et al. 2013). While this reef effect would likely produce a localized increase in fish biodiversity and the WTGs, OSSs and Met Tower could serve as “fish aggregating devices” attracting commercially-important species (Kirkpatrick et al. 2017), the majority of the Project area would not be affected.

No new habitat alterations are anticipated as a part of routine maintenance of the Project. Benthic habitat may be altered during operation of the Project if any of the submarine cables, WTG, OSS or Met Tower foundations or scour protection are damaged and require repair or replacement. The impacts of repairing or replacing submarine structures would be similar to, but less than the impacts from construction.

Turbidity/Suspended Sediment

Increases in turbidity and TSS are expected to occur during foundation construction and submarine cable laying. Routine operations of the Project will not affect turbidity levels in Indian River Bay or the Atlantic Ocean. However, should the submarine cables or WTG, OSS or Met Tower foundations require repair during the lifetime of the Project, sediment disturbance may occur. The impacts of increases in turbidity associated with Project maintenance would be similar to but less than the impacts of turbidity increases incurred during Project construction.

Noise

During Project operation, noise would be produced by vessels and the WTGs. Aquatic organisms that reside in the Project area are likely habituated to the sound of vessel traffic and unlikely to respond to it. Noises produced by the movement of the WTG are not expected to be loud enough to exceed thresholds at which fish would begin to experience behavioral or physiological impacts.

EMF

Once the Project is operational, electric current will be continuously transmitted through the inter-array and export cables. This current can produce an electromagnetic field (EMF). The EMF created by the cables could interfere with naturally occurring EMF.

At least some marine fishes are able to detect EMFs, including sharks, skates, rays, salmonids, sturgeons and mackerels (Normandeau Associates Inc. 2011). Many of the fish that are able to detect EMFs occupy different habitats during different times of year or life stages, and it has been suggested that these fish may use electromagnetic signatures to navigate (Kenneth J. Lohmann, Putman, and Lohmann 2008). Fish that feed on benthic organisms may also use EMFs to locate prey that may be difficult to see due to camouflage or low light levels (Collin and Whitehead 2004). Juveniles of some species, such as clearnose skate, are able to detect electrical signals produced by adults of other marine species that could be potential predators (Sisneros et al. 1998).

The mechanisms by which fish detect EMFs and use the information that they obtain are poorly understood, so studies of fishes’ behavioral responses to EMFs provide the best indication of how they may be impacted by potential changes in EMFs caused by the Project. For example, little skate have been observed to increase their movement and the amount of time they spend near the seafloor in the presence of an EMF that exceeds background levels (Hutchison et al. 2018). Variability in individual speeds and distances traveled were also greater in the presence of a high

EMF. While the skates modified their behavior in the presence of EMF alteration, the altered EMF did not prevent them from accessing any part of the study area (Hutchison et al. 2018). Although some species may use EMFs for important functions such as locating mating and spawning grounds, the high frequency of EMFs produced by submarine power cables relative to fishes' sensitivity levels (Normandeau Associates Inc. 2011) and the high variability observed in individual responses to EMF alterations suggest that population-level impacts are unlikely to occur. It is uncertain whether migratory species would be misled by an electromagnetic anomaly, use the anomaly as a navigational landmark, or disregard the anomaly as noise, as some species disregard their own EMF signals (Bodznick, Montgomery, and Tricas 2003). Demersal species are most likely to experience negligible, short-term impacts to their feeding and navigation patterns because the EMF generated by the cables will be strongest near the ocean floor and will only be detectable within a few meters of the cable route (Normandeau Associates Inc. 2011). Burying the cables will minimize the impact of the EMFs they produce, and the proposed submarine cables include protective shielding to further reduce the impact of EMFs produced by transmission cables in the Project area.

A site-specific study of potential impacts of EMF on electrosensitive marine organisms was completed by Exponent for the Project(Exponent 2023). They modelled the induced electric fields experienced by Atlantic sturgeon and dogfish (shown in Table 8-4), which were chosen based on documented electrosensitivity and presence in the Project area, respectively (Exponent 2023). These field values produced by the Project cables are 11 times lower than the reported threshold for behavioral changes for similar species (Exponent 2023). Therefore, impacts to finfish from EMF are expected to be negligible.

Table 8-4. Calculated Induced Electric Fields in Atlantic Sturgeon and Dogfish

Cable Configuration	Evaluation Height for Magnetic- or Electric-Field	Induced Electric Field (mV/m), Dogfish	Induced Electric Field (mV/m), Atlantic Sturgeon
Inter-array Cable	At the seabed	0.3	0.6
	3.3 ft (1 m) above the seabed	< 0.1	< 0.1
Offshore Export Cable	At the seabed	1.0	1.8
	3.3 ft (1 m) above the seabed	0.1	0.1
Export Cables in Indian River Bay [1]	At the seabed	1.0	1.8
	3.3 ft (1 m) above the seabed	0.1	0.1

Adapted from Exponent 2023

[1] For Indian River Bay Export Cables, the results at horizonal distances > 0 were provided relative to the cable with the higher current (1,200 A and 480 A for peak and average loading, respectively). Calculated fields near cables carrying lower currents will be lower.

Vessel Traffic

Over the lifetime of the installation, regular maintenance will be necessary, as well as potential non-routine repairs. Maintenance personnel and equipment will access the WTGs, OSSs, Met Tower, and submarine cables by boat. The impact of maintenance vessel traffic on finfish would be similar to but less than the impacts of vessel traffic during Project construction.

Lighting

Artificial lighting will be installed on the WTGs, OSSs and Met Tower for navigational safety purposes. It is not expected that this lighting will impact fish because it is not intended to penetrate the water's surface. Should any of the Project infrastructure be compromised during the lifetime of the Project, it is possible that maintenance vessels may need to use artificial lighting while repairing or replacing the infrastructure during nighttime hours. The impacts of this lighting on finfish would be similar to but less than the impacts of artificial lighting used during Project construction.

Routine/Accidental Releases

Emissions of liquids and gases into the environment are not part of the Project's routine operations. However, fuel discharges may occur if the Project infrastructure necessitates maintenance vessel trips, and lubricating oils contained within the WTGs could be released if the structures are damaged. The impact of these releases on finfish would be similar to but less than the impacts of routine and accidental releases that occur during Project construction.

8.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Removal of the WTGs, OSSs and Met Tower would alter the benthic environment by removing hard substrate habitats. Decommissioning would result in additional impacts to the benthic community due to interactions with bottom-contacting equipment (e.g., jack-up vessel pads, vessel anchors) and the temporary resuspension of sediments due to equipment removal. Impacts from these activities would be similar to those described above for construction. Removal of foundations and scour protection could have a significant negative impact on finfish by removing structures that provided artificial habitat. Leaving the submarine cables in place would significantly reduce turbidity impacts on finfish.

8.2.4 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on finfish and essential fish habitat.

- Based on consultation with DNREC, the following protection measures would be implemented to avoid and minimize impacts to finfish and EFH:
  - No in-water work (cables, HDD, etc.) in Indian River Bay from March 1 through September 30 to avoid impacts to young of year summer flounder.
  - No in-water work in Indian River from March 1 to May 15 to protect the American eel and allow passage of elvers upstream.
  - Landing Offshore Export Cables at 3R's Beach landfall location to avoid habitat of sandbar and sand tiger sharks.
- Conduct surveys and review existing data to identify important, sensitive, and unique marine habitats to be avoided.
- Minimize construction activities as practicable in areas containing anadromous fish during migration periods.

- Seafloor disturbance during construction will be minimized as practicable.
- Impacts to summer flounder HAPC will be minimized by using dynamic positioning where feasible to minimize the need for construction vessels to anchor to the seafloor and using midline buoys to reduce seafloor scarring when construction vessels need to anchor.
- Sediment disturbance associated with submarine cable laying will be minimized by jet plowing, HDD techniques and the use of gravity cells where feasible.
- Soft-start procedures and sound attenuation will be used during foundation pile driving.
- Fish monitoring equipment including nanotag antennas has been installed on the Metocean Buoy
- Work lighting will be limited to the extent practicable to areas of active construction in coordination with USCG and other agencies as appropriate.
- Project-specific SPCC Plan and Oil Spill Response Plan will be prepared prior to construction and for operations activities.
- Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination"), per BOEM guidelines for marine trash and debris prevention.
- Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.
- Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable.
- Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.
- US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.

9.0 Marine Mammals

9.1 Description of the Affected Environment

The following description of the affected environment for marine mammals draws upon recent studies focused on offshore areas that include the Lease area and areas around the Lease area that could be affected by the Project. In addition to the studies described below, other resources referenced include New Jersey's Ocean/Wind Power Ecological Baseline Studies Final Report: January 2008 – December 2009 (Geo-Marine 2010). This section has been updated to be consistent with the US Wind Application for Letter of Authorization under the Marine Mammal Protection Act for the Maryland Offshore Wind Project.

MABS Survey (Williams et al. 2015b, 2015a)

The Mid-Atlantic Baseline Studies (MABS) were conducted for the Department of Energy (DOE) and the Maryland Energy Administration (MEA) to provide wildlife information specific to the WEAs in the mid-Atlantic. The wildlife information was collected between 2012 and 2014 across a 13,245 km^2 (3,862 square NM) study area off the coasts of Delaware, Maryland, and Virginia, using HD digital aerial surveys and boat-based surveys. Over the survey period, sixteen boat surveys and fifteen aerial surveys were conducted within the WEAs. The surveys were designed to sufficiently capture the biological variations in both spatial and temporal dimensions, in accordance with BOEM wildlife survey guidelines.

In 2013, during the second year of the MABS study, MDNR and MEA expanded the existing surveys to cover a greater extent of Maryland's state and federal waters. This expansion, called the Maryland Project (MD Project), extended the ongoing boat surveys into Maryland state waters, extended the ongoing aerial surveys into areas west and south of the Maryland WEA, and added an additional annual aerial survey over Maryland waters. Survey findings from the MD Project are presented in a separate report (Williams et al. 2015b), and have been incorporated into the MABS Mid-Atlantic Outer Continental Shelf Final Report (Williams et al. 2015a).

VAQF Survey (S. Barco et al. 2015)

The Virginia Aquarium & Marine Science Center Foundation (VAQF) study was conducted for the Maryland Department of Natural Resources (MDNR) to provide fine scale data on the presence of protected species for Maryland's offshore wind development efforts. The wildlife information was collected monthly between 2013 and 2015 via observer based aerial surveys. Over the survey period, a total of twelve aerial surveys were conducted, resulting in over 16,000 km (8,639 NM) of observed track line running from shore to 50-70 km (27-38 NM) offshore, encompassing the entire Maryland WEA. The surveys were designed to sufficiently capture biological variations in both spatial and temporal dimensions, in accordance with the BOEM wildlife survey guidelines. For survey methodologies and details, a copy of this report can be requested from MEA.

Determining Offshore Use by Marine Mammals and Ambient Noise Levels Using Passive Acoustic Monitoring Study (H. Bailey et al. 2018)

This survey, conducted by scientists from the University of Maryland Center for Environmental Science Chesapeake Biological Laboratory and the Cornell University Bioacoustics Research Program, sought to detect vocalizations of large and small cetaceans within and around the Maryland WEA. This study was conducted from November 2014 to January 2017 and utilized Marine Autonomous Recording Units (MARUs) and Cetacean PODs (C-PODs, tonal click detectors) to detect whale presence in the area and characterize ambient noise levels.

US Wind 2015, 2016, 2017, 2021 and 2022 G&G Surveys (Alpine Ocean Seismic Survey Inc. 2015, 2017)

US Wind conducted preliminary geotechnical and geophysical (G&G) surveys within the boundaries of the Lease area in 2015, and along the formerly planned offshore export cable route in 2016, and along Onshore Export Cable Corridor 1 within Indian River Bay in 2017. Activities occurred onboard the Research Vessel (RV) Shearwater in 2015 and 2016 for a total of 44 and fifteen survey days, respectively. The 2017 survey within Indian River Bay was conducted on the MV George over a total of six survey days. Protected species observers (PSO) monitored the areas surrounding the survey boats for marine mammals using visual observation and passive acoustic monitoring. Observational data is included with the survey reports.

US Wind also conducted G&G surveys within the Lease area and along Offshore Export Cable Corridors in 2021-2022, and in Indian River Bay in 2022. PSO reports are submitted to BOEM and BSEE on a quarterly basis for the duration of the surveys, as required by the Lease.

Habitat-based Marine Mammal Density Models for the U.S. Atlantic (MGEL 2022)

The Duke Marine Geospatial Ecology Laboratory (MGEL) has collaborated with numerous academic and independent research organizations, and state and federal agencies, to produce modeled estimates of the predicted distribution and abundance of marine mammal species in the Western North Atlantic (MGEL 2022). These models were originally published in 2016 and were most recently updated in the spring of 2022. Current GIS information from the MGEL data sources for the different marine mammal species were used to determine density metrics. For each species, each month's data in the buffered Lease area[13] was analyzed to identify the greatest minimum and maximum values and to create a summary for each species/month analysis cycle.

NOAA Fisheries Marine Mammal Stock Assessment Reports (Hayes et al. 2019; Hayes et al. 2021; Hayes et al. 2022; Hayes et al. 2018; Waring et al. 2015a)

The National Marine Fisheries Service and the United States Fish and Wildlife Service are required to generate stock assessment reports for all marine mammal stocks within the U.S. Exclusive Economic Zone. This requirement was established under the 1994 amendments to the Marine Mammal Protection Act. Stock Assessment Reports are prepared by staff of the Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC) and are updated annually for strategic stocks and at least every 3 years for non-strategic stocks. These reports include estimates of stock sizes and annual human-caused serious injury/mortality.

Metocean Buoy Monitoring (WHOI 2022)

A near real-time passive acoustic monitoring buoy, part of a series of digital acoustic monitoring instruments along the U.S. East Coast deployed by the Woods Hole Oceanographic Institution, was deployed by the University of Maryland Center for Environmental Science (UMCES) in the Lease area in May 2021 (WHOI 2022). The near real-time whale monitoring buoy collects acoustic data for low frequency whales: North Atlantic right whales as well as fin, sei, and humpback whales. Funding for the first year of deployment was provided by the Maryland Energy Administration and Maryland Department of Natural Resources and the second year of deployment (May 2022 through May 2023) funding was provided by US Wind.

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[13] The buffer distance applied to the lease area boundary was the largest range to a regulatory threshold for the pile driving hammer sources proposed for use in the project, which was 5.4 km.

Overview

The Atlantic Coast's marine mammals are represented by members of the taxonomic orders Cetacea, Carnivora, and Sirenia. The order Cetacea includes the mysticetes (baleen whales) and the odontocetes (toothed whales). Occurrence of cetacean species is generally widespread in Western North Atlantic waters with many of the large whales and populations of smaller toothed whales undergoing seasonal migrations along the length of the U.S. Atlantic coast. The order Carnivora, suborder Pinnipedia, family Phociade, includes two species of seal that may occur in the mid-Atlantic, though these animals are mainly found in the North Atlantic. The order Sirenia is represented by the West Indian manatee, which occurs mainly in the South Atlantic.

Table 9-1 lists the marine mammal species that are known to occur at least occasionally in the mid-Atlantic OCS region and have a known stock presence in the area. Several of these species are known to occur only rarely in the mid-Atlantic OCS region and are modeled to occur at very low densities in the Project area (MGEL 2022). Due to the habitat preferences and distributions of these species, they are not likely to be affected by project activities, so are not discussed further.

Pygmy and dwarf sperm whales (*Kogia* spp.) were not observed or detected during recent site-specific visual and acoustic surveys of the Lease area (S. Barco et al. 2015; H. Bailey et al. 2018; Williams et al. 2015b) and are modeled to occur at very low densities within the Project area (MGEL 2022). Though passive acoustic monitoring data indicates that Kogia spp. are more abundant in Western North Atlantic waters than suggested by visual survey data, detections of these species are concentrated along the Atlantic shelf break and slope waters (L.E. Hodge et al. 2018), in deeper and more offshore habitats than those within the Lease area. Therefore, *Kogia* spp. sperm whales are not discussed further.

Killer whales (*Orcinus orca*) are also not considered below. Though killer whales can be found in temperate and tropical regions, this species is most abundant in colder arctic and Antarctic waters (NOAA Fisheries 2022r). Killer whales are uncommon or rare in waters of the U.S. Atlantic EEZ (S.K. Katona et al. 1988) and recent visual and acoustic surveys (S. Barco et al. 2015; H. Bailey et al. 2018; Williams et al. 2015b) did not yield any confirmed sightings or detections of killer whales in the region of the Lease area.

Though rough-toothed dolphins (*Steno bredanensis*) have been observed in a wide range of depths, from shallow nearshore areas to oceanic waters, most sightings occur in waters deeper than 305 m (1,000 ft) (Hayes et al. 2019). Because this species is not likely to be found in the shallower waters of the Lease area, and rough-toothed dolphin sightings in the Mid-Atlantic are rare (Williams et al. 2015b, 2015a; S. Barco et al. 2015), no further discussion of rough-toothed dolphins is presented.

Similarly, striped dolphins (*Stenella coeruleoalba*) are found in deeper waters than those present in the Lease area. From Cape Hatteras to the southern margin of Georges Bank, striped dolphins are generally found along the continental shelf edge at depths of approximately 1000 m (3280.8 ft) (S.A. Hayes et al. 2020).

Table 9-1. Marine Mammals with Potential Occurrence in the Project Area

Common Name	Scientific Name	Stock	ESA/ MMPA Status[a]	Best Abundance Estimate of Stock[b]	MGEL Density Models[c]		MABS Mid-Atlantic Surveys[d]		MABS MD Surveys[e]		VAQF Survey[f]	MD WEA Acoustic Survey[g]	General Occurrence within the Project Area
					Estimated Mean Density in buffered Lease area during Month of Max Density (#/25 km^2)	Month of Max Density	Boat Survey Sightings[da]	Aerial Survey Sightings[db]	Boat Survey Sightings[ea]	Aerial Survey Sightings[eb]	Aerial Survey Sightings[fa]	Presence Detected[ga]	
Order Cetacea													
Baleen Whales (Mysticeti)													
North Atlantic right whale	*Eubalaena glacialis*	Western North Atlantic	E/D	368	0.019	February	1	8	0	0	5 (13)	Y	Common
Fin whale	*Balaenoptera physalus*	Western North Atlantic	E/D	6,802	0.0535	January	3	1	0	0	9 (14)	Y	Common
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine		1,393	0.04675	April	12	2	1	1	2 (2)	Y	Common
Minke whale	*Balaenoptera acutorostrata*	Canadian East Coast		21,968	0.1875	May	3	3	3	1	1 (1)	Y	Common
Sei whale	*Balaenoptera borealis*	Nova Scotia	E/D	6,292	0.01525	April	1	0	0	0	0		Rare
Blue whale	*Balaenoptera musculus*	Western North Atlantic	E/D	402	0.00025	Annual	0	0	0	0	0		Rare
Toothed Whales (Odontoceti)													
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic		39,921	0.37625	August	4	0	0	0	1 (45)		Uncommon
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic		93,233	0.19947	May	0	0	0	0	0		Uncommon
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic Offshore	D[aa]	62,851	2.763	August	874	677	243	340	417 (2978)	Y	Common
		W. N. Atl. Northern Migratory Coastal		6,639	12.3185								

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					Estimated Mean Density in buffered Lease area during Month of Max Density (#/25 km^2)	Month of Max Density	Boat Survey Sightings[da]	Aerial Survey Sightings[db]	Boat Survey Sightings[ea]	Aerial Survey Sightings[eb]	Aerial Survey Sightings[fa]	Presence Detected[ga]	
Clymene dolphin	*Stenella clymene*	Western North Atlantic		4,237	0.00006	Annual	0	0	0	0	0		Rare
Cuvier's beaked whale	*Ziphius cavirostris*	Western North Atlantic		5,744	0.00[ca]	Annual	0	0	0	0	0		Rare
Dwarf sperm whale	*Kogia sima*	Western North Atlantic		7,750[ba]	0.00[cb]	Annual	0	0	0	0	0		Rare
False killer whale	*Pseudorca crassidens*	Western North Atlantic		1,791	0.00[ca]	Annual	0	0	0	0	0		Rare
Fraser's dolphin	*Lagenodelphis hosei*	Western North Atlantic		UNK	0.00[ca]	Annual	0	0	0	0	0		Rare
Harbor porpoise	*Phocoena*	Gulf of Maine/ Bay of Fundy		95,543	0.91325	January	0	3	0	1	0	Y	Uncommon
Killer whale	*Orcinus orca*	Western North Atlantic		UNK	0.0005	Annual	0	0	0	0	0		Rare
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic		39,215	0.0975	Annual	0	0	0	0	0		Uncommon
Melon-headed whale	*Peponocephala electra*	Western North Atlantic		UNK	0.00[ca]	Annual	0	0	0	0	0		Rare
Blainville's beaked whale	*Mesoplodon densirostris*	Western North Atlantic		10,107[bb]	0.00025	Annual	0	0	0	0	0		Rare
Gervais' beaked whale	*Mesoplodon europaeus*	Western North Atlantic		10,107[bb]	0.00025	Annual	0	0	0	0	0		Rare
True's beaked whale	*Mesoplodon mirus*	Western North Atlantic		10,107[bb]	0.00025	Annual	0	0	0	0	0		Rare
Northern bottlenose whale	*Hyperoodon ampullatus*	Western North Atlantic		UNK	0.00[ca]	Annual	0	0	0	0	0		Rare

Table 9-1. Marine Mammals with Potential Occurrence in the Project Area

Common Name	Scientific Name	Stock	ESA/ MMPA Status[a]	Best Abundance Estimate of Stock[b]	MGEL Density Models[c]		MABS Mid-Atlantic Surveys[d]		MABS MD Surveys[e]		VAQF Survey[f]	MD WEA Acoustic Survey[g]	General Occurrence within the Project Area
					Estimated Mean Density in buffered Lease area during Month of Max Density (#/25 km^2)	Month of Max Density	Boat Survey Sightings[da]	Aerial Survey Sightings[db]	Boat Survey Sightings[ea]	Aerial Survey Sightings[eb]	Aerial Survey Sightings[fa]	Presence Detected[ga]	
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic		6,593	0.001	Annual	0	0	0	0	0		Uncommon
Pygmy sperm whale	*Kogia breviceps*	Western North Atlantic		7,750[ba]	0.00[cb]	Annual	0	0	0	0	0		Rare
Risso's dolphin	*Grampus griseus*	Western North Atlantic		35,215	0.04225	December	0	1	0	1	0		Rare
Rough-toothed dolphin	*Steno bredanensis*	Western North Atlantic		136	0.0005	Annual	0	0	0	0	0		Rare
Short-beaked common dolphin	*Delphinus delphis*	Western North Atlantic		172,974	1.98475	December	209	52	26	27	24 (199)	Y	Common
Short-finned pilot whale	*Globicephala macrorhynchus*	Western North Atlantic		28,924	0.00975	Annual	0	0	0	0	0		Uncommon
Sperm Whale	*Physeter macrocephalus*	North Atlantic	E/D	4,349	0.0015	May	0	0	0	0	0		Rare
Spinner dolphin	*Stenella longirostris*	Western North Atlantic		4,102	0.00[ca]	Annual	0	0	0	0	0		Rare
Striped dolphin	*Stenella coeruleoalba*	Western North Atlantic		67,036	0.001	Annual	0	0	0	0	0		Rare
White-beaked dolphin	*Lagenorhynchus albirostris*	Western North Atlantic		536,016	0.00[ca]	Annual	0	0	0	0	0		Rare
Order Carnivora													
Earless seals (Phocidae)													
Harbor seal	*Phoca vitulina*	Western North Atlantic		61,336	0.1699	January	0	0	0	0	0		Rare

Table 9-1. Marine Mammals with Potential Occurrence in the Project Area

Common Name	Scientific Name	Stock	ESA/ MMPA Status[a]	Best Abundance Estimate of Stock[b]	MGEL Density Models[c]		MABS Mid-Atlantic Surveys[d]		MABS MD Surveys[e]		VAQF Survey[f]	MD WEA Acoustic Survey[g]	General Occurrence within the Project Area
					Estimated Mean Density in buffered Lease area during Month of Max Density (#/25 km^2)	Month of Max Density	Boat Survey Sightings[da]	Aerial Survey Sightings[db]	Boat Survey Sightings[ea]	Aerial Survey Sightings[eb]	Aerial Survey Sightings[fa]	Presence Detected[ga]	
Gray seal	*Halichoerus grypus*	Western North Atlantic		27,300	0.1699	January	0	0	0	0	0		Rare
Order Sirenia													
Manatee (Trichechidae)													
West Indian manatee	*Trichechus manatus*	Florida	T	8,810[bc]			0	0	0	0	0		Rare

[e] All species are protected under the MMPA, D = Depleted under the MMPA, E = Endangered under the ESA, T= Threatened under the ESA
[aa] Western North Atlantic Northern Migratory Coastal stock only
[b] Source: NOAA Stock Assessment Reports (Hayes et al. 2022, 2021, 2020, 2019; Waring et al. 2015). UNK indicates that stock size is unknown.
[ba] Estimated abundance includes both dwarf and pygmy sperm whales
[bb] Estimated abundance for all *Mesoplodon* spp. beaked whales
[bc] Best population estimate for the state of Florida (USFWS 2022).
[c] Source: MGEL 2022. Manatee densities not modeled.
[ca] Density estimates in the buffered Lease area not provided in MGEL (2022).
[cb] Estimated density includes both dwarf and pygmy sperm whales
[d] Source: Williams et al. 2015a
[da] Total number of individuals observed during 16 boat-based surveys of the mid-Atlantic conducted between March 2012 and May 2014. Only sightings of individuals identified to species are included. Additional MM sightings not included in table: 113 unidentified dolphin, 11 unidentified whale, 4 unidentified large whale
[db] Total number of individuals observed during 15 digital video aerial surveys of the mid-Atlantic conducted between March 2012 and May 2014. Additional MM sightings not in table: 1044 small beaked cetacean to 3m, 188 unidentified dolphin, 63 unidentified toothed whale, 1 unidentified fin/sei whale, 5 unidentified cetacean, 1 unidentified medium whale
[e] Source: Williams et al. 2015b
[ea] Total number of individuals observed during 16 boat-based surveys in the vicinity of the MD WEA conducted between April 2012 and April 2014. Only sightings of individuals identified to species are included. Additional sightings of MM not included in table: 29 unidentified dolphin, 4 unidentified whale
[eb] Total number of individuals observed during 14 aerial surveys in the vicinity of the MD WEA conducted between March 2012 and May 2014. Additional sightings or MM not classified to species: 644 small beaked cetacean to 3 m, 102 unidentified dolphin, 6 unidentified toothed whale, 1 unidentified medium whale
[f] Source: Barco et al. 2015
[fa] Total number of sightings (and total number of individuals observed) during monthly aerial surveys of the MD WEA and surrounding waters between July 2013 and June 2015. Additional MM sightings not reported in table: 11 (18) unidentified dolphin, 1 (1) unidentified whale, 2 (2) unidentified baleen whale
[g] Source: Bailey et al. 2018
[ga] Y indicates marine mammal species detected during monthly passive acoustic monitoring of the MD WEA and surrounding waters between November 2014 and January 2017

Additional species excluded from further consideration include the Clymene dolphin, false killer whale, Fraser's dolphin, melon-headed whale, and spinner dolphin, which are generally found in deep offshore habitats in tropical and subtropical waters (NOAA Fisheries 2022h, 2022j, 2022l, 2022t, 2022=). *Mesoplodon* beaked whales (Blainville's, Gervais', and True's) are also not described below. Though the ranges of these species can include warm temperate regions, these whales typically inhabit deeper waters than are present in the Project area (NOAA Fisheries 2022f, 2022m, 2022-). Northern bottlenose whale and the white-beaked dolphin are also not discussed, as these species inhabit deep cold temperate and subarctic waters to the north of the Project area (NOAA Fisheries 2022x, 2022□). Additionally, white-sided dolphins are not described below, as this species typically occurs from the outer continental shelf to the 100-m isopleth and has not been sighted in Maryland waters since 1995 (Hayes et al. 2021).

Though individual sightings of manatees have occurred in the mid-Atlantic in summer months, and even as far north as Massachusetts, warm weather sightings are most common in Florida and coastal Georgia (Rathbun, Bonde, and Clay 1982; Schwartz 1995; Fertl et al. 2005; USFWS 2021d). West Indian manatees are a sub-tropical species and cannot tolerate temperatures below 20°C (68°F) for extended periods of time. It is highly unlikely that this species will be encountered in the Project area, so it is not discussed further.

9.1.1 Cetaceans

The status and distribution of species likely to be impacted by project activities are discussed below. The blue whale (*Balaenoptera musculus*) is classified as absent from the mid-Atlantic OCS region (BOEM 2014) and is highly unlikely to be found within the relatively shallow waters of the Lease area. Similarly, the sperm whale generally occurs in mid-ocean regions, over the continental slope, and along the continental shelf edge (S.A. Hayes et al. 2020) and is not likely to be present in the Lease area. However, these ESA-listed endangered species may be encountered by vessels traveling to the Lease area from overseas or the Gulf of Mexico, so are discussed below.

In total, fifteen cetacean species are discussed in the following sections, all of which are federally protected by the Marine Mammal Protection Act (MMPA). Five of these species are listed as federally endangered under the ESA; the North Atlantic right whale (NARW) (*Eubaelena glacialis*), the fin whale (*Balaenoptera physalus*), the sei whale, and the previously mentioned sperm whale, and blue whale.

North Atlantic Right Whale (*Eubaelena glacialis*)

North Atlantic right whales (NARW) are among the rarest of all marine mammal species. These whales average approximately 15.25 m (50 ft) in length and can weigh 63,503 kilograms (70 tons) (NOAA Fisheries 2022v). NARW have stocky black bodies with no dorsal fin, and bumpy, coarse patches of skin on their heads called callosities (NOAA Fisheries 2022v). Right whales are slow moving grazers that feed on dense concentrations of prey, primarily zooplankton and copepods belonging to the *Calanus* and *Pseudocalanus* genera (Hayes et al. 2022), anywhere in the water column from the surface to the seafloor (NOAA Fisheries 2022v). Research suggests that NARW must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall NARW habitats (R.D. Kenney et al. 1986; R.D. Kenney, Winn, and Macaulay 1995).

NARWs are usually observed in groups of less than 12 individuals, and most often as single individuals or pairs, though larger groups of actively socializing right whales, known as "surface active groups”, may be observed in feeding or breeding areas (T.A. Jefferson, Webber, and Pitman 2008). Dive profiles and behavior of right whales varies seasonally and latitudinally. North of the Project area in Cape Cod Bay, right whales tend to swim and feed near to the surface where zooplankton is abundant, which this puts them at greater risk of vessel collision (M.F. Baumgartner et al. 2017; Mayo and Marx 1990; S. E. Parks et al. 2012). During summer months, NARW tends to forage deeper in the water column, putting them at a greater risk of entanglement with fisheries equipment (M.F. Baumgartner and Mate 2003; M.F. Baumgartner et al. 2017; Hamilton and Kraus 2019). During summer months, NARW tends to forage deeper in the water column, putting them at a greater risk of entanglement with fisheries equipment (M.F. Baumgartner and Mate 2003; M.F. Baumgartner et al. 2017; Hamilton and Kraus 2019). A recent study conducted by Dombroski et al. (2021) determined that lactating female NARW in the southeast U.S. calving ground, located approximately 600 km (373 miles) to the south of the Project area, spent up to 80% of the time in surface waters at depths of 3.5 m (11.5 ft) or less. In contrast, non-lactating whales (including juveniles and pregnant females) occupied surface waters for a smaller percentage of time, on average (30 and 32%, respectively; (Dombroski, Parks, and Nowacek 2021).

The NARWs occurring in U.S. waters belong to the western Atlantic stock. The size of this stock is considered to be extremely low relative to its Optimum Sustainable Population (OSP) in the U.S. Atlantic Exclusive Economic Zone (EEZ). The most recent official estimate of minimum NARW population size was 368 individuals, which was presented in the 2021 NOAA stock assessment report and reflects estimated abundance as of November 2019 (Hayes et al. 2022). However, more recent estimates indicate that the NARW population has fallen to 340 individuals (Pettis, Pace, and Hamilton 2022). Historically, the NARW population suffered severely from commercial overharvesting. Based on carrying capacity in the North Pacific, the estimate of the pre-whaling population of the western Atlantic stock is between 9,075 and 21,328 individuals (Monserrat et al. 2015). Whaling activities killed an estimated 5,500 right whales in the western North Atlantic between 1634 and 1950, although records are incomplete (Reeves, Smith, and Josephson 2007). Back calculations indicate that the right whale population in the western Atlantic stock was as low as 100 individuals by 1935, before international protection for right whales was passed (NOAA Fisheries 2022c).

Although the NARW population grew by approximately 2.8 percent per year from 1990 to 2011, population size has notably decreased between 2011 to 2019 (NOAA Fisheries 2022c). The minimum rate of annual human-caused mortality and serious injury to right whales averaged 5.56 individuals per year for the period of 2012 through 2016 (Hayes et al. 2019), 8.15 individuals per year for the period of 2014 through 2018, and 7.7 individuals per year for the period of 2015-2019 (Hayes et al. 2022). In the period of 2015-2019, incidental fishery entanglement mortality and serious injury averaged 5.7 individuals per year, and vessel strike mortality and serious injury averaged 2 individuals per year (Hayes et al. 2022). NARW are currently experiencing an unusual mortality event (UME); elevated numbers of dead or seriously injured NARW have been recorded in Canada and the United States since 2017 (NOAA Fisheries 2021b). Throughout this time period, 34 NARW deaths have been reported, as well as 21 serious injuries, and 37 sublethal injuries and illnesses (NOAA Fisheries 2022c). Human interaction, through vessel strikes and entanglements, is the leading cause of this UME (NOAA Fisheries 2022c). Due to the small NARW population size, it is estimated that human sources of mortality have a disproportionately large effect on population growth (Hayes et al. 2022). Additionally, changes to right whale habitat have caused migration into new territory, which has exposed right whales to new anthropogenic threats (NOAA Fisheries 2022c). The NARW is a strategic stock[14] and is listed as endangered under the ESA.

Surveys have demonstrated the existence of seven areas where Western North Atlantic right whales congregate seasonally: the coastal waters of the southeastern United States; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Roseway Basin on the Scotian Shelf (Hayes et al. 2019). The Project area does not include any of the areas listed above where NARW are known to congregate.

NMFS has designated two critical habitat areas for the NARW: the Northeastern U.S. Foraging Area in the Gulf of Maine/Georges Bank region, and the Southeastern U.S. Calving area in coastal waters from North Carolina to Florida (NOAA Fisheries 2022w). Two additional critical habitat areas in Canadian waters, Grand Manan Basin and Roseway Basin, were identified in Canada's final recovery strategy for the North Atlantic right whale (Brown et al. 2009). The Project area is located approximately 600 km (373 miles) southwest of the Northeast U.S. Foraging Area critical habitat, and approximately 600 km (372 miles) northeast of the Southeastern U.S. Calving Area critical habitat.

The NARW is a strongly migratory species that undertakes well-defined seasonal movements. However, this species exhibits condition-dependent partial migration; though all NARW have the potential to migrate each winter to the southeastern United States, only a portion of the NARW population migrates in any given year (Gowan et al. 2019). Migration behavior and habitat use varies between years and across different demographic groups (Gowan et al. 2019). Gowan et al. (2019) found that juvenile NARW were more likely to migrate than adults, and males were more likely to migrate to the southeastern U.S. than non-calving females. Therefore, Generally, NARW occupy feeding grounds in New England waters, the Canadian Bay of Fundy and Scotian Shelf, and the Gulf of St. Lawrence in spring, summer, and fall, and travel to their sole known calving and wintering grounds in the waters of the southeastern U.S. (R.D. Kenney and Vigness-Raposa 2009). Mid-Atlantic waters are a primary migration corridor during these seasonal migrations (Knowlton, Ring, and Russel 2002; Firestone et al. 2008). A study conducted over an 11-month period in 2012 and 2013 used acoustic detection in the nearshore waters of North Carolina and Georgia to detect right whale did not detect a bi-modal pattern of right whale occurrence during predicted migratory periods (K.B. Hodge et al. 2015). Mapped migration routes along the Atlantic coast are close to both major ports and shipping lanes (Hayes et al. 2022). Recently, North Atlantic right whales have been observed increasingly in the mid-Atlantic region (G.E. Davis et al. 2017).

Mating and socializing occurs in surface active groups, although the groups are observed during all seasons and in all habitats. Right whales are estimated to be able to live to around 70 years of age, although due to human-caused mortality the average lifespan for a right whale is now 45 years for females and 65 years for males. Recently, a higher portion of right whale deaths have occurred in the female population, likely due to a combination of stress from reproduction and chronic injuries including vessel strikes and entanglement. Female right whales reach sexual maturity at age 10, and they undergo a year-long pregnancy to birth a single calf. Female right whales are also having calves less frequently (every 6 to 10 years instead of every 3 years), which

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[14] A strategic stock is defined by the MMPA as a stock for which the level of direct human-caused mortality exceeds the potential biological removal, is declining and is likely to be listed as threatened under the ESA in the foreseeable future, or is currently listed as threatened or endangered under the ESA or designated as depleted under the MMPA.

is estimated to be due to entanglement stress (NOAA Fisheries 2022v). As mentioned above, several areas of Critical Habitat have been designated for the NARW off the U.S. east coast because they are highly productive feeding grounds (NOAA Fisheries 2022v).

Right whales are in the Low Frequency Cetaceans hearing group. Their predicted hearing sensitivity ranges from 20 Hz to 22 kHz (L.P. Matthews and Parks 2021). Right whales produce a variety of vocalizations, including low frequency moans, groans, pulses, upcalls, and “gunshots” (NOAA Fisheries 2022v; L.P. Matthews and Parks 2021). Most of the energy of NARW vocalizations is below 2,000 Hz (S. E. Parks, Johnson, et al. 2011). NARW of all ages and sexes produce a distinctive contact vocalization called an upcall, which ranges in frequency from 50 Hz to 200 Hz (L.P. Matthews and Parks 2021). NARWs have the capacity to produce sound signals for up to 10 seconds, but and have also been observed to produce short duration signals less than 0.5 seconds in duration (Matthews & Parks 2021). These shortest vocalizations, known as “gunshots,” range from 20 Hz to 20 kHz in frequency and occur more frequently during peak breeding season between October and December (L.P. Matthews and Parks 2021). A study conducted in the Bay of Fundy indicated that call rates are higher when right whales are socializing or traveling at the surface, and lower when whales are foraging or resting (S.E. Parks, Searby, et al. 2011). The characteristics of NARW vocalizations have also been shown to change in response to increased noise (S. E. Parks, Johnson, et al. 2011; S. E. Parks, Clark, and Tyack 2007).

Observations from recent aerial and acoustic surveys indicate that NARW are present in the region of the Lease area (Williams et al. 2015a; H. Bailey et al. 2018). This species was visually observed in the mid-Atlantic in February and March (Williams et al. 2015a), and in the Lease area from January to March (Williams et al. 2015b; S. Barco et al. 2015). However, acoustic data indicate that NARW are present in the vicinity of the Lease area throughout the year, with maximum abundance reported during the late winter and early spring (H. Bailey et al. 2018). These findings align with observations from North Carolina and Georgia waters, where NARW were acoustically detected in all seasons (K.B. Hodge et al. 2015). These observation patterns suggest that though pulses of NARW travel through mid-Atlantic waters during seasonal migrations, the region may also be a destination for non-breeding individuals (S. Barco et al. 2015).

Four sightings of NARW were recorded during surveys of the Lease Area and offshore export cable corridors conducted in December 2021, January 2022, and two in March 2022. Confirmed NARW acoustic detections by the UMCES near real-time monitoring buoy in the Lease area occurred on one day in both September and November 2021, then frequently in December 2021 to January 2022 and sporadically through March 2022 (WHOI 2022). The highest frequency of confirmed detections occurred from December 2021 to January 2022 (WHOI 2022), which coincides with sightings during US Wind survey activities. MGEL (2022) indicates that the highest average density of NARW in the buffered Lease area occurs in February and is estimated to be 0.00076 individuals per 1 km (0.54 NM) grid square (Figure 9-1).

According to the available data and site-specific information summarized above, while NARW are a rare species due to the small population size the likelihood of North Atlantic right whales to occur in the Project area is high.

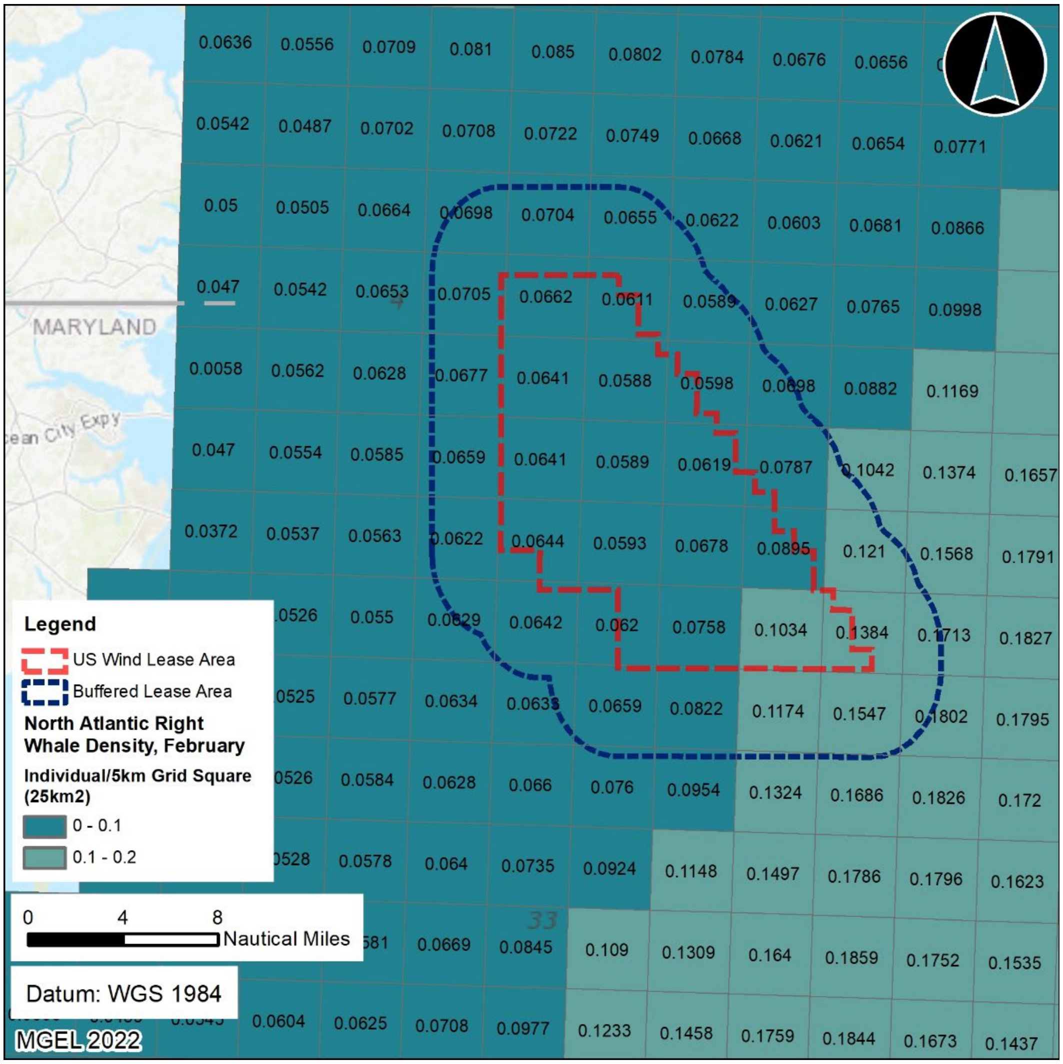

Figure 9-1. North Atlantic Right Whale Density in Buffered Lease Area in February (month of max density)

In order to protect this species, Seasonal Management Areas (SMAs) for reducing ship strikes of NARWs have been designated in the U.S. and Canada. Vessels greater than 19.8 m (65 ft) in overall length must operate at speeds of 10 knots or less within these areas during specified time periods (NOAA Fisheries 2022z). The closest SMA is located approximately 13 km (7 NM) from the northwestern portion of the Lease area and is active between November 1 and April 30 each year (NOAA Fisheries 2022z). Dynamic Management Areas (DMAs) or Right Whale Slow Zones may also be established by NOAA Fisheries in response to sightings of NARW, and vessels are encouraged to reduce speeds to 10 knots or avoid these areas (NOAA Fisheries 2022z) (Figure 9-2).

NOAA Fisheries is currently proposing changes to vessel speed regulations to reduce the risk of mortality or serious injury to NARW due to vessels strikes. The proposed rule would replace SMAs with expanded Seasonal Speed Zones (SSZs), approximately doubling the coastal area under speed restriction (NOAA Fisheries 2022z). Unlike current SMAs, speed regulations (limiting operating speed to 10 knots or less) would apply to most vessels greater than 10.7 m (35 ft) in length within active SSZs (NOAA Fisheries 2022z). This proposed rule would also allow for the establishment of discrete and temporally limited mandatory Dynamic Speed Zones (DMZs) to protect NARW outside of active SSZs (NOAA Fisheries 2022z).

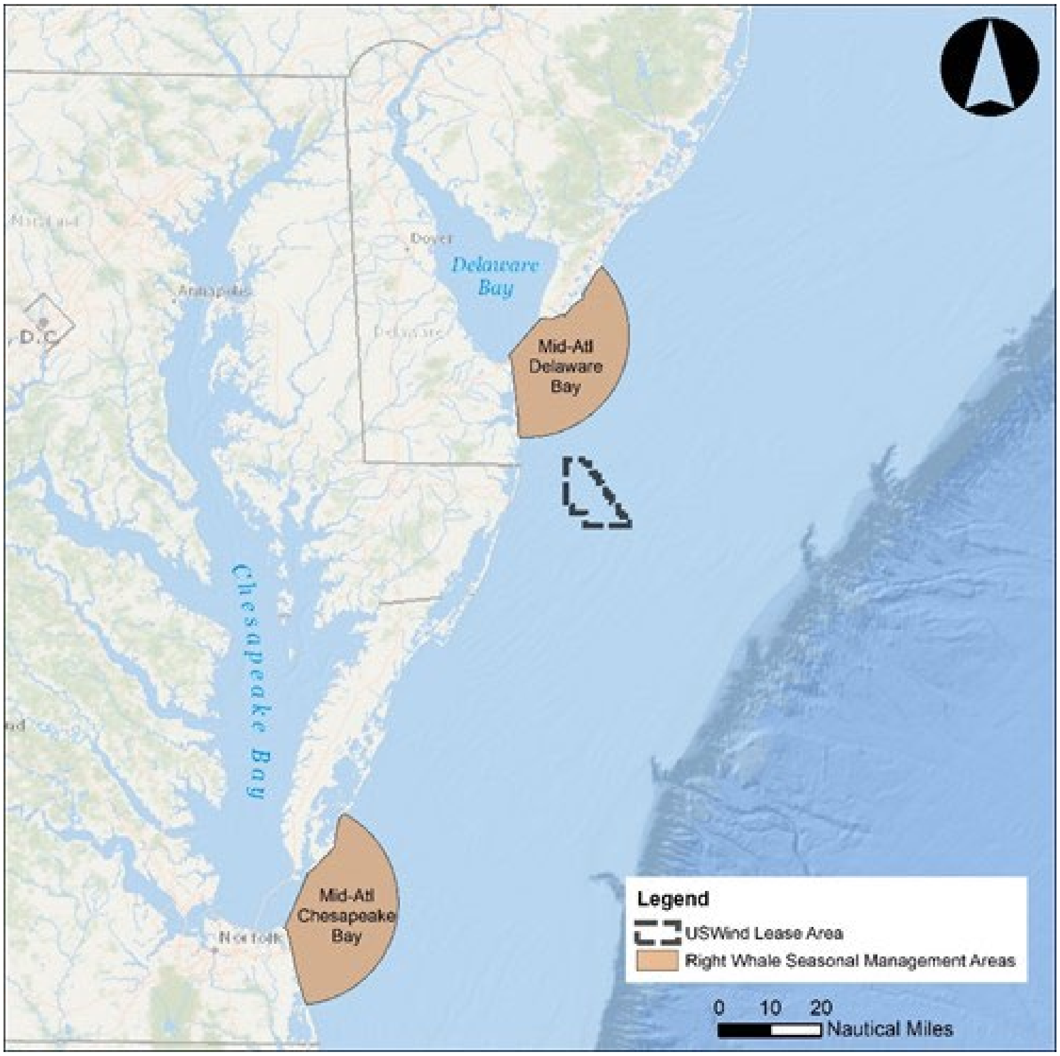

Figure 9-2. North Atlantic Right Whale Seasonal Management Areas

Fin Whale (*Balaenoptera physalus*)

Fin whales are the second largest whale species, ranging from 25 to 26 m (82 to 85 ft) in length. Fin whales typically feed on krill and schooling fish in the Gulf of Maine and the waters surrounding New England. Fin whales are fast swimmers and are most commonly found in groups of two to seven individuals, although they have been observed feeding in larger groups of mixed species (Hayes et al. 2022; NOAA Fisheries 2022k). Fin whales have two distinct types of dive behavior: foraging dives and traveling dives. Fin whale foraging dives tend to be deeper and longer in duration than travel dives and are punctuated by “lunges,” which are vertical excursions, presumably to feed (D.A. Croll et al. 2001). Fin whales dive up to approximately 98 m (322 ft) when foraging and 60 m (197 ft) when traveling (D.A. Croll et al. 2001).

Fin whales in the Project area would be expected to be part of the Western North Atlantic stock, which is comprised of fin whales off the eastern coast of the United States, Nova Scotia, and the southeastern coast of Newfoundland. The best abundance estimate available for the Western North Atlantic fin whale stock is 6,802 individuals and the average annual human-caused mortality and serious injury for fin whales between 2015 and 2019 was 1.85 (Hayes et al. 2022). The status of the Western North Atlantic stock relative to Optimum Sustainable Population (OSP) in the U.S. Atlantic Exclusive Economic Zone (EEZ) is unknown, and a population trend analysis has not been performed (Hayes et al. 2022). The Western North Atlantic population is listed as a strategic stock under the MMPA because it is listed as an endangered species under the ESA. Like most other whale species present along the U.S. east coast, ship strikes and fisheries entanglements are perennial causes of serious injury and mortality, although contaminants and climate-related changes may impact this population as well (Hayes et al. 2022).

The range of the Western North Atlantic stock of fin whales extends from the Gulf of Mexico and Caribbean Sea, to the southeastern coast of Newfoundland in the north (Hayes et al. 2022). Generally, fin whales migrate from the Arctic and Antarctic coastal feeding areas in the summer to deeper tropical breeding and calving areas in the winter (NOAA Fisheries 2022k). During migration, they generally travel in open seas away from coastal areas. However, calving, mating, and wintering locations are unknown for most of the fin whale population, and data from the north Pacific indicates that fin whales may not undergo large-scale annual migratory movements (Hayes et al. 2022). Critical habitat has not been designated by the ESA for fin whales in the western Atlantic (NMFS 2022).

Fin whales are in the Low Frequency Cetaceans hearing group. No direct measurement of fin whale hearing sensitivity has been made, although these whales are known to respond to anthropogenic sound sources such as shipping vessel noise, airguns, and small vessel noise (Jahoda et al. 2003; Castellote, Clark, and Lammers 2012). Fin whales produce a variety of low frequency sounds ranging from 10 to 200 Hz (Watkins, Tyack, and Moore 1987; Watkins 1981; Edds 1988). Fin whales produce well-known “20 Hz pulses” and most of their vocalizations are below 100 Hz (Watkins, Tyack, and Moore 1987). Males can produce these pulses in a repeated pattern that functions as song, a presumed reproductive display (Morano et al. 2012).

Recent acoustic and visual surveys indicate that fin whales are present in the region of the Lease area in all seasons, and are relatively abundant in the area, compared to other baleen whale species (Williams et al. 2015a; H. Bailey et al. 2018; S. Barco et al. 2015). Though this species was not observed in Maryland waters during the Williams et al. (2015b) study, fin whales were the most frequently observed whale species during the Barco et al. (2015) surveys and were one of the most frequently detected large whale species during the Bailey et al. (2018) study. This species was most abundant in the region of the Lease area during the winter and early spring (Williams et al. 2015b; S. Barco et al. 2015), but is present in the area during all seasons, with lowest abundances likely occurring in summer and early (H. Bailey et al. 2018). These findings align with those of other passive acoustic surveys conducted to the south of the Lease area in North Carolina, Georgia, and New Jersey, which detected fin whale presence year-round (Rice et al. 2014; Geo-Marine 2010).

Fin whales were frequently acoustically detected by the UMCES near real-time monitoring buoy in the Lease area between late September 2021 and mid-March 2022, and again from mid-August through November 2022 (WHOI 2022). The highest frequency of detection occurred in late February 2022 (WHOI 2022).

MGEL (2022) indicates that the highest average density of fin whales in the buffered Lease area occurs in January and is estimated to be 0.00214 individuals per 1 km (0.54 NM) grid square (Figure 9-3).

According to the available data and site-specific information summarized above, the likelihood of fin whales to occur in the Project area is high.

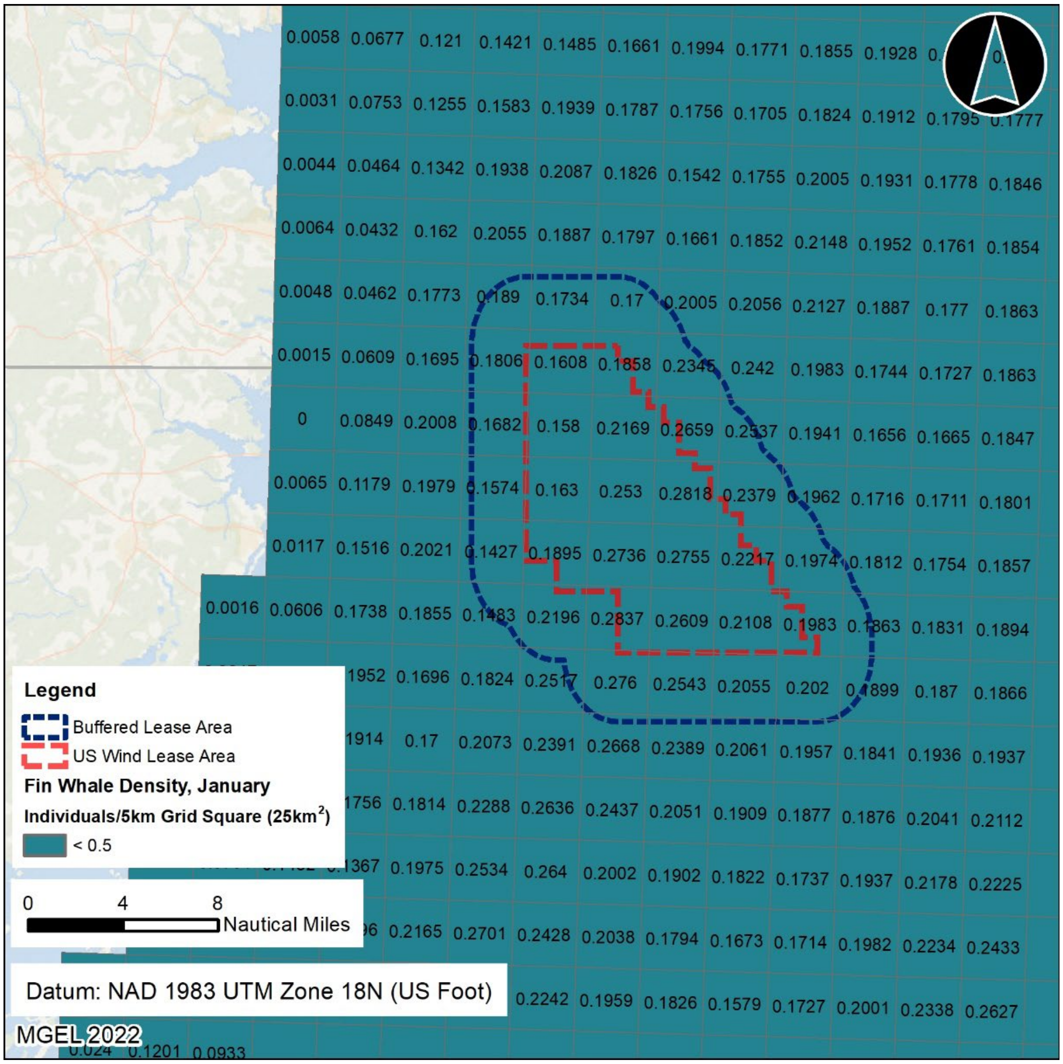

Figure 9-3. Fin Whale Density in the Buffered Lease Area in January (month of max density)

Humpback Whale (*Megaptera novaeangilae*)

Humpback whales are a cosmopolitan species that can reach lengths of up to 18 m (60 ft). This species is primarily dark gray in coloration, but individuals have variable and distinctive patterns of white on their pectoral fins, belly, and flukes that are used to identify individuals (NOAA Fisheries 2022q). These baleen whales feed on small prey that is often found in high concentrations, including krill and fish such as herring and sand lance (R.D. Kenney and Vigness-Raposa 2009). Humpback whales use unique behaviors including bubble nets, bubble clouds, and flickering of their flukes and fins, to herd and capture prey (NMFS 1991). Humpback whale group size in the mid-Atlantic is not well documented, but in the northwest Atlantic they tend to travel in groups of 1 to 10 (H. Whitehead 1983). Humpback whales exhibit diurnally variable dive behavior. During nighttime hours they are more vulnerable to vessel strikes as they tend to spend more time near the water surface and exhibit more directional travel (average night-time dive depth for humpback whales is 12.5m [41 ft]) (Calambokidis et al. 2019). During the day, humpback whales spend more time at depth feeding on krill (average day-time dive depth is 34.2m [112 ft]) and their movements are more localized (Calambokidis et al. 2019).

In the North Atlantic, six separate humpback whale subpopulations have been identified by their consistent matrilineally determined fidelity to different feeding areas (Clapham and Mayo 1987). The six humpback whale subpopulations can be found in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and Norway (S.A. Hayes et al. 2020; Hayes et al. 2019). The large majority of humpbacks that inhabit the waters off the eastern United States belong to the Gulf of Maine stock. Humpback whales in the Project area would most likely be part of the Gulf of Maine stock.

The best abundance estimate for the Gulf of Maine stock of humpback whales is 1,396 individuals (S.A. Hayes et al. 2020). For the period of 2013 through 2017, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged 12.15 individuals per year (S.A. Hayes et al. 2020). The Gulf of Maine stock of humpback whales has been recently characterized by an upward trend in population size (S.A. Hayes et al. 2020). Humpback whales were previously listed as endangered under the ESA throughout its range. However, in September 2016 NOAA Fisheries identified fourteen Distinct Population Segments of humpback whale worldwide and revised the ESA listing for this species. All humpback whales living along the North American Atlantic coast, including the Gulf of Maine Stock, belong to the West Indies Distinct Population Segment, which is not at risk and has been delisted from the ESA (NOAA Fisheries 2022q). The Gulf of Maine stock is currently not classified as depleted and is not considered a strategic stock. However, as observed humpback whale mortalities are estimated to account for only 20 percent of all mortality, the uncertainties associated with the population assessment may have produced an incorrect determination of strategic status (S.A. Hayes et al. 2020). Human impacts, including vessel collision and fishing gear entanglements, may be slowing the population recovery of the humpback whale. Humpback whales are currently experiencing an unusual mortality event (UME) along the Atlantic coast; elevated humpback whale mortalities have occurred from Maine to Florida since January 2016 (NOAA Fisheries 2022a). Evidence of human interactions (vessel strikes or entanglement) has been found on approximately 50 percent of the stranded whales examined, although more research is needed to determine the cause of this UME (NOAA Fisheries 2022a).

Humpback whales in the Gulf of Maine stock typically feed in the waters between the Gulf of Maine and Newfoundland during the spring, summer, and fall, but have been known to feed over a range that encompasses the entire U.S. east coast (S. K. Katona and Beard 1990). Humpback whales from most feeding areas, including the Gulf of Maine, migrate to the West Indies (including the Antilles, the Dominican Republic, the Virgin Islands, and Puerto Rico) in the winter, where they mate and calve their young (S.A. Hayes et al. 2020). However, not all humpback whales from the Gulf of Maine stock migrate to the West Indies every winter, because significant numbers of animals can be found in mid- and high-latitude regions at this time (Swingle et al. 1993). Humpback whales utilize the mid-Atlantic as a supplemental winter feeding ground and migration pathway (S.A. Hayes et al. 2020). There are currently no critical habitat areas designated for this species near the Project area (NMFS 2022).

Humpback whales are in the Low Frequency Cetaceans hearing group. Though the auditory sensitivity of humpback whales has not been measured, models indicate that this species is likely sensitive to frequencies ranging from 700 Hz to 10 kHz, with greatest sensitivity to sounds between 2 and 6 kHz (Houser et al. 2001). Humpback whales produce various vocalizations, including "social sounds" as well as the characteristic songs produced by males (Au et al. 2006). Vocalizations range from 10 Hz to more than 24 kHz (Au et al. 2006; Frankel et al. 1995; Zoidis et al. 2008), but most of energy is concentrated below 2 kHz (Au et al. 2006; Frankel et al. 1995; Zoidis et al. 2008). Humpback whales are known to react to anthropogenic sound (Frankel and Clark 2000; Fristrup, Hatch, and Clark 2003; Dunlop et al. 2018). Like some other whale species, they have shown the ability to at least partially compensate for increases in masking noise by increasing the source levels of their vocalizations (Dunlop et al. 2014).

Recent acoustic surveys indicate that humpback whales are present in the region of the Lease area in all seasons (H. Bailey et al. 2018; Williams et al. 2015b). These findings align with previous studies conducted to the south of the Lease area in North Carolina and Georgia, and in New Jersey, which detected humpback whale presence year round (Rice et al. 2014; Geo-Marine 2010). In the mid-Atlantic and the region of the Lease area, humpback whales were most frequently visually observed in the winter months (Williams et al. 2015b, 2015a; S. Barco et al. 2015). Acoustic monitoring revealed that humpback whale presence was lowest from June to September, increased through the winter, and peaked in April (H. Bailey et al. 2018).

Humpback whales were acoustically detected by the UMCES near real-time monitoring buoy in the Lease area between July 2021 and May 2022 (WHOI 2022). Sparse detections occurred between August and November 2022, and the highest frequency of detection was reported in between February and April 2022 (WHOI 2022).

MGEL (2022) indicates that the highest average density of humpback whales in the buffered Lease area occurs in April and is estimated to be 0.00187 individuals per 1 km (0.54 NM) grid square.

According to the available data and site-specific information summarized above, the likelihood of humpback whales to occur in the Project area is high.

Minke Whale (*Balaenoptera acutorostrata*)

Minke whales are the smallest baleen whale species found in North America waters, reaching only 10 m (35 ft) in length (NOAA Fisheries 2022u). Their diet is primarily composed of crustaceans, small schooling fish, and plankton (NOAA Fisheries 2022u) and some studies indicate that minke whales will adjust their diet in response to local prey abundances (Skaug et al. 1997). Minke whales generally travel in small groups (two to three individuals), but larger groups are observed on feeding grounds (NOAA Fisheries 2022u). Minke whale diving behavior has not been extensively studied. However, a study conducted on related Antarctic minke whales (*Balaenoptera bonaerensis*) identified three distinct types of foraging dive performed by the species: short surface dives, long shallow dives, and long deep dives (Friedlaender et al. 2014). Shallow dives accounted for 73 percent of all dives observed; average Antarctic minke whale foraging dives reached a depth of 18 m (59 ft) and were 1.4 minutes in duration (Friedlaender et al. 2014). Compared to other, larger whale species, Antarctic minke whales tend to have higher feeding rates and shallower dives (Friedlaender et al. 2014), characteristics which may be shared by the minke whale.

In the North Atlantic, there are four recognized populations of minke whale: Canadian East Coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). Until better information becomes available, minke whales off the eastern coast of the United States have been classified as part of the Canadian East Coast stock, which inhabits the area from the western half of the Davis Strait (45°W) to the Gulf of Mexico (Hayes et al. 2022). The current estimate of the size of Canadian East Coast stock is 21,968 individuals (Hayes et al. 2022).

Between 2015-2019, the average annual minimum human-caused mortality and serious injury to the Canadian East Coast stock of minke whales was 10.55 individuals per year (Hayes et al. 2022). A population trend analysis has not been conducted for the Canadian East Coast stock due to imprecise abundance estimates (Hayes et al. 2022).

Minke whales are not currently listed as threatened or endangered under the ESA and the Canadian East Coast stock is not considered strategic under the MMPA (Hayes et al. 2022). Minke whales are currently experiencing an unusual mortality event along the Atlantic coast; elevated mortalities have occurred from Maine through South Carolina since January 2017 (NOAA Fisheries 2022b). Further research is needed to determine if the UME is the result of human interaction or infectious disease (NOAA Fisheries 2022b).

Minke whales have a cosmopolitan distribution, as they can occur in temperate, tropical and high latitude waters in most seas worldwide (Hayes et al. 2022). Due to their small size, inconspicuous behavior, and frequent presence in remote waters, the seasonal distribution of minke whales is not well understood (Risch et al. 2019). Sightings data suggest that minke whale distribution is largely centered in the waters of New England and eastern Canada (Hayes et al. 2022). However, though minke whales are relatively widespread and abundant in New England waters in spring and fall, they are largely absent from this area in the winter (Risch et al. 2013). Passive acoustic monitoring data aligns with sightings data and indicate that minke whales generally begin a southward migration along the continental shelf in mid-October through early November, leaving their summer feeding areas (located north of 40° N) for winter grounds offshore the southeastern U.S. shelf break and, in the Caribbean (south of 30° N, (Risch, Castellote, et al. 2014)). Mating and calving most likely take place during the winter months, potentially offshore of the southeastern U.S. (Risch, Castellote, et al. 2014). Minke whales likely begin a northward migration to their summer feeding grounds from March through April (Risch, Castellote, et al. 2014). Critical habitat areas have not been designated for minke whales because their movement and behavior are poorly understood.

Minke whales are in the Low Frequency Cetaceans hearing group. Although the hearing sensitivity of minke whales has not been directly measured, models of their middle ears predict that their best hearing range overlaps with their vocalization frequency range(Tubelli et al. 2012). Minke whales produce a variety of sounds, primarily moans, clicks, downsweeps, ratchets, thump trains, grunts, and “boings” in the 80 Hz to 20 kHz range, and the signal features of their vocalizations consistently include LF, short-duration downsweeps from 250 to 50 Hz (Edds-Walton 2000; Mellinger, Carson, and Clark 2000; Risch, Gales, et al. 2014). Minke whales have been shown to be significantly affected by anthropogenic noise sources. Studies have shown up to an 80 percent loss in communication space for minke whales due to vessel noise (Cholewiak et al. 2018). However, due to their noise sensitivity, they are very responsive to acoustic deterrent devices that have been used as noise mitigation during construction activities (McGarry et al. 2017). Minke whales have been observed to respond to mid-frequency active sonar and other training activities by reducing or ceasing calling and by exhibiting avoidance behaviors (Harris et al. 2019; S.W. Martin et al. 2015).

Recent multi-year surveys detected minke whales in the mid-Atlantic and the region of the Lease area (H. Bailey et al. 2018; S. Barco et al. 2015; Williams et al. 2015b, 2015a). Though this species was the most frequently identified whale species within Maryland waters during the Williams et al. (2015b) study, minke whales were only observed a total of four times. Similarly, the Barco et al. (2015) surveys only identified one minke whale, and this species was infrequently acoustically detected in the region of the Lease area (H. Bailey et al. 2018). Minke whales are likely most abundant in the region during the fall, winter, and spring months, as sightings and detections occurred in November, January, February, and April (Williams et al. 2015b; H. Bailey et al. 2018; S. Barco et al. 2015). These findings roughly align with the conclusions of an earlier study to the north of the Lease area, which detected minke whales in New Jersey waters in winter (February) and spring (June) (Geo-Marine 2010).

One minke whale was sighted in March 2022 during surveys of the Lease Area and offshore export cable corridors.

MGEL (2022) indicates that the highest average density of minke whales in the buffered Lease area occurs in May and is estimated to be 0.00750 individuals per 1 km (0.54 NM) grid square.

According to the available data and site-specific information summarized above, the likelihood of minke whales to occur in the Project area is high.

Sei Whale (*Balaenoptera borealis*)

Sei whales are large sleek-bodied baleen whales that can reach 12 to 18 meters (40 to 60 feet) in length (NOAA Fisheries 2022|). This species is dark-bluish gray to black in color, with a pale underside, and is usually observed in small groups of two to five individuals (NOAA Fisheries 2022|). Sei whales are largely planktivorous, feeding primarily on euphausiids and copepods, but will also feed on small schooling fishes and cephalopods (NOAA Fisheries 2022|). These prey species generally exhibit diel vertical migrations within the water column and are found in deeper waters during the day and shallower waters at night. Research suggests that sei whales maximize foraging efficiency by feeding on near-surface aggregations of their prey during nighttime hours (Baumgartner, M. F., and Fratantoni 2008). Sei whales capture maneuverable prey (e.g., fish and euphausiids) in surface and subsurface waters using an intermittent form of filter feeding called lunge feeding, during which an individual rapidly accelerates then engulfs large volumes of prey-containing water (Segre et al. 2021). Sei whales also exhibit continuous filter feeding (skim feeding) in surface waters; individuals swim with an open mouth and rostrum above the water surface while continuously filtering slower moving prey (e.g., copepods) from the water (Segre et al. 2021).

Sei whales found in US Mid-Atlantic waters belong to the Nova Scotia stock, which includes the continental shelf waters north to Newfoundland (Hayes et al. 2022). The best abundance estimate available for the Nova Scotia sei whale stock is 6,292 individuals (Hayes et al. 2022). Between 2015 - 2019, the average annual minimum human-caused mortality and serious injury to the Nova Scotia stock of sei whales was 0.8 individuals per year (Hayes et al. 2022). A population trend analysis has not been conducted for the Nova Scotia stock due to imprecise abundance estimates (Hayes et al. 2022). The Nova Scotia sei whale stock is listed as a strategic stock under the MMPA because this species is listed as endangered under the ESA.

In U.S. waters, sei whales are generally found in the Gulf of Maine and in the region of George's Bank (Hayes et al. 2022). The sei whale is often observed in deeper waters characteristic of the continental shelf edge region (Hain et al. 1985), though they have been observed to make episodic and unpredictable incursions into shallower inshore waters (Hayes et al. 2022). The distribution and movement patterns of the sei whale are not well known, but this species is believed to migrate from temperate and subpolar summer feeding grounds to wintering grounds in tropical and subtropical latitudes (NMFS 2021). Sei whales are most commonly observed in U.S. waters near George's bank in the spring (Hayes et al. 2022). Recently collected passive acoustic monitoring data indicate distinct seasonal patterns in sei whale presence in the western North Atlantic (Davis et al. 2020). Sei whales were most commonly detected in northern areas, including feeding grounds from southern New England to the Scotian Shelf, during late summer and fall (Davis et al. 2020). During this time period, sparse sei whale detections south of the New York bight were recorded (Davis et al. 2020). In winter months, sei whale acoustic detections were recorded along the entire U.S. coastline, though detections in the Southeastern U.S. were generally limited to offshore areas (Davis et al. 2020). Sei whales mate and give birth during the winter, though specific breeding locations are currently unknown (NOAA Fisheries 2022|). There are currently no critical habitat areas established for the sei whale.

Sei whales are in the Low Frequency Cetaceans hearing group. The auditory sensitivity of sei whales has not been measured and information about sei whale vocalizations is sparse. Observations from the Great South Channel indicate that Sei whales produce low frequency vocalizations that sweep from 82 to 34 Hz over 1.4 seconds (Baumgartner et al. 2008). Similar calls, ranging from 34 to 38 Hz, were also reported in the Southern Ocean (Calderan et al. 2014). Tonal and broadband calls from 200 and 700 Hz, likely used for short-distance communication between sei whales, have also been documented west of the Antarctic Peninsula (McDonald et al. 2005). Additional observations of sei whale vocalizations describe higher frequency bursts of metallic pulses with peak energy at 3 kHz (T.J. Thompson, Winn, and Perkins 1979) and 1.5 to 3.5 kHz sweeps (Knowlton, Clark, and Kraus 1991). This reported variability in call characteristics may reflect population-specific acoustic behavior variations, but more research is needed (Prieto et al. 2012).

Recent visual and acoustic surveys did not yield any confirmed sightings or detections of sei whales in the region of the Lease area . This though this species was sighted once during surveys of the Mid-Atlantic (Williams et al. 2015a). A single confirmed sei whale acoustic detection by the UMCES near real-time monitoring buoy in the Lease area occurred in October 2021 (WHOI 2022).

MGEL (2022) indicates that the highest average density of sei whales in the buffered Lease Area and adjacent waters occurs in April and is estimated to be 0.00061 individuals per 1 km (0.54 NM) grid square (Figure 9-4).

According to the available data and site-specific information summarized above, the likelihood of sei whales to occur in the Project area is high.

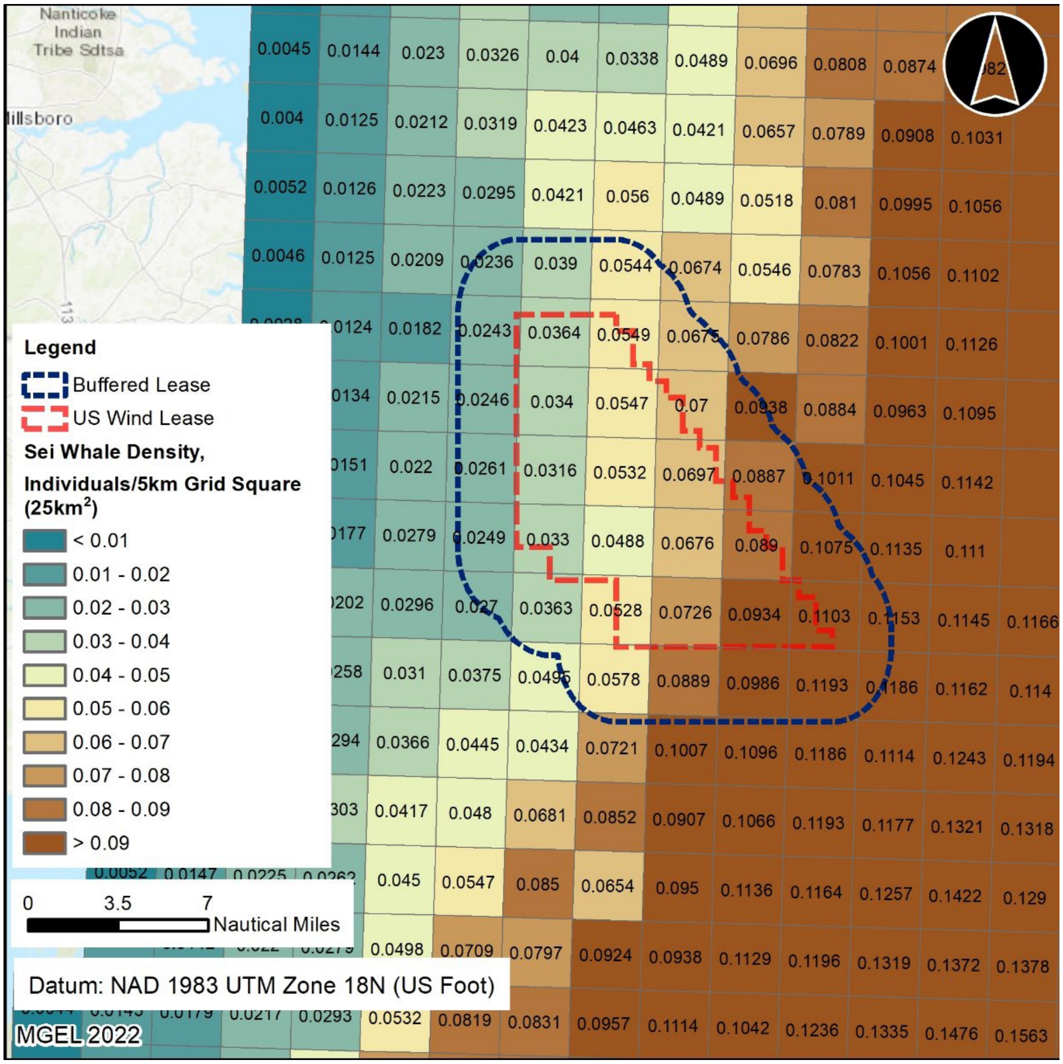

Figure 9-4. Sei Whale Density in the Lease Area and Adjacent Waters in April (month of max density)

Blue Whale (*Balaenoptera musculus*)

Blue whales range throughout the world's oceans, with the exception of Arctic waters, and are the largest animal that has ever existed (NOAA Fisheries 2022g). Individuals in the subspecies *Balaenoptera musculus*, which are found in the north Atlantic and the north Pacific, can reach lengths of over 27 m (90 ft) (NOAA Fisheries 2022g; S.A. Hayes et al. 2020). Blue whales are slender and mottled blue-gray in color, and are most frequently observed alone or in pairs in deeper continental shelf, slope, and open ocean habitats (USDOI and BOEM 2012; NOAA Fisheries 2022g). Blue whales feed primarily on krill, though they will occasionally consume copepods and fish (NOAA Fisheries 2022g). In the north Atlantic, blue whales are most frequently encountered in the waters off eastern Canada, and are only occasional visitors in Atlantic Exclusive Economic zone waters (Wenzel, Mattila, and Clapham 1988; CeTAP 1982).

Blue whales observed in U.S. Atlantic waters belong to the Western North Atlantic Stock (S.A. Hayes et al. 2020). The best available abundance estimate for this stock of blue whales is 402 individuals (S.A. Hayes et al. 2020). This estimate is based upon a catalogue of photo-identified blue whale individuals from the Gulf of Saint Lawrence compiled between 1980 to 2008 (S.A. Hayes et al. 2020). Though ship strikes and fisheries entanglements are regarded as threats to this species, there have been no recent observations of fishery-related mortalities or serious injuries to blue whales in US Atlantic EEZ or Atlantic Canadian waters (S.A. Hayes et al. 2020). This species is listed as endangered under the ESA.

The distribution and migratory patterns of north Atlantic blue whales are not well known, though individuals generally travel from summer feeding grounds to winter breeding grounds, and abundance is largely driven by the availability of prey species (NOAA Fisheries 2022g). In the northwestern Atlantic, blue whales are most commonly found in the Gulf of Saint Lawrence in spring, summer, and fall, and in waters off of southern Newfoundland in winter (S.A. Hayes et al. 2020). Infrequent sightings of blue whales in the Atlantic EEZ have generally occurred in late summer (July/August), and this region may represent the southern limit of the species' range (S.A. Hayes et al. 2020). The blue whale is generally considered to be absent from mid-Atlantic waters (USDOI and BOEM 2012). There are currently no critical habitat areas established for the blue whale.

Recent multi-year visual and acoustic surveys specific to the Lease area and surrounding waters did not yield any confirmed blue whale detections or sightings (S. Barco et al. 2015; Williams et al. 2015b, 2015a). Blue whales tend to occur in more northern regions of the Atlantic, and offshore at or beyond the continental shelf break, and therefore are unlikely to be found in the Lease area. However, this species could be encountered by vessels transiting to the Lease area from overseas ports.

MGEL (2022) indicates that the highest annual average density of blue whales in the buffered Lease Area is estimated to be 0.00001 individuals per 1 km (0.54 NM) grid square (Figure 9-5).

Atlantic Spotted Dolphin (*Stenella frontalis*)

Two species of oceanic spotted dolphins can occur within the northwestern Atlantic: the Atlantic spotted dolphin (*Stenella frontalis*) and the pantropical spotted dolphin (*S. attenuata*, see section 4.2.7). *Stenella* species in the Atlantic can be difficult to distinguish at sea, and hybrids have been documented (Kingston, Adams, and Rosel 2009). Information contained in this section is specific to the Atlantic spotted dolphin. Atlantic spotted dolphins are relatively small (generally less than 2.3 m [7.5 ft] long) and accumulate dark spots, especially on their dorsal surfaces, as they age (NOAA Fisheries 2022e). This species feeds upon a variety of organisms, including small fish, cephalopods, and benthic invertebrates (NOAA Fisheries 2022e). In coastal waters, Atlantic spotted dolphins are most often found in groups of five to fifteen individuals, though group sizes sometimes reach up to 200 (NOAA Fisheries 2022e). Atlantic spotted dolphin dives usually range from two to six minutes in duration and reach less than 9 m (30 ft), though this species can dive to depths of 61 m (200 ft) (NOAA Fisheries 2022e).

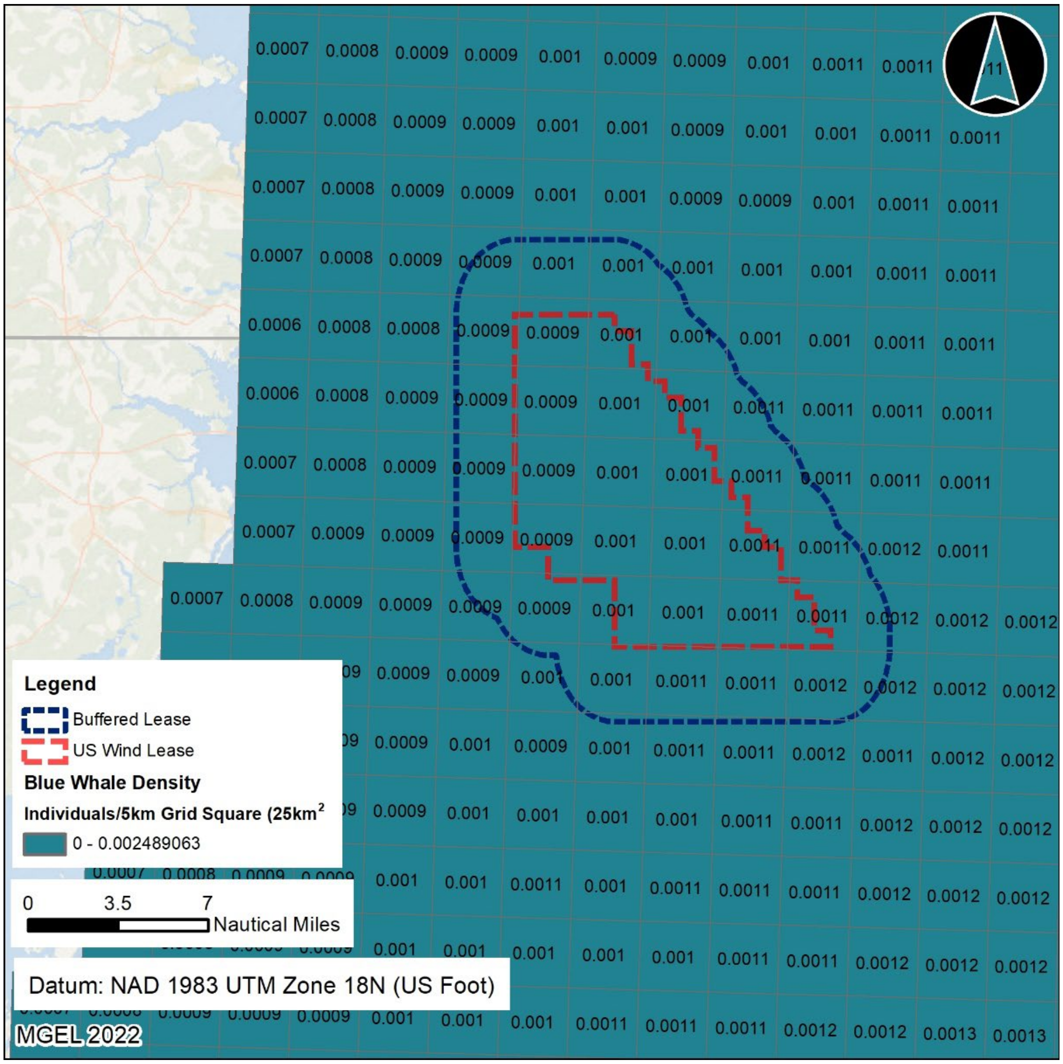

Figure 9-5. Blue Whale Maximum Annual Density in the Lease Area and Adjacent Waters

Atlantic spotted dolphins in U.S. Atlantic waters belong to Western North Atlantic stock. The best available abundance estimates for Atlantic spotted dolphins in the western North Atlantic is 39,921 individuals (S.A. Hayes et al. 2020). Total annual estimated fishery-related mortality and serious injury to Atlantic spotted dolphins between 2013 and 2017 was presumed to be zero as no reports of mortalities or serious injury were submitted. Based on three population estimates from 2004, 2011, and 2016, there has been a statistically significant decrease in Atlantic spotted dolphin abundance (S.A. Hayes et al. 2020). However, several confounding factors, including spatial distribution, add uncertainty to this abundance trend (S.A. Hayes et al. 2020). The Western North Atlantic stock of Atlantic spotted dolphins is not classified strategic, and this species is not listed as threatened or endangered under the ESA (S.A. Hayes et al. 2020). Threats to this species include vessel strikes and fishing gear entanglements, as well as habitat loss or degradation (S.A. Hayes et al. 2020).

Atlantic spotted dolphins are found in the tropical, subtropical, and warm-temperate waters of the Atlantic Ocean (NOAA Fisheries 2022e). In the western Atlantic, this species ranges from

Massachusetts south to the Gulf of Mexico, the Bahamas, and Brazil (NOAA Fisheries 2022e). Atlantic spotted dolphins prefer waters between 20 to 250 m (65 to 820 ft) deep on the continental shelf but can be found in deeper waters in the northern part of their range (NOAA Fisheries 2022e). Based on a study conducted on the west Florida continental shelf, Atlantic spotted dolphins occur in lower abundances from June to October and in higher abundances from November to May (Griffin and Griffin 2004). A genetic study indicated that though the Atlantic spotted dolphin is a highly mobile species with a largely continuous distribution, distinct genetic clusters were found to reside in different habitats (based on variables including depth and sea surface temperature, (Viricel and Rosel 2014). Seasonal migration of Atlantic spotted dolphins is poorly understood, although hypotheses for migration patterns include inshore-offshore movements relative to season and prey, or alongshore migration to warmer waters during the cold seasons (Mills and Rademacher 1996). Although the lifespan of Atlantic spotted dolphins is unknown, they reach sexual maturity at approximately eight to fifteen years of age, and females reproduce at a rate of one calf every one to five years (NOAA Fisheries 2022e). Information on specific habitat areas used for mating and calving is not readily available for the Western North Atlantic stock of Atlantic spotted dolphins (NOAA Fisheries 2022e), and no critical habitat has been designated for this species.

Atlantic spotted dolphins are in the Mid Frequency Cetaceans hearing group. This species produces a variety of sounds, including whistles, buzzes, barks, screams, squawks, tail slaps, and echolocation clicks (Herzing 1996). Their echolocation clicks have bi-modal frequencies, with the low-frequency peak between 40 and 50 kHz and the high-frequency peak between 110 and 130 kHz (Au & Herzing 2003). Atlantic spotted dolphins produce signature whistles with a frequency range of 4 to 18 kHz for a duration of 0.5 to 8 seconds (Herzing 1996). These whistles are associated with mother/calf reunions, alloparental care, and courtship (Herzing 1996). Excitement vocalizations, which have the same frequency range as the signature whistle, are burst-pulsed vocalizations overlapped with the signature whistle and are often associated with bubbles emitted from the blowhole (Herzing 1996). Squawks, screams, and barks range in frequency from 0.2 kHz to 15 kHz (Herzing 1996).

Recent visual and acoustic surveys conducted by Barco et al. (2015), Williams et al. (2015b, 2015a), and Bailey et al. (2018) indicate that spotted dolphins have a limited presence in the region of the Lease area and are most likely to be present in the summer months. Barco et al. (2015) observed one group of 45 spotted dolphins (*Stenella* sp.) east of the Lease area in July 2014, and Williams et al. (2015a) sighted four individuals during a shipboard survey outside of Maryland waters in June 2013. No Atlantic spotted dolphins were detected during a two-year acoustic survey of the Lease area and surrounding region (H. Bailey et al. 2018).

Spotted dolphins (*Stenella* spp.[15]) were observed 5 times (56 individuals) during the 2015 HRG survey of the Lease Area, and once (10 individuals) during the 2016 HRG survey of the proposed transmission cable route in offshore Maryland waters. Atlantic spotted dolphins were sighted nine times during the 2021 and 2022 surveys of the offshore export cable corridors and the Lease area.

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[15] *Stenella* spp. includes both the Atlantic spotted dolphin and the pantropical spotted dolphin.

MGEL (2022) indicates that the highest annual density of Atlantic spotted dolphins in the buffered Lease area occurs in August and is estimated to be 0.01505 individuals per 1 km (0.54 NM) grid square.

According to the available data and site-specific information summarized above, the likelihood of spotted dolphins to occur in the Project area is high.

Bottlenose Dolphin (*Tursiops truncatus*)

Bottlenose dolphins reach lengths of 1.8 to 4 m (6 to 13 ft) and range in color from light gray to black on their dorsal surface, with light grey to white coloration on their ventral surface (NOAA Fisheries 2022i). In nearshore waters, bottlenose dolphins are often smaller and lighter in color compared to offshore individuals (NOAA Fisheries 2022i). Bottlenose dolphins commonly travel alone or in groups, and groups frequently break apart and re-form during travel (NOAA Fisheries 2022i). They are considered generalist feeders and consume a wide variety of organisms, including fishes, squids, and shrimps and other crustaceans (T.A. Jefferson, Webber, and Pitman 2008). Bottlenose dolphins use the full water column for feeding and have been found to dive on a regular basis, although they spend the majority of their time near the surface (Hastie, Wilson, and Thompson 2014). A study conducted on offshore populations of bottlenose dolphins found that they regularly dove up to 450 m (1476 ft) during the night, with almost half of all night-time dives lasting 5 minutes or more (Klatsky, Wells, and Sweeney 2007). This same study found that during the day, offshore bottlenose dolphins tend to take shallower, shorter dives with 96 percent of dives occurring within 50 m (164 ft) of the surface and over half the dives lasting less than one minute (Klatsky, Wells, and Sweeney 2007).

Common bottlenose dolphins in U.S. Atlantic waters are divided into multiple offshore, estuarine, and coastal stocks. Within the western North Atlantic there are two distinct bottlenose dolphin forms, or ecotypes: coastal and offshore. The two forms are genetically and morphologically distinct, though regionally variable (T.A. Jefferson, Webber, and Pitman 2008), and in areas north of Cape Hatteras, North Carolina, the coastal form is likely restricted to waters <25 m (<82 ft) deep (R. D. Kenney 1990). Bottlenose dolphins in waters off the Maryland coast belong to one of two stocks: the Western North Atlantic offshore stock or the Western North Atlantic northern migratory coastal stock. The best available population estimate for the offshore stock of bottlenose dolphins in the Western North Atlantic is 62,851 (S.A. Hayes et al. 2020). The best available estimate for the northern migratory coastal stock of bottlenose dolphins in the western North Atlantic is 6,639 (Hayes et al. 2021). Generally, bottlenose dolphin population density appears to be higher within inner shelf areas than offshore (T.A. Jefferson, Webber, and Pitman 2008).

The estimated mean annual fishery-related mortality and serious injury of the western North Atlantic offshore stock from 2013 to 2017 was 28 (S.A. Hayes et al. 2020). For the western North Atlantic northern migratory coastal stock, this number ranged between 12 and 21 for the period of 2014 to 2018 and is likely an underestimate due to missing data (Hayes et al. 2021). Bottlenose dolphins from New York to Florida experienced an Unusual Mortality Event (UME) from July 2013 to March 2015 caused by cetacean morbillivirus infections (NOAA Fisheries 2021a). The Western North Atlantic northern migratory coastal stock is classified as depleted under the MMPA and is also classified as a strategic stock (Hayes et al. 2021). The Western North Atlantic offshore stock is not listed as depleted under the MMPA and is not classified as a strategic stock (S.A. Hayes et al. 2020). Neither stock is classified as threatened or endangered under the ESA (Hayes et al. 2021; S.A. Hayes et al. 2020).

Bottlenose dolphins *a*re distributed worldwide in temperate and tropical waters, including nearshore harbors, bays, gulfs, and estuaries and open ocean farther offshore. Coastal bottlenose dolphins are primarily found in shallower coastal and estuarine waters (Hayes et al. 2021). Bottlenose dolphins of the offshore morphotype are distributed primarily along the outer continental shelf and continental slope in the northwest Atlantic Ocean from Nova Scotia to the southern Florida peninsula, but have been documented to occur relatively close to the shore south of Cape Hatteras, North Carolina (Hayes et al. 2021). Coastal form bottlenose dolphins are continuously distributed along the Atlantic Coast from south of New York to around the Florida peninsula and may overlap with the offshore form off the southeastern U.S. (S.A. Hayes et al. 2020). Torres et al. (Torres et al. 2003) found a statistically significant break in the distribution of coastal and offshore morphotypes at 34 km from shore based upon genetic analysis of tissue samples collected from New York to Florida. The offshore bottlenose dolphin morphotype was found exclusively seaward of 34 km (18.4 NM) and in waters deeper than 34 m (111 ft), and all animals were of the coastal morphotype within 7.5 km (4.1 NM) of the shore (Torres et al. 2003). However, offshore morphotype dolphins have been found in waters as shallow as 13 m (42 ft) and as close to shore as 7.3 km (4 NM) (Garrison 2003). Therefore, bottlenose dolphins of both the offshore and coastal stocks may be present in the region of the Lease area. The Western North Atlantic northern migratory coastal stock occupies waters between Virginia and Long Island during the warm water months and migrates in late summer and fall to waters off the coast of North Carolina (Hayes et al. 2021). Migratory patterns of the western North Atlantic offshore stock are not well understood (S.A. Hayes et al. 2020).

Common bottlenose dolphins can live up to 40 years (NOAA Fisheries 2022i). Females begin to reproduce when they are between 5 to 15 years of age and give birth approximately every 3 to 6 years (NOAA Fisheries 2022i). Gestation lasts for 12 months, and mothers nurse their calves for 20 months (NOAA Fisheries 2022i). Little information is available on the mating and calving habitats preferred by bottlenose dolphins in the western north Atlantic, and critical habitat has not been designated for bottlenose dolphins off the U.S. Atlantic coast.

Bottlenose dolphins are in the Mid Frequency Cetaceans hearing group. The underwater hearing range of bottlenose dolphins is 150 Hz to 135 kHz (C.S. Johnson 1967; Ljungblad, Scoggins, and Gilmartin 1982). Their best underwater hearing occurs between 15 and 110 kHz, and threshold levels range from 42 to 52 dB RL (Au and L. 1993). Nachtigall et al. (2000) more recently measured the bottlenose dolphin range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz. Bottlenose dolphins produce a variety of whistles, echolocation clicks, low-frequency narrow, “bray” and burst-pulse sounds with frequencies as low as 50 Hz and as high as 150 kHz with dominant frequencies at 0.3 to 14.5 kHz, 25 to 30 kHz, and 95 to 130 kHz (Janik 2000).

Bottlenose dolphins were the most frequently observed marine mammal species during multiple recent surveys of the Lease area and surrounding waters (H. Bailey et al. 2018; S. Barco et al. 2015; Williams et al. 2015b). This species was observed primarily in warmer months; the number of sightings was greatest in spring, and group size and individual abundance was highest in summer (S. Barco et al. 2015). This pattern suggests that bottlenose dolphins arrive in or migrate through the study area in spring, remain in the region during summer, and begin to vacate the region with the arrival of cold weather in the late fall. Bottlenose dolphins were observed in groups ranging from one to 230 individuals (S. Barco et al. 2015), and were most acoustically active in the evening and early morning hours (H. Bailey et al. 2018). Generally, detections of bottlenose dolphins occurred more frequently to the west of the Lease area during spring, summer, and fall and further offshore during the winter (S. Barco et al. 2015). Williams et al. (2015b) states that bottlenose dolphins are the species that is most likely to be exposed to construction activities in the Lease area during the spring, summer and fall.

MGEL (2022) indicates that the highest average density of both stocks of bottlenose dolphins in the buffered Lease area occurs in August and is estimated to be 0.49274 and 0.11052 individuals per 1 km (0.54 NM) grid square for the Western North Atlantic Northern Migratory Coastal and Western North Atlantic Offshore stocks, respectively.

According to the available data and site-specific information summarized above, the likelihood of bottlenose dolphins to occur in the Project area is high.

Harbor Porpoise (*Phocoena phocoena*)

The Harbor porpoise is a small, stocky cetacean with a blunt, short-beaked head, a dark gray back, and a white underside (NOAA Fisheries 2022o). Harbor porpoises reach a maximum length of 1.8 m (6 ft) and feed on a wide variety of small fishes and cephalopods (R.D. Kenney and Vigness-Raposa 2009; Reeves, Stewart, and Clapham 2002). Most harbor porpoise groups are small, usually between five and six individuals, although they aggregate into large groups for feeding or migration (T.A. Jefferson, Webber, and Pitman 2008). A study published in 2011 by the Canadian Journal of Fisheries and Aquatic Sciences found that harbor porpoises make fewer but deeper dives during nighttime (Westgate et al. 2011). A study conducted on two harbor porpoises off the coast of Japan found that the two tagged porpoises dived continuously with maximum dive depths ranging from 70 to 98 m (230 to 322 ft), and 70% of their diving time was spent at depths of 20 m (66 ft) or less (Otani et al. 1998).

There are four distinct populations of harbor porpoise in the Western Atlantic: Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland (Hayes et al. 2019). Harbor porpoises observed off the U.S. mid-Atlantic coast are considered part of the Gulf of Maine/Bay of Fundy stock. The current best abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is 95,543 individuals (Hayes et al. 2021). The total annual estimated average human-caused mortality to this stock is 164 harbor porpoises per year, 163 of which are fisheries-related (Hayes et al. 2021). A population trend analysis has not been conducted for this stock (Hayes et al. 2022). The Gulf of Maine/Bay of Fundy stock is not classified as strategic, and harbor porpoises are not listed as threatened or endangered under the ESA.

Harbor porpoises are usually found in shallow waters of the continental shelf, though they occasionally occur in deeper offshore waters (NOAA Fisheries 2022o). This species is commonly found in bays, estuaries, harbors, and fjords less than 200 m (650 ft) deep (NOAA Fisheries 2022o). Harbor porpoises are generally concentrated along the continental shelf within the northern Gulf of Maine and southern Bay of Fundy region during the summer months, generally in waters less than 150 m (492 ft) deep (July-September) (Hayes et al. 2022). During fall (October-December) and spring (April-June), harbor porpoises are more widely dispersed from New Jersey to Maine (Hayes et al. 2022). During winter (January-March), they are found in lower densities off the coast of New York to New Brunswick and in higher densities off the coast of New Jersey and North Carolina (Hayes et al. 2022). Off the coast of Maryland, harbor porpoises have been acoustically detected regularly between January and May (Hayes et al. 2022). There are no known seasonal migration routes for harbor porpoises, although studies suggest that there are seasonal inshore-offshore movements that may be influenced by prey availability or sea ice (NOAA Fisheries 2022o). Specific locations used for mating and calving of harbor porpoises are poorly documented and no critical habitat areas have been designated for this species.

Harbor porpoises are in the High Frequency Cetaceans hearing group. Based on a study that examined a two-year-old harbor porpoise, the range of best hearing for this species is between 16 and 140 kHz, with a reduced sensitivity around 64 kHz and a maximum sensitivity between 100 and 140 kHz (R.A. Kastelein, Bunskoek, and Hagedoorn 2002). This maximum frequency corresponds with the peak frequency of harbor porpoise echolocation clicks, which range between 120 and 130 kHz (R.A. Kastelein, Bunskoek, and Hagedoorn 2002). Harbor porpoises are classified as high frequency hearing specialists and produce narrowband high-frequency echolocation clicks (Madsen et al. 2006). Despite their high frequency hearing, harbor porpoises are well known for exhibiting sometimes strong behavioral reactions to low frequency sound (Jakob Tougaard et al. 2009; R. Kastelein 2013; R. A. Kastelein et al. 2017; Graham et al. 2017; Graham et al. 2019). Several studies have been conducted to evaluate the hearing sensitivity of harbor porpoises to different anthropogenic sounds. One study found that exposure to impulsive low-frequency sounds, such as those produced by pile driving, can reduce hearing in harbor porpoises at higher frequencies (R.A. Kastelein et al. 2015). However, this hearing damage was not within the frequency range of their echolocation signals (R.A. Kastelein et al. 2015). A simulation approach also indicated that the simultaneous implementation of a combination of soft start protocols, SEL_{ss} regulation, and previous deterrence could limit the risk of TSS exposure in harbor porpoises during wind energy development (Schaffeld et al. 2020).

Recent multi-year visual and acoustic surveys specific to the Lease area and surrounding waters indicate that harbor porpoises are present but uncommon in the region. Though this species was not observed during the Barco et al. (2015) study, acoustic monitoring indicates that harbor porpoises are present in the vicinity of the Lease area, primarily between January and May (H. Bailey et al. 2018). These findings align with observations from the Williams et al. (2015b) survey, which observed one porpoise in the Maryland Wind Energy Area in March of 2013. Harbor porpoise presence is likely variable between years, and this species was most acoustically active during the evening and early morning hours (H. Bailey et al. 2018).

MGEL (2022) indicates that the highest average density of harbor porpoises in the buffered Lease area occurs in January and is estimated to be 0.03653 individuals per 1 km (0.54 NM) grid square.

According to the available data and site-specific information summarized above, the likelihood of harbor porpoises to occur in the Project area is high.

Pilot Whales (*Globicephala* spp.)

Two species of pilot whale occur within the Western North Atlantic: the long-finned pilot whale (*Globicephala melas*) and the short-finned pilot whale (*G. macrorhynchus)*. Though these species differ in size and coloration patterns, they are difficult to differentiate at sea and cannot be reliably identified during most surveys (NOAA Fisheries 2022s, 2022~; Rone and Pace 2012). Therefore, some of the information below refer to *Globicephala* spp. (NOAA Fisheries 2022s, 2022~; Rone and Pace 2012).

Pilot whales have bulbous heads, are dark gray, brown, or black in color, and have a stocky, sturdy body (NOAA Fisheries 2022s, 2022~). Short-finned pilot whales range in length from 3.7 to 4.3 m (12 to 24 ft), and long-finned pilot whales range in length from 5.8 to 7.6 m (19 to 25 ft) (NOAA Fisheries 2022s, 2022~). Short-finned and long-finned pilot whales form relatively stable aggregations of 25 to 50 or 10 to 20 individuals, respectively (NOAA Fisheries 2022s, 2022~) Long-finned pilot whales can sometimes be found in very large aggregations of several hundred to a thousand individuals (NOAA Fisheries 2022s).

Long-finned pilot whales consume fish, cephalopods, and crustaceans, while short-finned pilot whale feed primarily on squid, although they also take small to medium-sized fish and octopus when available (NOAA Fisheries 2022s, 2022~). Short-finned pilot whales mainly feed in moderately deep water at depths of 304 m (1,000 ft) or more and perform high-speed dives to chase and capture large squid (NOAA Fisheries 2022~). Long-finned pilot whales can dive to depths of 608 m (2,000 ft) for up to 16 minutes to feed on fish, although most feeding occurs during the night at a depth of between 198 and 503 m (650 and 1,650 ft) (NOAA Fisheries 2022s). Long-finned pilot whales often display various active behaviors at the water surface, and sometimes approach slow-moving vessels (NOAA Fisheries 2022s). Long-finned pilot whales can dive to depths of 608 m (2,000 ft) for up to 16 minutes to feed on fish, although most feeding occurs during the night at a depth of between 198 and 503 m (650 and 1,650 ft) (NOAA Fisheries 2022s). One study found that short-finned pilot whales typically engage in shallow dives, rest, travel, and social activity during the day, and take deeper dives at night to search for vertically migrating prey (Baird et al. 2003). Another study also documented this behavior in long-finned pilot whales, which were observed to remain within the top 16 m of the water column during the day and take deeper, longer dives at night when vertically migrating prey became more accessible (Baird et al. 2002). These studies suggest that the differences in diving behavior between short-finned and long-finned pilot whales may be motivated by differences in prey depth (Baird et al. 2003; Baird et al. 2002).

Within the U.S. Atlantic EEZ, both pilot whale species are categorized into Western North Atlantic stocks. The best available population estimates for short-finned and long-finned pilot whales in the Western North Atlantic are 28,924 and 39,215 individuals, respectively (Hayes et al. 2022). These estimates are from summer 2016 surveys covering waters from central Florida to the lower Bay of Fundy (short-finned), and summer 2016 surveys covering waters from central Virginia to Maine and in Canadian waters from the U.S. border to Labrador (long-finned) (Hayes et al. 2022). Total annual estimated average fishery-related mortality or serious injury during 2015 to 2019 was 136 short-finned pilot whales and nine long-finned pilot whales (Hayes et al. 2022). Based on abundance estimates from 2004, 2011, and 2016, there was no statistically significant population trend for the Western North Atlantic stock of short-finned pilot whales, and a population trend analysis has not been conducted for this long-finned pilot whale stock (Hayes et al. 2022). The Western North Atlantic stocks of short-finned and long-finned pilot whales are not considered strategic under the MMPA and neither species is listed as threatened or endangered under the ESA. Based on abundance estimates from 2004, 2011, and 2016, there is no statistically significant population trend for short-finned pilot whales and a population trend analysis has not been conducted for the long-finned pilot whale stock (Hayes et al. 2022).

Short-finned pilot whales have a tropical and temperate distribution (NOAA Fisheries 2022~), while long-finned pilot whales occur in subpolar and deep temperate waters, excluding the North Pacific (NOAA Fisheries 2022s). The two species overlap spatially between the southern flank of Georges Bank and New Jersey, where they both occur along the mid-Atlantic shelf break (Payne and Heinemann 1993; G.T. Waring et al. 2015b). Short-finned pilot whales have occasionally stranded as far north as Massachusetts, and long-finned pilot whales have stranded as far south as Florida (Pugliares et al. 2016). The latitudinal ranges of the two species therefore remain uncertain, although most pilot whale sightings south of Cape Hatteras are expected to be short-finned pilot whales, and most sightings north of ~42°N are expected to be long-finned pilot whales (Hayes et al. 2022). Sightings of pilot whales in the western North Atlantic occur primarily near the continental shelf break from Florida to the Nova Scotian Shelf (Mullin and Fulling 2003). In U.S. Atlantic waters, pilot whales are distributed principally along the continental shelf edge off the northeastern U.S. coast in winter and early spring (CeTAP 1982; Payne and Heinemann 1993;

Abend and Smith 1999). In late spring, long-finned pilot whales move into the Gulf of Maine and northern waters, and onto Georges Bank, and remain in these regions through late autumn (CeTAP 1982; Payne and Heinemann 1993). Specific pilot whale calving areas are not known, though a study of short-finned pilot whales off the coast of Portugal found that they may use the same area for resting, socializing, foraging, breeding, calving, and birthing (Alves and F.M.A. 2013). Critical habitat areas have not been designated for pilot whales.

Both long-finned and short-finned pilot whales are in the Mid Frequency Cetaceans hearing group. Peak hearing sensitivity of a captive short-finned pilot whale was measured at approximately 40 kHz, and the upper limit of functional hearing was determined to fall between 80 and 100 kHz (Schlundt et al. 2011). Pilot whales echolocate with a precision similar to bottlenose dolphins. Short-finned pilot whales produce sounds as low as 280 Hz and as high as 100 kHz, with dominant frequencies between 2 to 14 kHz and 30 to 60 kHz (Fish and Turl 1976; Scheer, Hofmann, and Behr 1998). (Caldwell & Caldwell 1969). The mean frequency of calls produced by short-finned pilot whales is 7,870 Hz, much higher than the mean frequency of calls produced by long-finned pilot whales (Rendell et al. 1999). As demonstrated during click production, pilot whales echolocate with a precision similar to bottlenose dolphins (Evans 1973), and source levels of clicks have been measured as high as 180 dB (Fish and Turl 1976).

Pilot whales tend to occur at or beyond the continental shelf break, and therefore are most likely to be found east of the Maryland Wind Energy Area (Williams et al. 2015a). Recent multi-year visual and acoustic surveys specific to the Lease area and surrounding waters did not yield any confirmed pilot whale detections or sightings (Williams et al. 2015b, 2015a; S. Barco et al. 2015).

MGEL (2022) indicates that the average annual density of pilot whales in the buffered Lease area is estimated to be 0.00039 individuals per 1 km (0.54 NM) grid square.

According to the available data summarized above the likelihood of pilot whales to occur in the Project area is high.

Pantropical Spotted Dolphin (*Stenella attenuata*)

Two species of oceanic spotted dolphins can occur within the northwestern Atlantic: the pantropical spotted dolphin (*Stenella attenuata*), and the Atlantic spotted dolphin (*S. frontalis*, see section 4.2.1). *Stenella* species in the Atlantic can be difficult to distinguish at sea, and hybrids have been documented (Kingston, Adams, and Rosel 2009). Pantropical spotted dolphins are relatively small, ranging in size from 1.8 to 2.1 m (6 to 7 ft), and feed primarily on mesopelagic cephalopods and fish (NOAA Fisheries 2022y). Pantropical spotted dolphins are quite social are often observed in groups ranging in size from several hundred to 1,000 individuals and will often school with other dolphin species (NOAA Fisheries 2022y). During daylight hours, pantropical spotted dolphins generally occur in waters ranging from 300 and 1,000 m (984 and 3280 ft) in depth but move to deeper waters a night where they hunt for mesopelagic cephalopods and fishes (NOAA Fisheries 2022y). Data from a study conducted in the eastern tropical Pacific suggests that pantropical spotted dolphins are nocturnal feeders; dolphins were mainly found at depths between 10 and 20 meters (33 to 66 ft) during daytime hours, but exhibited longer and deeper dives at night, tracking the vertical movement of prey organisms (M.D. Scott and Chivers 2009).

Pantropical spotted dolphins in U.S. Atlantic waters belong to the Western North Atlantic Stock. The best available abundance estimate for pantropical spotted dolphins in the western North Atlantic is 6,593, based on summer 2016 surveys covering waters from the lower Bay of Fundy to central Florida (S.A. Hayes et al. 2020). Total annual estimated fishery-related mortality and serious injury to pantropical spotted dolphins between 2013 to 2017 was presumed to be zero (Hayes et al., 2020). Based on abundance estimates from 2004, 2011, and 2016, there is statistically significant population trend was identified (S.A. Hayes et al. 2020). This stock is not classified as strategic, and pantropical spotted dolphins are not listed as threatened or endangered under the ESA (S.A. Hayes et al. 2020).

Pantropical spotted dolphins occur throughout tropical and sub-tropical waters of the world from roughly 40°N to 40°S (T. A. Jefferson, Webber, and Pitman 2015). Pantropical spotted dolphin sightings on the U.S. east coast are concentrated in the slope waters north of Cape Hatteras and in deeper waters offshore off the mid-Atlantic states, though some sightings have been reported from as far north as George's Bank (S.A. Hayes et al. 2020). The migration patterns and life history of this species is not well understood, but pantropical spotted dolphins are believed to inhabit more inshore waters in the fall and winter months, and migrate to offshore areas in the spring (NOAA Fisheries 2022y). Calving behavior in the Western North Atlantic stock of Pantropical spotted dolphins is not well studied, but a study conducted on Hawai'i stocks found that peak calving occurred between July and October (Baird and R.W. 2016). Critical habitat areas have not been designated for the pantropical spotted dolphin.

Pantropical spotted dolphins are in the Mid Frequency Cetaceans hearing group. Very limited data about the hearing sensitivities of pantropical spotted dolphins is available. However, this species produces whistles with a frequency range of 3.1 to 21.4 kHz (W.J. Richardson 1995) and click sounds that are typically bimodal in frequency with peaks at 40 to 60 kHz and 120 to 140 kHz (Schotten et al. 2004). Click sounds can reach source levels of up to 220 dB re 1 µPa at 1m (Schotten et al. 2004).

Recent visual and acoustic surveys conducted by Barco et al. (2015), Williams et al. (2015c; 2015b), and Bailey et al. (2018) indicate that *Stenella* spp. dolphins have a limited presence in the region and are most likely to be present in the summer months. Barco et al. (2015) observed one group of 45 spotted dolphins east of the Lease area in July 2014, and Williams et al. (2015c) sighted four individuals during a shipboard survey outside of Maryland waters in June 2013. No spotted dolphins were detected during a two-year acoustic survey of the Lease area and surrounding region (H. Bailey et al. 2018).

Spotted dolphins (*Stenella* spp.[16]) were observed 5 times (56 individuals) during the 2015 HRG survey of the Lease Area, and once (10 individuals) during the 2016 HRG survey of the proposed transmission cable route in offshore Maryland waters. Pantropical spotted dolphins were observed three times during the 2021 and 2022 surveys of the Lease area and offshore export cable corridors.

MGEL (2022) indicates that the average annual density of pantropical spotted dolphins in the buffered Lease area is estimated to be 0.00004 individuals per 1 km (0.54 NM) grid square.

According to the available data and site-specific information summarized above, the likelihood of spotted dolphins to occur in the Project area is high.

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[16] *Stenella* spp. includes both the Atlantic spotted dolphin and the pantropical spotted dolphin

Risso's Dolphin (*Grampus griseus*)

Risso's dolphins are medium sized cetaceans that range in length from 2.6 to 4 m (8.5 to 13 ft) (NOAA Fisheries 2022{). This species generally feeds at night on a variety of fish, cephalopods, and krill, though their diet predominantly consists of squid (NOAA Fisheries 2022{). Risso's dolphins are usually found in groups of 10 to 30 animals, though solitary individuals or pairs are sometimes observed, and very large aggregations of hundreds of thousands of individuals have been reported (NOAA Fisheries 2022{). This species feeds primarily at night on a variety of fish, cephalopods, and krill, although most of their diet consists of squid. Though Risso's dolphins are active at the water surface, they can dive to at least 305 m (1,000 ft), and are generally found in deep offshore waters near the continental shelf edge and slope (NOAA Fisheries 2022{).

Risso's dolphins along the U.S. east coast belong to the Western North Atlantic stock, generally occurring from Florida to Eastern Newfoundland (Hayes et al. 2022). The best population estimate for the Western North Atlantic stock of Risso's dolphin is approximately 35,215 individuals (Hayes et al. 2022). This estimate was generated from the sum of surveys conducted by the NEFSC (Northeast Fisheries Science Center) and Department of Fisheries and Ocean Canada from Newfoundland to Florida in 2016 (Hayes et al. 2022). Total annual estimated average fishery-related mortality or serious injury to this stock during the period of 2015 to 2019 was 35 individuals, the majority of which resulted from interactions with mid-Atlantic bottom trawling gear (Hayes et al. 2022). A population trend analysis has not been conducted for this stock due to a lack of precise abundance estimates (Hayes et al. 2022). The Western North Atlantic Stock of Risso's dolphins is not classified as depleted or strategic (Hayes et al. 2022), and Risso's dolphins are not listed as threatened or endangered under the ESA. A population trend analysis has not been conducted for this stock due to imprecise abundance estimates (Hayes et al. 2022).

Risso's dolphins generally inhabit temperate and tropical zones of oceans worldwide, though they prefer deeper offshore waters near the continental shelf edge and slope between 30 and 45 degrees in latitude (NOAA Fisheries 2022{). This species has been observed in association with Gulf Stream features (including warm-core rings and the Gulf stream north wall) and strong bathymetric features in continental shelf and oceanic waters (G.T. Waring et al. 1992; Hamazaki 2002). Very little is known about the migration patterns of Risso's dolphins, though movements may be influenced by squid spawning or oceanographic conditions (NOAA Fisheries 2022{). Risso's dolphins occur from Cape Hatteras northeast to Georges Bank (35˚ to 42˚N) during the spring, summer, and fall, and are present in oceanic waters of the mid-Atlantic bight in winter (CeTAP 1982; Payne, Selzer, and Knowlton 1984b). This species is known to inhabit waters of the Mid-Atlantic continental shelf edge year-round (Payne, Selzer, and Knowlton 1984b). The timing of mating and calving for the West North Atlantic stock of Risso's dolphins is poorly documented, but the peak of breeding and calving season likely varies geographically (NOAA Fisheries 2022{). Specific areas used for calving have not been documented in the mid-Atlantic (NOAA Fisheries 2022{). Critical habitat areas have not been designated for Risso's dolphins.

Risso's dolphins are in the Mid Frequency Cetaceans hearing group. Audiograms for Risso's dolphins indicate that their hearing sensitivity ranges in frequency from 1.6 to 110 kHz, with optimal hearing between 4 and 80 kHz (P. E. Nachtigall et al. 1995). It is suspected that like other mammals, Risso's dolphins lose their higher frequency hearing as they age. A stranded infant male Risso's dolphin was studied in Portugal and that individual's hearing ranged from 4 to 150 kHz (P.E. Nachtigall et al. 2005). A study conducted on Risso's dolphins off the coast of Australia found that vocalizations consisted of broadband clicks, barks, buzzes, grunts, chirps, whistles, and simultaneous whistle/burst-pulse sounds and ranged from 30 Hz to 22 kHz (Corkeron, P.J., and Van Parijs 2001).

Recent multi-year visual and acoustic surveys specific to the Lease area and surrounding waters indicate that Risso's dolphins are rare in the region. Though this species was not observed during the Barco et al. (2015) or Bailey et al. (2018), study, one Risso's dolphin was sighted during aerial surveys in waters offshore of Maryland in October of 2013 (Williams et al. 2015b, 2015a).

MGEL (2022) indicates that the highest average density of Risso's dolphin in the buffered Lease area occurs in December and is estimated to be 0.00169 individuals per 1 km (0.54 NM) grid square.

According to the available data summarized above the likelihood of Risso's dolphins to occur in the Project area is high.

Short-Beaked Common Dolphin (*Delphinus delphis*)

The short-beaked common dolphin, herein referred to as the "common dolphin," is one of the most abundant and widely distributed cetacean species and occurs in temperate, tropical, and subtropical regions (T.A. Jefferson, Webber, and Pitman 2008). Common dolphins can reach 2.7 m (9 ft) in length and have a distinct color pattern with a white ventral patch, yellow or tan flank, and dark gray dorsal "cape" (NOAA Fisheries 2022}). This species primarily feeds at night on squid and small fish, including species that school in proximity to surface waters as well as mesopelagic species found near the surface at night (IUCN 2010; NOAA Fisheries 2022}). Common dolphins generally gather in schools of hundreds of individuals, though this species is also found in mega-pods of thousands of individuals (NOAA Fisheries 2022}). Dives are typically to less than 30 m (100 ft) but dives to over 304.8 m (1000 ft) have been recorded (NOAA Fisheries 2022}).

Common dolphins along the U.S. east coast belong to the Western North Atlantic stock, generally occurring from Cape Hatteras, North Carolina to the Scotian Shelf (Hayes et al. 2022). The best population estimate for the Western North Atlantic stock of common dolphin is approximately 172,947 individuals (Hayes et al. 2022). Total annual estimated average fishery-related mortality or serious injury to this stock during 2015-2019 was 390.4 individuals (Hayes et al. 2022). No data on population trends for this stock is current available (Hayes et al. 2022). The Western North Atlantic stock is not classified as depleted, and the common dolphin is not listed as threatened or endangered under the ESA (Hayes et al. 2022). The biggest threat to common dolphins is entanglement in fishing gear (NOAA Fisheries 2022}).

Common dolphins are a highly seasonal, migratory species. In waters off the northeastern U.S. coast this species is distributed along the continental shelf between the 100 to 2000 m (328 to 6,562 ft) isobaths and is associated with Gulf Stream features (CeTAP 1982; Selzer and Payne 1988; G.T. Waring et al. 1992; Hamazaki 2002). Common dolphins occur from Cape Hatteras northeast to Georges Bank (35° to 42°N) during mid-January to May and move as far north as the Scotian Shelf from mid-summer to autumn (Selzer and Payne 1988). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs when water temperatures exceed 11°C (52°F) (Sergeant, Mansfield, and Beck 1970; Gowans and Whitehead 1995). Specific habitats used by common dolphins for mating and calving in the mid-Atlantic are not well documented, and critical habitat areas have not been designated for this species.

Common dolphins are in the Mid-Frequency Cetaceans hearing group. Though little is known about the hearing sensitivities of the common dolphin, the hearing threshold of a common dolphin was measured with an auditory range from 10 to 150 kHz, with greatest sensitivity between 60 and 70 kHz (Popov and Klishin 1998). Common dolphins produce sounds as low as 0.2 kHz and as high as 150 kHz, with dominant frequencies at 0.5 to 18 kHz and 30 to 60 kHz (Au and L. 1993; Moore and Ridgway 1995). Signal types consist of clicks, squeals, whistles, and creaks (Evans 1994). The whistles of common dolphin's range between 3.5 and 23.5 kHz (Ansmann et al. 2007). Most of the energy of common dolphin echolocation clicks is concentrated between 15 and 100 kHz (Croll et al. 1999). In the North Atlantic, the mean source level of common dolphin whistles was approximately 143 dB with a maximum of 154 (Croll et al. 1999).

Recent multi-year studies in the Lease area and surrounding waters suggest that common dolphins occur year-round in the region but exhibit strong seasonal changes in abundance. This species was the second most frequently observed delphinid in Maryland waters, after bottlenose dolphins (Williams et al. 2015b), and was observed in groups ranging in size from one to 75 individuals (S. Barco et al. 2015). Common dolphins are cold tolerant species, and likely migrate into or through the region of the Lease area in the fall, remain in the area over the winter, and depart in the spring (Williams et al. 2015b). This pattern was observed during the Barco et al. (2015), Williams et al. (2015b), and Bailey at al. (2018) studies; common dolphins were abundant in the region in the fall, winter, and spring months, and were not detected or observed in the summer. During these time periods, acoustic activity was greatest during the evening and early morning hours (H. Bailey et al. 2018). Interestingly, though the number of sightings of this species peaked in winter, group size and the number of observed individuals was greatest in spring (S. Barco et al. 2015), and common dolphins were most often detected offshore of the Lease area on the outer continental shelf.

MGEL (2022) indicates that the highest average density of common dolphins in the buffered Lease area occurs in December and is estimated to be 0.07939 individuals per 1 km (5.4 NM) grid square.

According to the available data and site-specific information summarized above, the likelihood of common dolphins to occur in the Project area is high.

Sperm Whale (*Physeter macrocephalus*)

The sperm whale is the largest of all toothed whales; males can reach 16 m (52 ft) in length and weigh over 40,823 kg (45 tons), and females can attain lengths of up to 11 m (36 ft) and weigh over 13,607 kg (15 tons) (Perrin, Wursig, and Thewissen 2002). This species tends to be uniformly dark gray in color, though lighter spots may be present on the ventral surface. Sperm whales frequently dive to depths of over 400 m (1,300 ft) in search of their prey, which includes large squid, fishes, octopus, sharks, and skates (Perrin, Wursig, and Thewissen 2002). Sperm whales have a worldwide distribution in deep water and range from the equator to the edges of the polar ice packs (H Whitehead 2002). Sperm whales form stable social groups and exhibit a geographic social structure; females and juveniles form mixed groups and primarily reside in tropical and subtropical waters, whereas males are more solitary and wide-ranging and are found at higher latitudes (H Whitehead 2002; H. Whitehead 2003).

Though Reeves and Whitehead (1997) and Dufault et al. (1999) suggest that sperm whale populations lack clear geographic structure, all sperm whales found off the U.S. Atlantic coast are part of the North Atlantic stock. The best recent population estimate for the North Atlantic stock of sperm whale is 4,349 individuals (S.A. Hayes et al. 2020). This estimate was generated from the sum of surveys conducted in 2016 (S.A. Hayes et al. 2020). There were no documented reports of fishery-related mortalities or serious injuries to sperm whales in US Atlantic EEZ waters during 2013-2017 (S.A. Hayes et al. 2020). The status of the North Atlantic sperm whale stock relative to OSP is unknown, but this stock is classified as depleted and strategic under the MMPA (S.A. Hayes et al. 2020). Sperm whales are also listed as endangered under the ESA.

Sperm whales mainly reside in deep-water habitats on the outer continental shelf, along the shelf edge, and in mid-ocean regions (S.A. Hayes et al. 2020). Sperm whale migratory patterns are not well defined. However, in U.S. Atlantic EEZ waters sperm whales appear to exhibit seasonal movement patterns (CeTAP 1982; T.M. Scott and Sadove 1997). Sperm whales are concentrated to the east and north of Cape Hatteras during winter months (S.A. Hayes et al. 2020). This distribution shifts northward in spring, when sperm whales are most abundant in the central portion of the mid-Atlantic Bight to the southern region of Georges Bank (S.A. Hayes et al. 2020). In summer, sperm whale distribution expands to include the area east and north of Georges Bank and the continental shelf to the south of New England (S.A. Hayes et al. 2020). In fall months, sperm whales are most abundant on the continental shelf to the south of New England and remain abundant along the continental shelf edge in the mid-Atlantic Bight (S.A. Hayes et al. 2020). There are no critical habitat areas designated for the sperm whale (S.A. Hayes et al. 2020).

Recent visual and acoustic surveys did not yield any confirmed sightings or detections of sperm whales in the region of the Lease (S. Barco et al. 2015; H. Bailey et al. 2018; Williams et al. 2015b) or in the mid-Atlantic (Williams et al. 2015a).

MGEL (2022) indicates that the highest average density of sperm whale in the buffered Lease area occurs in December and is estimated to be 0.00006 individuals per 1 km (5.4 NM) grid square.

9.1.2 Pinnipeds

The status and distribution of two pinniped species, both federally protected by the MMPA, are discussed below. Both gray and harbor seals are rare in the Mid-Atlantic region but are considered here because one unidentified seal was observed during the 2017 HRG survey Onshore Export Cable Corridor 1 in Indian River Bay (Alpine 2017).

Harbor Seal (*Phoca vitulina*)

The harbor seal, also known as the common seal, is found throughout coastal waters of the Atlantic Ocean and adjoining seas above 30°N and is the most abundant pinniped on the east coast of the United States (Hayes et al. 2022). This species can reach approximately two meters (6 ft) in length and has a blue-gray back with light and dark speckling (NOAA Fisheries 2022p). The harbor seal diet consists primarily of fish, shellfish, and crustaceans, and this species generally forms groups as a means of avoiding predation (NOAA Fisheries 2022p). Harbor seals complete both shallow and deep dives when hunting, dependent upon prey availability (Tollit et al., 1997). Pups can swim at birth and can dive for up to two minutes when they are only two to three days old (NOAA Fisheries 2022p). Adult harbor deals can sleep underwater and come up for air once every 30 minutes (NOAA Fisheries 2022p).

Although the stock structure of the Western North Atlantic population is unknown, it is thought that harbor seals found along the eastern U.S. and Canadian coasts represent one population that is termed the Western North Atlantic stock (Tempte, Bigg, and Wiig 1991; Anderson and Olsen 2010). The best abundance estimate for harbor seals in the Western North Atlantic stock is 61,336 (Hayes et al. 2022). This estimate was derived from a survey along the Maine coast during May and June of 2012 and 2018 (Hayes et al. 2022). For the period of 2015 through 2019 the average human-caused mortality and serious injury to harbor seals is estimated to be 339 individuals per year (Hayes et al. 2022). Though estimated mean change in pup and non-pup harbor seal abundance was steady or declining from 2005 through 2018, these trends were not statistically significant (Hayes et al. 2022). The Western North Atlantic stock of harbor seals is not considered strategic under the MMPA and the harbor seal is not listed as threatened or endangered under the ESA (Hayes et al. 2022). An Unusual Mortality Event, believed to be the result of phocine distemper virus, was declared for pinnipeds on the northeastern coast of the U.S. from July 2018 to the present (NOAA Fisheries 2022d). Though most mortalities have been reported from Maine, New Hampshire, and Massachusetts, strandings have been reported as far south as Virginia (NOAA Fisheries 2022d).

Harbor seals commonly occur in coastal waters and on coastal islands, ledges, and sandbars (T.A. Jefferson, Webber, and Pitman 2008). They are year-round inhabitants of the coastal waters of eastern Canada and Maine (S.K. Katona, Rough, and Richardson 1993), and occur seasonally along the southern New England to New Jersey coastline from September through late May (Schneider and Payne 1983; Barlas 1999; Schroeder 2000; deHart 2002). A general southward movement of harbor seals, from the Bay of Fundy to southern New England waters, occurs in autumn and early winter (Rosenfeld, George, and Terhune 1988; Whitman and Payne 1990; Barlas 1999). A northward movement from southern New England to Maine and eastern Canada occurs prior to the pupping season, which takes place from mid-May through June along the Maine Coast (D.T. Richardson 1976; Wilson 1978; Whitman and Payne 1990; M.K. Kenney 1994; deHart 2002). Although haulout locations in New England and off the east coast of Canada are routinely used yearly and are well documented (Hayes et al. 2022), no harbor seal haulouts in the Project area, including the potential offshore export cable landing locations, are known.

Harbor seals are in the Phocid Pinnipeds (PW) Underwater hearing group. Underwater, harbor seals hearing sensitivity ranges from 0.125 kHz to 100 kHz, with best hearing at frequencies from below one kHz and above 40 kHz (R.A. Kastelein et al. 2009). During the breeding season, male harbor seals defend their breeding territories by using acoustic displays (L. Matthews and Parks 2016). A low frequency vibration known as a “roar” is used to ward off any opposing males attempting to enter the resident male’s territory (L. Matthews and Parks 2016). Harbor seal vocalizations are uncommon outside of the breeding season.

Recent multi-year surveys specific to the Lease area and surrounding waters did not yield any confirmed harbor seal sightings (Williams et al. 2015b, 2015a; S. Barco et al. 2015). Though strandings have been reported in Delaware and Maryland between 2017 and 2019 (Hayes et al. 2017), harbor seals are not regular visitors to the Lease area.

MGEL (2022) indicates that the highest average density of harbor seals in the buffered Lease area occurs in January and is estimated to be 0.16993 individuals per 1 km (0.54 NM) grid square.

According to the available data the likelihood of harbor seals to occur in the Project area is high.

Gray Seal (*Halichoerus grypus*)

Gray seals are the second most common pinniped along the Atlantic coast of the United States (T.A. Jefferson, Webber, and Pitman 2008). Gray seals are large, reaching two to three meters (7.5 to 10 ft) in length, and have a silver-gray coat with scattered dark spots (NOAA Fisheries 2022n). These opportunistic feeders primarily consume fish, crustaceans, squid, and octopus (Bonner 1971; Reeves, Stewart, and Leatherwood 1992; T.A. Jefferson, Webber, and Pitman 2008). Gray seals are generally gregarious, and live in loose colonies while breeding (T.A. Jefferson, Webber, and Pitman 2008). Though gray seals gather in large groups during the breeding and pupping seasons, throughout for the rest of the year they can be found on individually, in small groups, or in larger groups that will meet either at land or sea (NOAA Fisheries 2022n). Though they spend most of their time in coastal waters, gray seals can dive to depths of 300 m (984 ft), and frequently forage in OCS regions (T.A. Jefferson, Webber, and Pitman 2008). Gray seal diving behavior varies between males and females. Female gray seals generally undertook more frequent and longer, but shallower (averaging 49 m [160 ft]), dives than males (57 m [187 ft]), in the seven months before parturition (Beck et al. 2003). Additionally, male gray seals dive depth was consistent throughout the night and day, whereas female gray seals dives were deeper during the day, and shallower at night (Beck et al. 2003).

Gray seals found on the U.S. east coast are part of the Western North Atlantic stock. The size of the Northwest Atlantic gray seal population is estimated separately for the Canadian and U.S. populations, although the rate of exchange between these two populations is unknown. The best abundance estimate of gray seals in U.S. waters is 27,131 individuals, based on the number of pups born in U.S. breeding colonies and the pup-to-adult ratio of the Canadian population (Hayes et al. 2021). For the period of 2014 through 2018, the average estimated human caused mortality and serious injury to gray seals was 4,729 individuals per year for both the U.S. and Canadian populations (Hayes et al. 2021). The current trend for U.S. and Canadian gray seal populations is positive, though year-over-year pup production increase are slowing (Hayes et al. 2021). The Western North Atlantic stock is not considered strategic under the MMPA and gray seals are not listed as threatened or endangered under the ESA (Hayes et al. 2021). An Unusual Mortality Event, believed to be the result of phocine distemper virus, has been declared for pinnipeds on the northeastern coast of the US from July 2018 to the present (NOAA Fisheries 2022d). Though most mortalities have been reported from Maine, New Hampshire, and Massachusetts, strandings have been reported as far south as Virginia (NOAA Fisheries 2022d).

Gray seals inhabit temperate and sub-arctic waters and live on remote, exposed islands, shoals, and unstable sandbars (T.A. Jefferson, Webber, and Pitman 2008). The eastern Canada population ranges from New Jersey to Labrador and is centered at Sable Island, Nova Scotia (Davies 1957; A.W. Mansfield 1966; S.K. Katona, Rough, and Richardson 1993; Lessage and Hammill 2001). There are three breeding concentrations of gray seals in eastern Canada: Sable Island, the Gulf of St. Lawrence, and along the east coast of Nova Scotia (Laviguer and Hammill 1993). In U.S. waters, gray seals currently pup at four established colonies from late December to mid-February: Muskeget and Monomony Islands in Massachusetts, and Green and Seal Islands in Maine (Hayes et al. 2021), all of which are significant distance from the Project area. Following the breeding season, gray seals may spend several weeks ashore in the late spring and early summer while undergoing a yearly molt (NOAA Fisheries 2022n). Critical habitat areas have not been designated for gray seals.

Gray seals are in the Phocid Pinnipeds (PW) Underwater hearing group. Little information is available on the hearing sensitivity of this species. However, captive young gray seals, collected from the coast of Newfoundland, Nova Scotia, and the Gulf of St. Lawrence, were found to produce three to four different types of clicks when submerged (Schusterman, Balliet, and St John 1970). A buzz-like series of clicks (70 to 80 clicks per second) ranged in frequency from 0.5 kHz to 12 kHz (Schusterman, Balliet, and St John 1970). Additional clicking vocalizations produced high-pitched moaning or humming sounds, mooing-type sounds (Schusterman, Balliet, and St John 1970). The use of these vocalizations was observed mainly when the young gray seals were taking part in social interactions (Schusterman, Balliet, and St John 1970).

Recent multi-year surveys specific to the Lease area and surrounding waters did not yield any confirmed gray seal sightings (Williams et al. 2015b, 2015a; S. Barco et al. 2015). Though gray seal strandings have been reported from Delaware and Maryland (Hayes et al. 2021), this species is not a regular visitor to the Lease area.

MGEL (2022) indicates that the highest average densities of gray seals in the buffered Lease Area occurs in January and is estimated to be 0.16993 individuals per 1 km (0.54 NM) grid square.

According to the available data the likelihood of gray seals to occur in the Project area is high.

9.2 Impacts

Marine mammals in the Project area have the potential to be impacted by a variety of factors associated with Project activities. Given the presence of marine mammals in the Project area, US Wind has designed the Project to minimize and mitigate the potential for mortality, injury and disturbance. The potential Project noise and vessel traffic impacts on marine mammals are discussed in more detail in Volume II, Sections 9.2.1, 9.2.2, and 9.2.3.

9.2.1 Construction

Noise

Marine mammals are heavily reliant upon sound for navigation, communication, reproduction, prey location, and predator avoidance. Marine mammal responses to anthropogenic sound exposure can range from apparent indifference to behavioral changes or physical injury, depending upon the sound source and species. In light of these potential impacts, NOAA issued technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing in 2016. A review of the guidance was initiated in 2017 under Executive Order 13795, and the document was confirmed to represent the best available science in 2018. Though the technical content of the Guidance remained unchanged, it was revised to add clarification on implementation procedures (NOAA Fisheries 2018b). The NOAA acoustic guidance bases the criteria for impacts of sound on marine mammals on the potential of a sound source to cause a permanent loss of hearing (permanent threshold shift, PTS). Exposure to sound levels above PTS thresholds results in Level A harassment under the MMPA.

The NOAA criteria divide marine mammals into five functional hearing groups, based upon differences in sensitivity to noise of varying frequencies (Table 9-2). Due to differences in the generalized hearing ranges of marine organisms, PTS thresholds vary between hearing groups (Table 9-3). Because PTS can result from exposure to either impulsive (short duration, characterized by high peak sound pressures and rapid rise times; e.g. impact pile driving) or non-impulsive (brief or prolonged, continuous or intermittent, broadband, narrowband or tonal, e.g. vibratory pile driving) sound sources, NOAA established independent thresholds for each type of source. Additionally, a dual metric threshold was established for impulsive sounds, as exposure to conditions in excess of either peak sound pressure (Lpk) or cumulative sound exposure (SELcum) can result in PTS.

Table 9-2. NOAA Marine Mammal Hearing Groups

Hearing Group	Species that May Occur in the Project Area
Low-Frequency Cetaceans (baleen whales)	North Atlantic right whale
	Fin whale
	Humpback whale
	Minke whale
	Sei whale
Mid-frequency Cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	Atlantic spotted dolphin
	Atlantic white-sided dolphin
	Bottlenose dolphin
	Long-finned pilot whale
	Short-beaked common dolphin
	Short-finned pilot whale
	Sperm Whale
High-frequency Cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger*, & *L. australis*)	Harbor porpoise
Phocid pinnipeds* (true seals)	Harbor seal
	Gray seal

Source: NOAA 2018
*Otariid pinniped hearing group not included as these organisms are not present in the Atlantic EEZ

Table 9-3. NOAA Marine Mammal Acoustic Injury Thresholds

Hearing Group	Generalized Hearing Range[1]	Threshold type[2]	PTS Onset Thresholds (received level)	
			Impulsive	Non-impulsive
Low-Frequency Cetaceans	7 Hz – 35 Hz	SELcum	183 dB	199 dB
		Lpk	219 dB	-
Mid-frequency Cetaceans	150 Hz – 160 Hz	SELcum	185 dB	198 dB
		Lpk	230 dB	-

Table 9-3. NOAA Marine Mammal Acoustic Injury Thresholds

Hearing Group	Generalized Hearing Range[1]	Threshold type[2]	PTS Onset Thresholds (received level)	
			Impulsive	Non-impulsive
High-frequency Cetaceans	275 Hz – 160 Hz	SELcum	155 dB	173 dB
		Lpk	202 dB	-
Phocid pinnipeds in water*	50 Hz – 86 Hz	SELcum	185 dB	201 dB
		Lpk	218 dB	-

Source: NOAA 2018
*Otariid pinniped hearing group not included as these organisms are not present in the Atlantic EEZ
[1] Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on a ~65 decibel (dB) threshold from normalized composite audiogram, with the exception for lower limits for low frequency cetaceans (Southall et al., 2007) and earless seals (approximation).
[2] SELcum= cumulative sound exposure level (reference value of 1 µPa2s), Lpk= peak sound pressure level (reference value of 1 µPa).

Though exposure to sound below PTS levels does not cause permanent physical damage to marine mammals, behavioral impacts caused by anthropogenic sound can include masking of communication and exclusion of organisms from the area of activity. These responses have the potential to cause population level impacts due to reduced fecundity or non-direct mortality due to reduced foraging efficiency or access to food, decreased mating opportunities, and reduced time spent nursing or caring of young (reviewed in Tyack 2008; Weilgart 2007). Actions that have the potential to disturb a marine mammal stock in the wild by altering behavioral patterns are classified as Level B harassment under the MMPA. The auditory thresholds defined by NOAA for Level B harassment are 120 dB_{rms} re 1 µPa for continuous noise, and 160 dB_{rms} re 1 µPa for impulsive noise, which apply to all marine mammals and were not updated with the 2016 technical guidance.

Project construction activities that will generate noise with the potential to impact marine mammals include pile driving (impact hammer) and vessel traffic (including use of DP thrusters).

Pile Driving

Impact pile driving is proposed to install the WTGs, OSSs and the Met Tower piled jacket and monopile foundations. Monopile foundations will take two days to install including approximately 2 – 4 hours of pile driving. Numerous factors, including water depth, impact the sound levels produced by pile driving (HDR 2019), but this procedure generates loud sound pressures (235 dB re 1 uPapp at 1m, (Jakob Tougaard et al. 2009)). This activity could affect marine mammals from all four hearing groups detailed in Table 9-2 and has the potential to cause PTS in marine mammals located close to the piling. Because pile driving generates low frequency impulsive sounds, low frequency cetaceans (baleen whales) are likely the most at risk due to the alignment of these species' hearing ranges with the sound frequencies typically generated from pile driving. Of particular concern is the North Atlantic right whale, one of the rarest and most endangered whale species in the world, which is known to occur in the Lease area year-round (Williams et al. 2015b; S. Barco et al. 2015; H. Bailey et al. 2018). NARW are more vulnerable to communication masking by anthropogenic sounds than other baleen whales due to the lower sound source levels of NARW communication calls compared to the songs of other species (e.g. fin and humpback)

(Clark et al. 2009). This species is under stress throughout its range, and research into one area of the NARW's range has identified a dramatic decrease in potential communication space since the 1950's due to increasing vessel traffic and offshore activities (63% loss of communication opportunities on Stellwagen Bank) (L.T. Hatch et al. 2012).

Though mid-frequency cetaceans, including dolphins, are not as susceptible to pile driving noise as those species that rely upon low-frequency vocalizations, these mammals could also be impacted by noise from Project construction activities. Certain species, like bottlenose dolphins, are unlikely to experience permanent damage from pile driving, though behavioral effects are likely. Field measurements of pile driving noise off Northeastern Scotland indicated that sound levels sufficient to cause behavioral disturbance, due to masking of bottlenose dolphin communication whistles, were present up to 50 km (27 NM) from the sound source (H. Bailey et al. 2010). However, sound levels sufficient to cause permanent injury to bottlenose dolphin were only present within 100 m (328 ft) of the pile driving activity (H. Bailey et al. 2010). Though pile driving noise could result in behavioral impacts to bottlenose dolphins, temporary displacement from the area is the most likely response, and dolphins have shown some ability to modify their behavior when exposed to communication-masking sound levels (reviewed in David 2006). Bottlenose dolphins are common within the Project area, and are expected to experience temporary displacement, but no permanent injury or population-level impacts are anticipated.

Pile driving noise is also likely to impact harbor porpoises, which are present but uncommon in the region of the Lease area. Pile driving noise has been documented to cause displacement of porpoises up to 25 km (13.5 NM) away from the sound (J. Tougaard et al. 2012; Jakob Tougaard et al. 2009), and vocalizations of this species have been documented to remain below pre-activity levels until 24 to 72 hours after cessation of pile driving (Brandt et al. 2011). Because breaks between pile driving events are expected to be less than 72 hours, porpoises could be functionally excluded from the Project area for the duration of pile driving operations (Brandt et al. 2011). However, local porpoise distributions are expected to return to pre-event levels within a few days of the completion of pile driving. Impacts to harbor porpoises due to construction within the Lease area are expected to be temporary, and a limited number of individuals are expected to be exposed to pile driving noise due to the scarcity of this species.

An underwater acoustic assessment was conducted to evaluate the potential for the Project's pile driving noise to impact marine mammals (Appendix II-H1). This assessment, and the resulting modeled distances to marine mammal hearing thresholds, are conservative, as the model assumed both that animals would remain in the area and used varying hammer energies for duration of the driving of the 11-m diameter pile. Additionally, sound propagation modeling was based upon environmental conditions in the Project area in May, the month during which pile driving may occur that has the lowest transmission loss (no pile driving will occur between the months of December and April). The unmitigated modeled range to the regulatory behavioral threshold for the pile driving of a monopile was 13,650 m (44,783 ft) for marine mammals. The unmitigated modeled range to the injury marine mammal thresholds were greatest for the LF cetaceans with ranges for the SEL threshold from 8,850 m (29,035 ft). Table 9-4 below provides modeled ranges to the marine mammal behavioral and injury regulatory thresholds assuming various levels of noise attenuation for the driving of the 11-m diameter pile. US Wind will implement sound attenuation measure during pile driving with a minimum reduction of 10 dB. US Wind will implement additional mitigation and monitoring measures as described in Volume II, Section 9.3 to minimize noise impacts to marine mammals.

Table 9-4. Modeled Ranges to Behavioral and Injury Regulatory Threshold Levels for Low-Frequency Cetaceans (Impulsive Sounds)

Mitigation	0 dB	10 dB	20 dB
Injury Threshold (183 dB ($L_{E,LF,24h}$))	8,850 m (29,035 ft)	2,900 m (9,514 ft)	650 m (2,133 ft)
Behavioral Threshold (160 dB (L_p)) *	13,650 m (44,782 ft)	5,250 m (17,224 ft)	1,650 m (5,413 ft)

See Appendix II-H1 ** For all marine mammals*

Vessel Noise

Increased vessel traffic associated with installation activities could impact marine mammals due to the noise from work boats. Vessel noise is primarily composed of low-frequency components caused by propeller cavitation, though rotational and reciprocal machinery movement, and hydrodynamic water movement over the boat hull also contribute to sound generation (Hildebrand 2009). As the intensity of vessel noise is largely related to ship size and speed (Hildebrand 2009), exposure of marine mammals to noise from construction and installation vessels would be variable. Recent research has indicated that porpoises can exhibit behavioral response to low levels of high frequency sound present in vessel noise (Dyndo et al. 2015), and NARW are vulnerable to communication masking due to low frequency vessel traffic (L.T. Hatch et al. 2012). Similarly, high levels of vessel traffic (e.g. from whale watching operations) have been noted to cause behavior changes in many cetacean species (reviewed in E.C.M. Parsons 2012). The Lease area and adjacent waters are well-traveled by commercial shipping traffic in the nearby shipping lanes as well as recreational and commercial fishing. Marine mammals in the region are likely habituated to vessel noise. The underwater acoustic assessment in Appendix II-H1 provides a brief summary of documented ambient noise levels in and around the Lease area based on the passive acoustic study conducted by Bailey et al. (2018).

Construction vessel noise related to the Project would be limited, as boats will travel to and from the Project area at reduced speeds and will remain stationary at work sites for extended periods of time. Dynamic positioning thrusters (DP thrusters) may be used during Project installation activities. NOAA has indicated that the sound produced by this equipment is similar to that generated by transiting vessels (communications cited in (CSA Ocean Sciences 2018a, 2018b; Tetra Tech 2018)). Any impacts to marine mammals due to vessel noise during Project installation would be temporary, with behavior rapidly returning to normal following passage of a vessel, and it is unlikely that such short-term effects would result in long-term population-level impacts.

Vessel Traffic

Vessel collisions with marine mammals can cause serious injury or death and are a leading cause of mortality for certain species. Baleen whales are most at risk from ship strikes, and species including fin whale, NARW, humpback whale, and sperm whale are particularly vulnerable (Laist et al. 2001). Most ship strikes resulting in severe injury or death occur from ships traveling at 14 knots or faster, and strikes from larger vessels (>80 m (262 ft)) are more likely to result in mortality (Laist et al. 2001).

The highly endangered NARW experiences the most numerous per capita vessel strikes (Vanderlaan and Taggart 2007) and is especially vulnerable because it primarily utilizes busy coastal areas, swims slowly, and congregates at or just below the water surface (NOAA Fisheries

2018a). This species also shows no avoidance response when exposed to approaching vessels (Nowacek, Johnson, and Tyack 2003), perhaps indicating habituation to ubiquitous vessel noise in its habitat. However, vessel speed restrictions are effective in decreasing NARW ship strikes; vessel speed limits of 10 knots have been shown to reduce ship strike mortality risk by 80-90% (Conn and Silber 2013). Construction vessels will follow NOAA Fisheries collision avoidance guidance, including vessel speed restrictions to minimize the risks to NARW and other marine mammals. In addition, US Wind will continue to evaluate technologies that may increase the ability to detect marine mammals from vessels, such as thermal detection technologies. US Wind anticipates that vessel strike avoidance measures will be modified to reflect conditions set by NOAA Fisheries following the application for Incidental Harassment Authorization (IHA) or Letter of Authorization (LOA). Impacts to marine mammals from vessel strikes are expected to be negligible.

For information about the proposed Project ports, vessel trips and routes can be found in sections: Volume I, Section 4.1 for information about construction ports, Volume I Section 3.7 for information about operations and maintenance ports, and Volume II, Appendix II-C1, Figure 1 and Tables 2 and 3 for vessel routes and trips.

Entanglement and Marine Debris

Entanglement will not pose a risk to marine mammals during Project construction. US Wind does not anticipate the use of anchored vessels during construction. If used, mooring lines during WTG, OSS, Met Tower and submarine cable installation will be of relatively large diameter and will generally be kept under tension, eliminating entanglement risk. US Wind will follow BOEM guidelines for marine trash and debris prevention (see Volume II, Section 4.2). Therefore, construction impacts to marine mammals due to entanglement and marine debris are anticipated to be negligible.

Routine/Accidental Releases

During the course of Project construction, pollutants may be discharged into the environment as part of routine activities, such as the operation of construction vessels and vehicles, or due to accidental spills. See Volume II, Section 4.2 for a discussion of the impacts of routine and accidental releases during Project activities. Water quality impacts due to routine and accidental releases are anticipated to be negligible and are therefore not anticipated to impact marine mammals or their prey species.

Suspended Sediment/Deposition

Pile driving during WTG, OSS and Met Tower foundation installation, the use of jack-up and feeder vessels, jet plow operations during cable laying and embedment, vessel anchoring, and the installation and removal of gravity cells will disturb sediment on the seafloor. See Volume II, Section 4.2 for a discussion of the impacts of these activities on suspended sediment levels and sediment deposition. Water quality impacts associated with jet plow operations, HDD, and other bottom-disturbing activities are expected to be minor and temporally limited and are not anticipated to directly impact marine mammals.

Impacts to marine mammal prey species due to bottom disturbing activities are also expected to be minor. Though direct bottom disturbance and sediment deposition will result in localized mortality of benthic organisms, impacts to communities of benthic crustacean and shellfish species which may serve as prey for marine mammals are expected to be negligible (Volume II, Section 7.2.1). Therefore, impacts to marine mammals are not anticipated to result from bottom-disturbing activities related to Project construction.

9.2.2 Operations

Noise

Operational Noise

Noise produced by the operation of the WTGs is unlikely to result in population-level impacts to marine mammals. Though operational noise will not approach levels that could permanently harm marine mammals, it is not clear if underwater noise from WTGs will influence marine mammal behavior (Betke, Schultz-von Glahn, and Matuschek 2004). Harbor porpoises have the ability to detect low frequency operational WTG noise, and Koschinski et al. (2003) observed that these species altered their behavior in response to a simulated 2 MW WTG. However, this study utilized amplified playbacks, which included background noise, in addition to WTG noise conditions. Madsen et al. (2006) argues that the observed reactions of harbor porpoises and harbor seals to the playback was likely in response to embedded high frequency background noise, and not noise produced by the WTG. Additionally, Koschinski et al. (2003) only observed responses within 200 m (656 ft) of the simulated WTG area, and modeling conducted by Tougaard et al. (2009) indicated that behavioral responses of harbor porpoises are only expected close to WTGs. As operational WTG noise is considered incapable of masking communication by harbor porpoises (J. Tougaard, Henriksen, and Miller 2009), any behavioral impacts of WTG operation are likely to be highly spatially limited. Though NARW may detect operational WTG noise up to a few kilometers (nautical miles) from WTGs in quiet conditions (Madsen et al. 2006), any behavioral impacts from Project operation are likely to be minor.

Vessel Noise

Project O&M activities will require vessel travel within the Project area. Vessel noise has the potential to impact marine mammals (see Volume II, Section 9.2.1). However, as the region is heavily traveled by commercial shipping and fishing vessels, low levels of vessel noise associated with Project activities are not anticipated to alter acoustic conditions.

Vessel Traffic

Vessel traffic associated with O&M activities could endanger marine mammals (see Volume II, Section 9.2.1). US Wind will implement vessel strike avoidance procedures in consultation with NOAA Fisheries. PSOs or trained observers will be present on vessels, therefore the risk of harm to marine mammals from vessel strikes is considered negligible. In addition, US Wind will continue to evaluate technologies that may increase the ability to detect marine mammals from vessels, such as thermal detection technologies.

Habitat Alteration

Habitat alteration due to the presence of the submarine cables, WTGs, OSSs and the Met Tower foundations are not expected to impact marine mammal populations. The addition of man-made structures to the marine habitat within the Project area will not physically restrict marine mammal movement. WTG spacing is 0.77 NM East-West (1.43 km, 0.89 mi) by 1.02 NM North-South (1.89 km, 1.17 mi) and the Project will not present a barrier for marine mammals. Studies examining the impact of wind farms on marine mammal density have yielded somewhat contradictory results. Teilmann and Cartensen (2012) observed a significant decline in harbor porpoise abundance following wind farm construction in the Baltic Sea, whereas Scheidat et al. (2011) documented a dramatic increase in harbor porpoise density in the Dutch North Sea. However, these changes are likely not the result of direct impacts of habitat modification on marine mammal movement or behavior. Secondary effects of physical habitat alteration and Project operation may facilitate increased abundance of some marine mammal species due to increased prey densities due to the artificial reef effect.

EMF

Certain marine mammals have the ability to detect magnetic intensity gradients and use this sensitivity for navigation during migration (Czech-Damal et al. 2012; Kirschvink, Dizon, and Westphal 1986; Normandeau Associates Inc. 2011). The presence of anthropogenic magnetic fields could illicit behavioral responses in marine mammals, ranging from changes in swim direction to alteration of migration routes (A.B. Gill et al. 2005). EMF associated with the submarine cables such as offshore export cables and inter-array cables could be detectable by marine mammals, however impacts are unlikely due to the low intensity and localized nature of these fields. Multiple reviews of current research have documented a lack of evidence of cable EMF impacts on marine mammal behavior (A. Gill and Desender 2020; Normandeau Associates Inc. 2011), though this topic remains understudied. Because the inter-array and export cables will be shielded and buried or covered by cable protection, the intensity of the electromagnetic fields generated by operation of the cables will be minimized (BOEM 2021c). Therefore, impacts to marine mammals due to EMF are anticipated to be negligible. Additionally, as marine mammals are pelagic and must regularly return to the water surface to breath, they will rarely, if ever, be in close proximity to project cables (Exponent 2023). Therefore, impacts to marine mammals due to EMF are anticipated to be negligible.

Entanglement and Marine Debris

Entanglement will not pose a risk to marine mammals during Project operations. Submarine cables will be buried approximately 1 - 4 m (3 - 13 ft) beneath the sea floor or covered with protective material (e.g., concrete mattresses) when target burial depths are not achievable. Similarly, the diameter of the WTG and OSS foundation structures will be 1.5 - 4.0 m (4.9 - 13 ft) for jacket foundation piles, 8 – 12 m (26 - 39 ft) for monopiles and 10 - 15 m (33 - 49 ft) for jacket on suction buckets and do not pose an entanglement risk. Secondary entanglement, due to marine debris becoming snagged on WTG and OSS foundations, is a risk for marine mammals. However, the likelihood of this occurrence is low as the structures are largely free of protrusions upon which such debris could attach. US Wind will follow BOEM guidelines for marine trash and debris prevention (see Volume II, Section 4.2). Therefore, operations impacts to marine mammals due to entanglement and marine debris are anticipated to be negligible.

9.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Removal of structures would result in the generation of underwater noise and would necessitate increased vessel traffic in the Project area. Impacts from these activities would be similar to those described above for the construction portion of the Project.

9.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on marine mammals.

Pile Driving

US Wind will implement the following pile driving sound mitigation measures:

- Prepare a pile driving monitoring plan, to include details about the measures listed below, prior to construction activities. Mitigation measures may be modified to reflect conditions set by NOAA Fisheries following the application for IHA or LOA associated with construction activities.
- Consistent with the anticipated NMFS requirements for an LOA, US Wind will implement at least two functional noise abatement systems, such as double bubble curtains and nearfield attenuation devices, to reduce noise levels to the modeled harassment isopleths, assuming 10-dB attenuation, during all impact pile driving for monopile foundations.
- Pile driving is planned between May 1 and November 30. Pile driving, if necessary, in November, may require additional mitigation measures such as larger clearance or exclusion zones.
- Establish a clearance zone prior to pile driving using a combination of visual and acoustic monitoring for large whales. The clearance zone is to be monitored for a minimum of 60 minutes and the zone must be clear for 30 minutes before beginning soft-start procedure.
- Once clearance zone is confirmed clear of marine mammals, pile driving will begin with minimum hammering at low energy for no less than 30 minutes (soft-start).
- Additional restrictions on pile driving will include: no simultaneous pile driving; no more than one monopile driven per day; daylight pile driving only unless health and safety issues require completion of a pile; and initiation will not begin within 1.5 hours of civil sunset or in times of low visibility when the visual clearance zone and exclusion zone cannot be visually monitored, as determined by the lead PSO on duty.
- Establish an exclusion zone using a combination of visual and acoustic monitoring for large whales. Pile driving will be halted if species enters defined exclusion zone, with exceptions for health and safety considerations as well as technical feasibility.
- Visual clearance and exclusion zones will be monitored by PSOs which are individuals with a current NOAA Fisheries approval letter as a PSO.

Vessel Strike Avoidance

US Wind will implement the following vessel strike avoidance mitigation measures:

- PSOs or trained observers will be present on crew vessels and other project vessels.
- US Wind will ensure that from November 1 through April 30, vessel operators monitor NOAA Fisheries NARW reporting systems (e.g., Early Warning System,

Sighting Advisory System, and Mandatory Ship Reporting System) for the presence of NARWs.

- Vessels 19.8 m (65 ft) in length or greater will operate at speeds of 10 knots or less in NARW Seasonal Management Areas (SMAs) Additionally, all vessels will operate at speeds of 10 knots or less in Right Whale Slow Zones, identical to Dynamic Management Areas (DMAs), to protect visually or acoustically detected NARW. US Wind will incorporate the proposed revision to the NARW vessel speed rule for vessels 10.6-19.8 m (35-65 ft) in length upon implementation.
- All vessels will maintain a minimum separation distance of 500 m (1,640 ft) or greater from any sighted NARW. If a NARW is sighted within this exclusion zone while underway, the vessel will steer a course away from the NARW at 10 knots or less until the 500 m (1,640 ft) minimum separation distance has been established. If a NARW is sighted within 100 m (328 ft) of an underway vessel, the vessel operator will immediately reduce speed and promptly shift the engine to neutral. If the vessel is stationary, the operator will not engage engines until the NARW has moved beyond 100 m (328 ft).
- All vessels will maintain a minimum separation distance of 100 m (328 ft) or greater from any sighted non-delphinid cetaceans other than the NARW. If a non-delphinid cetacean is sighted within this exclusion zone while underway, the vessel operator will immediately reduce speed and promptly shift the engine to neutral. The vessel operator will not engage the engines until the non-delphinid cetacean has moved beyond 100 m (328 ft). If the vessel is stationary, the operator will not engage engines until the non-delphinid cetacean has moved beyond 100 m (328 ft).
- All vessels will maintain a minimum separation distance of 50 m (164 ft) or greater from any sighted delphinid cetacean or pinniped, except if the mammal approaches the vessel. If a delphinid cetacean or pinniped approaches an underway vessel, the vessel will avoid excessive speed or abrupt changes in direction to avoid injury to these organisms. Additionally, vessels underway may not divert to approach any delphinid cetacean or pinniped.
- US Wind will continue to evaluate technologies that may increase the ability to detect marine mammals from vessels, such as thermal detection technologies.

Other Mitigation and Monitoring

US Wind will implement the following other mitigation and monitoring measures:

- Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable.
- Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination"), per BOEM guidelines for marine trash and debris prevention.
- Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.

- The Metocean Buoy includes acoustic recorders to detect and identify marine mammal calls.
- US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.
- Additional opportunities to support passive acoustic monitoring of marine mammals in and around the Lease area in conjunction with ongoing research efforts by others, such as the University of Maryland Center for Environmental Science, will continue to be explored.

10.0 Sea Turtles

10.1 Description of Affected Environment

Sources

The following description of the affected environment for sea turtles draws upon recent studies and literature focused on offshore areas that include the mid-Atlantic WEAs and areas around the WEAs that could be affected by the Project. The most relevant studies relating to sea turtle occurrence are described below.

MABS Survey (Williams et al. 2015b, 2015a)

The MABS were conducted for the DOE and the MEA to provide wildlife information specific to the WEAs in the mid-Atlantic. The wildlife information was collected between 2012 and 2014 across a 13,245 km^2 (3,862 square NM) study area off the coasts of Delaware, Maryland, and Virginia, via HD digital aerial surveys and boat-based surveys. Over the survey period, sixteen boat surveys and fifteen aerial surveys were conducted concentrating data acquisition within the WEAs. The surveys were designed to sufficiently capture the biological variations in both spatial and temporal dimensions, in accordance with the BOEM wildlife survey guidelines.

In 2013, during the second year of the MABS study, MDNR and MEA expanded the existing surveys to cover a greater extent of Maryland's state and federal waters. This expansion, called the Maryland Project (MD Project), extended existing boat surveys into Maryland state waters, extended aerial surveys into areas west and south of the Maryland WEA, and added an additional annual aerial survey within Maryland waters. Survey findings from the MD Project are presented in a separate report (Williams et al. 2015b), and incorporated into the MABS Mid-Atlantic Outer Continental Shelf Final Report (Williams et al. 2015a). Observed species data from the "broad" and "narrow" video surveys (2012-2014) and boat surveys (2012 - 2014) were evaluated in a geographic information system (GIS). Species observations were queried from the combined survey data and turtle observations were identified within the Maryland WEA. A distribution ratio "Total Count per Hour" was calculated for each turtle species within the Maryland WEA based on the number of observed individuals divided by the amount of survey time associated with each observation.

VAQF Survey (S. Barco et al. 2015)

The VAQF study was conducted for the MDNR to provide fine scale data on the presence of protected species for Maryland's offshore wind development efforts. The wildlife information was collected monthly between 2013 and 2015 via observer based aerial surveys. Over the survey period, a total of twelve aerial surveys resulted in more than 16,000 km (8,639 NM) of observed track line running from shore to 50-70 km (27-38 NM) offshore encompassing the entire Maryland WEA. The surveys were designed to sufficiently capture the biological variations in both spatial and temporal dimensions, in accordance with the BOEM wildlife survey guidelines. For survey methodologies and details, a copy of this report can be requested from the MEA.

US Wind 2015, 2016, 2017 and 2021 G&G Surveys ((Alpine Ocean Seismic Survey Inc. 2015, 2017))

US Wind conducted preliminary G&G surveys within the boundaries of the Lease area in 2015, along the formerly planned offshore export cable route in 2016, and along Onshore Export Cable Corridor 1 within Indian River Bay in 2017. Activities occurred onboard the RV Shearwater in 2015 and 2016 for a total of 44 and fifteen survey days, respectively. The 2017 survey within Indian

River Bay was conducted on the MV George over a total of six survey days. PSOs monitored the areas surrounding the survey boats for sea turtles using visual observation.

US Wind conducted G&G surveys within the Lease area and along the Offshore Export Cable Corridors in 2021. The results of these surveys, including the PSO reports, have been provided in Appendix II-A2.

Overview

Five species of sea turtle can be found offshore of the U.S. Atlantic coast. Four of these species have the potential to utilize the Project area, all of which are listed as endangered or threatened under the ESA (Table 10-1). These species include the loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles (USDOI and BOEM 2012). Loggerhead turtles are common in the vicinity of the Lease area, while green, leatherback, and Kemp's ridley turtles are less frequently observed, as described in the following sections. A total of 136 turtle observations were recorded in the Maryland WEA during the MABS survey (Williams et al. 2015b, 2015a). In general, Williams et al. (2015b) suggested that the Maryland WEA does not appear to be an area with consistently high numbers of sea turtles throughout time (a population hotspot). Though the range of the endangered hawksbill turtle includes the Project area, this species prefers tropical and sub-tropical waters and is rarely found in the mid-Atlantic (USDOI and USFWS 2018a). However, this species may be encountered by vessels traveling to the Project Area from ports in the Gulf of Mexico. Detailed discussions of the four turtle species likely to occur in the Project area, and hawksbill turtles, are presented below.

Loggerhead Turtle (*Caretta caretta*)

Loggerhead turtles can reach 1 m (3 ft) in length, have a reddish-brown, slightly heart shaped carapace, and feed primarily upon hard-shelled prey including mollusks, crabs, and horseshoe crabs (NOAA Fisheries 2017e). This species has a circumpolar distribution, and inhabits continental shelves, bays, estuaries, and lagoons throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1998). Loggerheads occur in continental shelf waters of the Northwest Atlantic from Florida to Nova Scotia (USFWS and NOAA Fisheries 2008), although their presence varies seasonally due to changes in water temperature (Shoop and Kenney 1992; Epperly, Braun, and Chester 1995; Epperly, Braun, and Veishlow 1995; Braun-McNeill and Epperly 2004). The primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges (NOAA Fisheries 2017e). Loggerhead sea turtles in the Northwest Atlantic Ocean distinct population segment (DPS) are listed as threatened under the ESA.

The most recent regional abundance data for the loggerhead turtle was collected in 2010. The preliminary regional abundance was approximately 588,000 individuals based on only positive identifications of loggerhead sightings, and approximately 801,000 individuals based on positive identifications and a portion of unidentified turtles from the survey (National Marine Fisheries Service Northeast Fisheries Science Center 2011).

Table 10-1. Sea Turtles with Potential Occurrence in the Project Area

Common Name	Scientific Name	ESA Status	MABS Mid-Atlantic Surveys[a]		MABS MD Surveys[b]		MABS WEA Surveys[c]	VAQF Survey[d]	Relative Occurrence in Project Area
			Boat Survey Sightings [a]	Aerial Survey Sightings[ab]	Boat Survey Sightings[ba]	Aerial Survey Sightings[bb]	Annual count per hour per km^2 [ca]	Aerial Survey Sightings[da]	
Family Cheloniidae (hardshell sea turtles)									
Loggerhead turtle	*Caretta*	Threatened	89	188	15	22	0.00047	809 (833)	Common
Green turtle	*Chelonia mydas*	Threatened	0	11	0	5	0.00020	45 (45)	Uncommon
Kemp’s Ridley turtle	*Lepidochelys kempii*	Endangered	0	38	0	8	0.00012	1 (1)	Uncommon
Hawksbill turtle	*Eretmochelys imbricata*	Endangered	0	2	0	1	0.00004	0 (0)	Rare
Family Dermochelyidae (leatherback sea turtle)									
Leatherback turtle	*Dermochelys coriacea*	Endangered	15	122	3	16	0.00025	14 (14)	Common

[a] Source: Williams et al. 2015a

[aa] Total number of individuals observed during 16 boat-based surveys of the mid-Atlantic conducted between March 2012 and May 2014. Only sightings or individuals identified to species are included. Additional sea turtle sightings not included in table: 6 small turtles (loggerhead, green, hawksbill, or Kemp's ridley), 4 unidentified turtles.

[ab] Total number of individuals observed during 15 digital video aerial surveys of the mid-Atlantic conducted between March 2012 and May 2014. Additional sea turtle sightings not in table: 1397 small turtles.

[b] Source: Williams et al. 2015b

[ba] Total number of individuals observed during 16 boat-based surveys in the vicinity of the MD WEA conducted between April 2012 and April 2014. Only sightings or individuals identified to species are included. Additional sightings of sea turtles not included in table: 2 small turtles.

[bb] Total number of individuals observed during 14 aerial surveys in the vicinity of the MD WEA conducted between March 2012 and May 2014. Additional sightings of sea turtles not classified to species: 312 small turtles.

[c] Source: Williams et al. 2015a and 2015b.

[ca] Annual count of observations per hour of survey effort per square km within the MD WEA. Additional sightings of sea turtles not classified to species: 0.00449 small turtles per hour per km^2.

[d] Source: Barco et al. 2015

[da] Total number of sightings (and total number of individuals observed) during monthly aerial surveys of the MD WEA and surrounding waters between July 2013 and June 2015. Additional sea turtle sightings not reported in table: 83(84) unidentified hard-shelled turtles.

In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina (NOAA Fisheries 2017e). Adult loggerheads migrate seasonally from nesting beaches to foraging grounds, primarily driven by changes in sea surface temperatures (T.E.W.G. TEWG 2000b). Nesting sites for loggerhead turtles in the Northwest Atlantic DPS are primarily located along the Atlantic and the Gulf of Mexico coastlines of Florida, South Carolina, Georgia, North Carolina, and Alabama (NOAA Fisheries 2017e). Though it is rare for this species to nest north of Virginia, a limited number of loggerhead nests have been observed in Maryland and Delaware (NPS 2017; DNREC 2018a). The first record of successful loggerhead nesting in Maryland was reported in 2017 at Assateague Island National Seashore, and three nests hatched from this location in 2020 (NPS 2017; WJLA 2020). In Delaware, a single loggerhead nest was laid in Fenwick, Delaware in 2018, below the high tide line (DNREC 2018a). This nest was relocated to Fenwick Island State Park and later successfully hatched, marking the first recorded loggerhead hatching in the state since 1973 (DNREC 2018a). Loggerhead turtles occur year-round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the Southeast U.S. and move up the U.S. Atlantic Coast (Epperly, Braun, and Chester 1995; Epperly et al. 1995; Braun-McNeill and Epperly 2004). During spring and summer months, loggerhead turtles are abundant in coastal waters off New York and the mid-Atlantic states, and are found as far north as New England (S.J. Morreale and Standora 1989). In late September through mid-October, loggerhead turtles begin to migrate southward to coastal areas off the south Atlantic states, particularly from Cape Hatteras, North Carolina, to Florida (S.J. Morreale and Standora 1989; Musick, Barnard, and Keinath 1994). During the winter, loggerhead turtles tend to aggregate in warmer waters along the western boundary of the Gulf Stream off Florida (N. B. Thompson 1988), or hibernate in bottom waters and soft sediments in channels and inlets along the Florida coast (Ogren and McVea Jr. 1981; Butler, Nelson, and Henwood 1987). In the winter and spring, loggerheads congregate off southern Florida before migrating northward to their summer feeding ranges (CeTAP 1982). There are 38 critical habitat areas designated for the Northwest Atlantic Ocean DPS of loggerhead sea turtles, including nearshore reproductive habitat, *Sargassum* habitat, migratory corridors, breeding areas and wintering habitat. All critical habitat areas are located to the south of the Project area.

Recent multi-year surveys specific to the Lease area and the surrounding nearshore waters indicate that loggerhead sea turtles are common between May and October (Williams et al. 2015b). This species was the most frequently observed turtle in the Lease area; loggerheads accounted for 93% of all turtles identified to species during the VAQF survey (S. Barco et al. 2015). This species was detected within the Lease area during the spring, summer, and fall (Williams et al. 2015b). Loggerheads appear to enter the area beginning in mid-May, and leave the region when water temperatures drop in October (S. Barco et al. 2015). The calculated annual density of loggerhead turtles observed within the Lease area during the MABS surveys was 0.00047 individuals per hour per square km (0.29 square nautical mile) (Williams et al. 2015b, 2015a). The MABS survey provides valuable data regarding loggerhead turtle distribution. However, the figures presented above are based only upon confirmed loggerhead sightings, and the majority of small turtles observed during aerial surveys could not be identified to species. Therefore, it is possible that populations of this species could be underestimated (Williams et al. 2015b).

Leatherback Turtle (*Demochelys coriacea*)

Leatherbacks are the largest living turtles, reaching up to 2 m (6.5 ft) in length, and are the only sea turtle that lacks a hard, bony shell (NOAA Fisheries 2017d). The leatherback gets its name from its distinctive longitudinally-ridged carapace, which is composed of layers of oily connective tissue overlain on loosely interlocking dermal bones (NOAA Fisheries 2017d). This species is the most wide-ranging of all sea turtles, and is found in tropical, subtropical, and cold-temperate waters (USFWS and NOAA Fisheries 1992; Carriol and Vader 2002). Leatherbacks have evolved several physiological and anatomical adaptations that allow them to survive in cold waters (USFWS and NOAA Fisheries 1992; Frair, Ackman, and Mrosovsky 1972; Greer, Lazell, and Wright 1973), enabling them to range along the entire east coast of the U.S. (USFWS and NOAA Fisheries 1992). Unlike most other sea turtles, which feed upon hard-shelled organisms, leatherbacks consume soft bodied prey, including salps and jellyfish (NOAA Fisheries 2017d). Threats to leatherback sea turtles include fisheries bycatch, habitat loss, vessel strikes, incidental ingestion of marine debris, legal and illegal harvest of turtles and eggs, climate change, disease, oil and gas activities, and coastal development, among others (USFWS and NOAA Fisheries 2020). Leatherback turtles are currently listed as endangered under the ESA.

On December 17, 2017, NOAA Fisheries and USFWS initiated a review of the leatherback turtle, to gather data on the species, apply the DPS policy, and evaluate this species' risk of extinction. This review was published in 2020 and identified seven leatherback turtle DPSs (USFWS and NOAA Fisheries 2020). Leatherback turtles found along the eastern U.S. Atlantic coast belong to the Northwest (NW) Atlantic DPS. Like all other DPSs, the NW Atlantic leatherback DPS is at high risk of extinction (USFWS and NOAA Fisheries 2020). Confidence in this conclusion for the NW Atlantic DPS is moderate, due to the spatial distribution, diversity, and abundance of this population segment (USFWS and NOAA Fisheries 2020). The best available estimate of nesting female leatherback abundance in the NW Atlantic DPS is 20,659 females, 1,694 of which nest in the United States (USFWS and NOAA Fisheries 2020). This estimate includes all nesting areas utilized by the DPS, largely concentrated from Florida throughout the wider Caribbean region (Dow et al. 2007). In the United States, leatherback nesting occurs primarily on the eastern coast of Florida, Puerto Rico, and St. Croix, though occasional nesting has been observed in North and South Carolina (USFWS and NOAA Fisheries 2020). Though temporal trends vary between nest sites, the NW Atlantic leatherback turtle DPS, including the Florida nesting population, has exhibited a decreasing nest trend in recent years (USFWS and NOAA Fisheries 2020).

Leatherback turtles are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (S. Morreale et al. 1994; S. A. Eckert 1999). Adult leatherbacks migrate extensively throughout the Atlantic basin in search of food, and may swim 6,000 to 12,000 km (3,240 to 6,480 NM) in a year (James et al. 2006). In the North Atlantic Ocean, leatherback turtles regularly occur in deep waters (>100 m (328 ft)), but are also sighted in coastal areas of the U.S. continental shelf (USFWS and NOAA Fisheries 1992). Leatherback turtle seasonal movement patterns are dictated by sea surface temperatures (Davenport and Balazs 1991; Luschi et al. 2006). Following breeding and nesting in Florida and the tropical Caribbean and aided by the northward flow of the Gulf Stream, leatherback turtles in the NW Atlantic DPS move northward and westward beyond the shelf break in the spring. During the summer months, leatherbacks move into fairly shallow coastal waters, apparently following their preferred jellyfish prey. Leatherbacks become more numerous off the mid-Atlantic and southern New England coasts in late spring and early summer, and by late summer and early fall, leatherbacks may be found in the waters off eastern Canada (CeTAP 1982; Shoop and Kenney 1992; N.B. Thompson et al. 2001; James et al. 2006). In response to cooling sea surface temperatures in the fall, leatherback turtles move offshore and begin a southward migration to their winter breeding grounds (Payne, Selzer, and Knowlton 1984a). There are no critical habitat areas designated for the leatherback sea turtle along the U.S. Atlantic coast.

Recent multi-year surveys specific to the Lease area and the surrounding nearshore waters indicate that leatherback sea turtles routinely occur between May and October (Williams et al. 2015b; S. Barco et al. 2015). This species was the second most frequently observed turtle species in the Lease area in the Williams et al. (2015b) study, and the third most frequently observed turtle species in the Barco et al. (2015) study. Leatherbacks accounted for 2% of all turtles identified to species during the VAQF survey (S. Barco et al. 2015). This species was infrequently detected in spring, and was most abundant in the Lease area in summer and fall (S. Barco et al. 2015). The MABS survey identified September and October as the peak period of leatherback occurrence in the Project area (Williams et al. 2015b). The calculated annual density of leatherback turtles observed within the Maryland WEA during the MABS surveys was 0.00025 individuals per hour per square km (0.29 square nautical mile) (Williams et al. 2015b, 2015a).

Green Turtle (*Chelonia mydas*)

The green turtle is the largest hard-shelled sea turtle, and can reach over 1 m (3 ft) in length (NOAA Fisheries 2017b). This species has an oval carapace that is variable in color and can be green, brown, yellow, gray, or black (NOAA Fisheries 2017b). Unique among sea turtles, the adult green turtle is exclusively herbivorous and eats seagrass and algae (NOAA Fisheries 2017b). Green turtles are found worldwide, and are known to occur in temperate waters, though they are generally found in tropical and subtropical regions (NOAA Fisheries 2017b; National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991). Current human-caused threats to green sea turtles include destruction of nesting habitats, noise and light pollution on coastal beaches, boat strikes, disease, and entanglements with fishing gear and marine debris (USDOC 2007; Epperly, Braun, and Chester 1995; TEWG 2000a; NOAA Fisheries 2017b). Green turtles in waters along the eastern U.S. Atlantic coast belong to the North Atlantic DPS, which is listed as threatened under the ESA.

Estimates of the population size of the North Atlantic DPS of green turtles are unavailable. Green turtles in the North Atlantic DPS nest to the south of the Project area; in small numbers in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina, and in larger numbers in Florida (NOAA Fisheries 2017b).

In the Western North Atlantic, green turtles are found in inshore and nearshore waters from Texas to Massachusetts (NOAA Fisheries 2017b). Like other sea turtles, green turtles display highly migratory behavior, making seasonal coastal and annual transoceanic migrations (Godley et al. 2003; Godley et al. 2008; Godley et al. 2010). However, green turtles appear to occupy smaller home ranges than other sea turtle species (Seminoff, Resendiz, and Nichols 2002; Makowski, Seminog, and Salmon 2006; Broderick et al. 2007). This species generally feeds in shallow lagoons, inlets, reefs, shoals, and bays that have abundant algae or sea grass (USDOC 2007). Females nest between June and September on mainland or island sandy beaches along the southeastern U.S. coast, and are not known to nest as far north as the mid-Atlantic states (NOAA Fisheries 2017b). Though green turtles are reported to use the coastal waters of North Carolina and Virginia as summer foraging habitat (K.L. Mansfield et al. 2009), this species is generally classified as uncommon in the mid-Atlantic, and is usually a transient species present during the summer and fall. The only designated critical habitat area for green sea turtles surrounds an island off the coast of Costa Rica, and is far to the south of the Project area (NOAA Fisheries 2017b).

Green turtles were the second most frequently observed turtle species in the Maryland WEA in the VAQF study; they accounted for 5% of all turtles identified to species and were most abundant during the summer (S. Barco et al. 2015). In contrast, green turtles were uncommonly observed in Maryland waters during the MABS survey; only five were identified over the duration of the study (Williams et al. 2015b). The calculated annual density of green turtles observed within the Lease area during the MABS surveys was 0.0020 individuals per hour per square km (0.29 square nautical mile) (Williams et al. 2015b, 2015a). Though the MABS survey is a source of data regarding green turtle abundance, the majority of small turtles observed during aerial surveys could not be identified to species. Therefore, it is possible that green turtle populations could be underestimated (Williams et al. 2015b).

Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley turtle has a nearly circular grayish-green carapace and is the smallest sea turtle in the world, reaching only 60 to 70 cm in length (24 to 28 in). This species feeds primarily on swimming crabs, but will also consume fish, jellyfish, and mollusks (NOAA Fisheries 2017c). Kemp's ridley turtles primarily reside in the nearshore neritic zone, and rarely venture into waters deeper than 50 m (160 ft) (NOAA Fisheries 2017c; Byles, Nelson, and Henwood 1994). Like other sea turtle species, the Kemp's ridley is threatened by habitat loss (specifically of nesting beaches in the Gulf of Mexico), commercial fishery gear entanglement, disease, climatic changes, and pollution (USDOI and USFWS 1999). The Kemp's ridley turtle is listed as endangered under the ESA.

The most recent estimate of the Kemp's ridley turtle population is 7,000 to 8,000 nesting females (USFWS and NOAA Fisheries 2007). As this species is female biased, there are likely several thousand additional males (USFWS and NOAA Fisheries 2007). Kemp's ridley sea turtles exhibit unique nesting behavior observed in only one other sea turtle species; during events called "arribada" female turtles arrive onshore in large, synchronous aggregations to nest (NOAA Fisheries 2017c). This species nests almost exclusively in the Western Gulf of Mexico, primarily in the states of Tamaulipas and Veracruz, Mexico (BOEM 2014). Though extremely large arribadas occurred in the 1940s (as many as 42,000 Kemp's ridley turtles were observed in one day in 1947), populations plummeted between the 1940s and the 1980s, reaching a low of fewer than 250 nesting females in 1985 (NOAA Fisheries 2017c). Conservation efforts led to annual increases of approximately 15% in Kemp's ridley breeding populations through 2009. However, recent data indicate a decrease in the number of Kemp's ridley nests since 2010 (NOAA Fisheries 2017c).

The Kemp's ridley sea turtle is found most commonly along the eastern coast of North America, from the Gulf of Mexico to Nova Scotia (NOAA Fisheries 2017c; BOEM 2014). After nesting and breeding in Mexico, this species travels to foraging grounds in shallow coastal waters, embayments, and estuarine systems along the Atlantic seaboard, where they remain for the duration of the spring and summer (BOEM 2014). The Kemp's ridley is present in areas including Chesapeake Bay, Pamlico Sound, Charleston Harbor, and Delaware Bay during the summer (USFWS and NOAA Fisheries 2007), and is the second most common turtle reported off the coast of Virginia (VIMS 2014). Kemp's ridley turtles begin leaving northern areas in mid-September, and most have departed for warmer southern waters by the beginning of November (Burke, Standora, and Morreale 1989; S.J. Morreale and Standora 1989). Wintering habitats for Kemp's ridley turtles include shelf habitats off of Florida and waters south of Cape Hatteras, North Carolina (Gitschlag 1996). There are no critical habitat areas designated for the Kemp's ridley sea turtle, though petitions to designate areas on the Texas coast and marine habitat in the Gulf of Mexico are currently being reviewed.

Kemp's ridley turtles occur in the Project area, but were infrequently observed during the VAQF study (S. Barco et al. 2015). Only one sighting of this species was reported during the study, in August 2014, accounting for just 0.1% of all turtles identified to species (S. Barco et al. 2015).

This species was also infrequently observed during the MABS survey; only eight Kemp's ridley turtles were positively identified in Maryland waters over the duration of the study (all of which were observed during aerial surveys) (Williams et al. 2015b). Most observations of this species in the Project area were reported in September and October (Williams et al. 2015b). The calculated annual density of Kemp's ridley turtles observed within the Lease area during the MABS surveys was 0.00012 individuals per hour per square km (Williams et al. 2015b, 2015a). Though the MABS survey is a source of data regarding Kemp's ridley turtle abundance, the majority of small turtles observed during aerial surveys could not be identified to species. Therefore, it is possible that Kemp's ridley turtle populations could be underestimated (Williams et al. 2015b).

Hawksbill Turtle (*Eretmochelys imbricata*)

Hawksbill turtles can reach 65 to 90 cm in length (26 to 35 in) and have highly patterned amber and brown shells and distinctive beak-like mouths (NOAA Fisheries 2021d). This species has a circumtropical distribution in the Atlantic, Pacific, and Indian Oceans (NOAA Fisheries 2021d). Adult hawksbill turtles are most commonly found in shallow coastal areas on healthy coral reefs, though juveniles live in pelagic waters, and utilize floating algal mats for shelter (NOAA Fisheries 2021d; USDOI and USFWS 2018a). This species feeds primarily on sponges, but will also consume algae, mollusks, crustaceans, jellyfish, and other marine organisms (NOAA Fisheries 2021d). The hawksbill is threatened by habitat loss (specifically of coral reef habitats), entanglement in commercial fishing gear, disease, vessel strikes, incidental ingestion of marine debris, and intentional harvest (NOAA Fisheries 2021d). Historical declines in hawksbill turtle populations were largely driven by harvest of these animals for their beautifully patterned shells, which were used to make a variety of decorative products (USDOI and USFWS 2018a). Though harvest of hawksbill turtles is now illegal in most countries, poaching is still a threat to the species (NOAA Fisheries 2021d). The hawksbill turtle is listed as endangered under the ESA.

No DPSs have been established to date for the hawksbill turtle (NOAA 2013). However, available data indicate that distinct populations of hawksbill turtles exist, at least between ocean basins (NOAA 2013). Estimating hawksbill turtle populations and evaluating trends is difficult, as this species nests in low densities on small beaches (NOAA Fisheries 2021d). This dispersed nesting pattern is believed to be the result of past overexploitation of once sizeable colonies (Limpus 1995; Meylan and Donnelly 1999). Current estimates place the number of hawksbill nests laid in United States at 600 to 1,150 nests, located in Puerto Rico and the U.S. Virgin Islands (NOAA Fisheries 2021d). Nesting is rare in the continental United States and is limited to the Florida Keys and the southeastern shore of Florida (NOAA Fisheries 2021d).

In the western Atlantic, hawksbill turtles are largely confined to tropical and subtropical waters, and are found in the Gulf of Mexico, the Caribbean, and the waters surrounding Puerto Rico, the U.S. Virgin Islands, and southern Florida (NOAA Fisheries 2021d). This species is regarded as uncommon north of Florida (BOEM 2014) and rare in the mid-Atlantic (USDOI and BOEM 2012), though deceased individuals have rarely been reported from as far north as Cape Cod (Mass DFW 2019). Hawksbill turtles are believed to exhibit a mixed migratory strategy, with some individuals traveling great distances between nesting beaches and foraging areas, and others remaining in proximity to their natal beaches (NOAA 2013). Female hawksbills turtles return to their natal beaches to nest, generally between April and November (NOAA 2013). Critical habitat for the Hawksbill turtle has been designated around Mona Island, located to the west of Puerto Rico (NOAA 1998).

Hawksbill turtles were not observed during the multi-year Barco et al. (2015) study, and only two confirmed sightings of this species were recorded during the MABS surveys (Williams et al.

2015a), accounting for 0.001% of all turtle observations. Both sightings of this species occurred in October of 2012 (Williams et al. 2015b, 2015a). Though the MABS survey is a source of data regarding hawksbill turtle abundance, the majority of small turtles observed during aerial surveys could not be identified to species. Therefore, it is possible that hawksbill turtle populations could be underestimated (Williams et al. 2015b). Due to the rarity of this species in the region, it is highly unlikely that Project activities would impact hawksbill turtles (USDOI and BOEM 2012). However, vessels transiting to the Project area from ports in the Gulf of Mexico or Caribbean may encounter this species.

10.2 Impacts

Sea turtles in the Project area have the potential to be impacted by a variety of factors associated with Project activities. The impacts of noise and vessel traffic on these organisms are discussed in more detail in Volume II, Sections 10.2.1, 10.2.2, and 10.2.3. DNREC identified potential for sea turtle impacts related to dredging offshore, specifically use of a hopper dredger (DNREC 2023b). US Wind does not propose dredging using a hopper dredger at OSS locations; therefore, this impact to sea turtles would be avoided.

10.2.1 Construction

Noise

Sea turtles may use auditory signals to locate prey, avoid predators, and aid in navigation (Dow Piniak, Mann, et al. 2012). Though adult sea turtles are not known to use sound for communication, hatchlings vocalize in the nest, which may play a role in the synchronization of emergence (McKenna 2016). Relatively little is known about sea turtle hearing capabilities, but recent studies have identified hearing thresholds by examining electrical responses of the auditory nervous system following the application of a sound stimulus (auditory evoked potentials, AEPs). Results of these studies indicate that sea turtles are generally sensitive to low-frequency sounds, though hearing thresholds vary by species and age.

Examinations of juvenile green sea turtle AEPs indicate that this species can hear sounds between 50 and 800 Hz in air, and 50 and 1600 Hz in water (Dow Piniak, Eckert, Mann, et al. 2012; Piniak et al. 2012). Maximum hearing sensitivity in this species was observed between 300 and 400 Hz in air and 50 and 400 Hz in water, and sensitivity to sounds sharply decreased at frequencies above 400 Hz (Dow Piniak, Eckert, Mann, et al. 2012). An earlier study, utilizing different methodology, reported a narrower hearing range for subadult green turtles of between 100 and 500 Hz (most sensitive between 200 and 400 Hz), and noted that individuals collected from Maryland exhibited an expanded hearing range compared to individuals collected from Hawaii (Bartol and Ketten 2006). This study also described Kemp’s ridley turtle hearing, which was found to range from 100 and 500 Hz, and was most sensitive between 100 and 200 Hz (Bartol and Ketten 2006). The hearing range of loggerhead turtles has been described to range from 100 and 1131 Hz (K.J. Martin et al. 2012) and 50 and 1100 Hz (Lavender, Bartol, and Bartol 2014). Similar to the other sea turtle species described above, leatherback hatchlings responded to stimuli between 50 and 1600 Hz in air and 50 and 1200 Hz in water, and maximum sensitivity was documented in response to sounds below 400 Hz (Dow Piniak, Eckert, Harms, et al. 2012).

Little is known about sea turtle physiological responses to sound, including if these organisms experience temporary or permanent threshold shifts as a result of noise exposure (Popper et al. 2014), but these organisms are believed to be less sensitive to hearing damage than marine mammals. Additionally, little is known about turtle behavioral responses to sound (Dow Piniak, Eckert, Mann, et al. 2012; Dow Piniak, Eckert, Harms, et al. 2012). Exposure to high levels of pervasive noise may influence sea turtle behavior (Samuel et al. 2004), and individuals exposed to loud noises are expected to exhibit an avoidance response (McCauley et al. 2000). Behavioral impacts could also result from communication masking, perhaps leading to decreased feeding activity.

NOAA has not established formal acoustic guidance for sea turtles, however, Finneran et al. (2017) provides thresholds for noise-induced injury and behavioral impacts for ESA-listed species associated with pile driving. The thresholds for sea turtles are 175 dB re 1 µPa RMS for behavioral impacts (Finneran et al. 2017). For physiological impacts, weighted acoustics threshold levels range from 189 dB re 1µPa^2-s (TTS) to 204 dB re 1µPa^2-s (injury) for impulsive signals and 220 dB re 1µPa^2-s (injury) for non-impulsive signals (GARFO 2018). Sea turtle hearing ranges overlap with low-frequency sounds produced by multiple Project activities, including pile driving and vessel noise, which are discussed below.

Pile Driving

Impact pile driving is proposed during installation of WTG, OSS, and Met Tower piled jacket and monopile foundations. Though the impacts of pile driving on sea turtles are not understood, this activity generates loud sound pressures within the hearing range of these organisms.

The impacts of loud impulsive sounds on sea turtles are unclear, but individuals located close to the sound source (where noise levels exceed 204 dB re 1 µPa RMS) may experience physiological damage. Sea turtle behavioral responses to pile driving noise may include avoidance behavior, as was noted by McCauley at al. (2000) during seismic airgun survey activities. This study examined the responses of two caged sea turtles (one green and one loggerhead) to airgun noise, and documented increased swimming speeds when the organisms were exposed to sound louder than 166 dB re 1 µPa RMS (McCauley et al. 2000). The turtles exhibited erratic behavior and were deemed to be in an agitated state, indicating a probable avoidance response, when exposed to sound levels exceeding 170 dB re 1 µPa RMS (McCauley et al. 2000).

Impacts to sea turtles due to pile driving noise are likely to be minor due to the implementation of mitigation measures, including the monitoring of exclusion zones and employment of soft-start procedures, as well as the deployment of mitigation measures such as double bubble curtains or nearfield attenuation devices. Physiological damage to sea turtles is not expected, as this would only occur within the exclusion zone, in the area immediately surrounding pile driving activities. Any sea turtles present in the vicinity of pile driving activities are expected to rapidly vacate the area upon the initiation of soft start procedures. Additionally, pile driving activities, and any associated impacts, would be short term, temporary, and in discrete locations, and therefore are not anticipated to result in long-term impacts to sea turtle populations in the area.

An underwater acoustic assessment was conducted to evaluate the potential for pile driving noise to impact sea turtles (Appendix II-H1). This assessment, and the resulting modeled distances to sea turtle hearing thresholds, are conservative, as the model assumed that animals would remain in the area and used varying hammer energies for duration of the driving of the 11-m diameter pile. Additionally, sound propagation modeling was based upon environmental conditions in the Project area in April and in May, as these are the months during which pile driving may occur that have the lowest transmission loss (no pile driving will occur between the months of December and March). US Wind will implement mitigation and monitoring measures as described in Volume II, Section 10.3 to minimize noise impacts to sea turtles.

The other type of foundation under consideration are jackets on suction buckets. The installation of these foundations would not require pile driving and would generate much lower levels of noise than the installation of traditional piles.

Vessel Noise

Increased noise caused by vessel traffic associated with Project activities could impact sea turtles. Vessel noise is primarily composed of low-frequency components (Hildebrand 2009), and is therefore within the hearing ranges of the sea turtle species likely to occur in the Project area. Exposure of sea turtles to noise from construction and operations vessels would be variable, as the intensity of vessel noise is largely related to ship size and speed (Hildebrand 2009). Because the Project area and adjacent waters are already well-traveled and host active fishing (commercial and recreational) and shipping industries, sea turtles in the region are likely habituated to vessel noise. Construction vessel noise would be limited, as boats will travel to and from the Project area at low speeds and will remain stationary at work sites for extended periods of time. Dynamic positioning thrusters (DP thrusters) may be used during Project installation activities. NOAA has indicated that the sound produced by this equipment is similar to that generated by transiting vessels (communications cited in (CSA Ocean Sciences 2018a, 2018b; Tetra Tech 2018)). Any impacts to sea turtles are expected to be temporary, with behavior rapidly returning to normal following passage of a Project vessel, and it is unlikely that such short-term effects would result in long-term population-level impacts.

Vessel Traffic

Though sea turtles spend a majority of the time submerged (Southwood et al. 1999; Houghton et al. 2002; Scott A. Eckert 2006), these organisms are vulnerable to vessel collisions when feeding or basking in surface waters, or breathing at the water surface (NOAA Fisheries 2017f). These interactions can result in serious injury or death (Susan Barco et al. 2016; Hazel et al. 2007). Hazel et al. (2007) observed that green turtles likely habituate to vessel noise, and found that the proportion of turtles that fled from approaching vessels decreased with increasing vessel speed. This study concluded that turtles in surface waters may not be able to effectively avoid being struck by vessels traveling in excess of 4 knots (Hazel et al. 2007). The risk of vessel strike during Project activities is limited as vessels will follow NOAA Fisheries collision avoidance guidance such as establishing minimum separation distances from sea turtles.

For information about Project ports vessel trips and routes please see the following sections: Volume I, Section 3.1 for information about construction ports, Volume I Section 2.7 for information about operations and maintenance ports, and Volume II, Appendix II-C1, Figure 1 and Tables 2 and 3 for vessel routes and trips.

Entanglement and Marine Debris

Entanglement will not pose a risk to sea turtles during Project construction. US Wind does not anticipate the use of anchored vessels during construction. If used, mooring lines will be of relatively large diameter and will generally be kept under tension, eliminating entanglement risk.

All Clean Water Act and other federal regulations regarding marine debris will be followed during construction activities. Items that have the potential to become marine debris will be disposed of on shore. Construction activities are not anticipated to generate marine debris and will therefore not pose a risk to sea turtles.

Land Disturbance

US Wind will locate cable landfalls and onshore facilities so as to avoid impacts to known sea turtle nesting beaches, where feasible. The use of HDD for cable installation under the Barrier Beach Landfalls will avoid impacts on beaches. Construction is anticipated to occur outside of turtle nesting season. Agency consultation and monitoring will be conducted as needed to mitigate disturbances.

Routine/Accidental Releases

During the course of construction, pollutants may be discharged into the environment as part of routine activities, such as the operation of construction vessels and vehicles, or due to accidental spills. See Volume II, Section 4.2 for a discussion of the impacts of routine and accidental releases during Project activities. Water quality impacts due to routine and accidental releases are anticipated to be negligible and are therefore not anticipated to impact sea turtles or their prey species.

Suspended Sediment/Deposition

Pile driving during WTG, OSS and Met Tower foundation installation, the use of jack-up and feeder vessels, jet plow operations during cable laying and embedment, vessel anchoring, and the installation and removal of gravity cells will disturb sediment on the seafloor. The use of mechanical trenching or conventional cable plowing will also result in sediment disturbance, though this activity will be limited only to areas where site conditions do not allow for the use of jet plowing. See Volume II, Section 4.2 for a discussion of the impacts of these activities on suspended sediment levels and sediment deposition. Water quality impacts associated with jet plow operations, HDD, and other bottom-disturbing activities are expected to be minor and temporally limited and are not anticipated to directly impact sea turtles.

Impacts to sea turtle prey species due to bottom disturbing activities are also expected to be minor. Though direct bottom disturbance and sediment deposition will result in localized mortality of benthic organisms, impacts to communities of benthic crustacean and shellfish species which may serve as prey for sea turtles are expected to be negligible (Volume II, Section 7.2.1). Similarly, local increases in suspended sediment concentrations are expected to have negligible to minor, and spatially limited, impacts on other sea turtle prey species including jellyfish, ctenophores, and salps, and fish (Volume II, Section 8.2.1). Therefore, impacts to sea turtles are not anticipated to result from bottom-disturbing activities related to project construction.

10.2.2 Operations

Noise

Operational Noise

Sea turtles are likely able to detect noise produced by the operation of WTGs (Dow Piniak 2012). Operational noise is not expected to approach levels that could harm sea turtles, but behavioral responses are possible. However, exposure to operational WTG noise is unlikely to result in population-level impacts to sea turtles in the Project area.

Vessel Noise

Project O&M activities will require vessel travel within the Project area. Vessel noise has the potential to impact sea turtles (see Volume II, Section 10.2.1). However, as the region is heavily traveled by commercial shipping and fishing vessels, low levels of vessel noise associated with Project activities are not anticipated to alter acoustic conditions.

EMF

Several species of sea turtle are able to detect and utilize the earth's natural magnetic field (Kenneth J. Lohmann and Lohmann 1994; Kenneth J. Lohmann et al. 2004; Kenneth J. Lohmann, Putman, and Lohmann 2008). Sea turtles are able to detect both magnetic field intensity (Kenneth J. Lohmann and Lohmann 1996) and magnetic inclination angle (Kenneth J. Lohmann and Lohmann 1994) and possess a heritable "magnetic map" that they use for navigation (K. J. Lohmann et al. 2007). The highest intensity EMF, located directly above the cable, may be experienced by sea turtles foraging in the vicinity of the Project area. Loggerheads, the most common turtle in the Project area, primarily forage for finfish and other prey in the top 10 m (33 ft) of the water column, though this species does intermittently venture to the seafloor in search of benthic invertebrate prey and may come in contact with cable-generated EMF (Smolowitz et al. 2015; Seney and Musick 2007). Green sea turtles may also forage near buried submarine cables. This species exhibits ontogenetic shifts in diet; adult turtles are almost entirely herbivorous, and are found in benthic coastal regions, whereas juveniles consume an omnivorous diet and forage within the water column (Arthur, Boyle, and Limpus 2008). Therefore, adult green turtles are most likely to spend time in proximity to buried cables. In contrast, leatherback turtles are obligate feeders on gelatinous zooplankton and are unlikely to spend time in the vicinity of the submarine cable.

Offshore export cables and inter-array cables will produce EMF. The intensity of EMF generated by the cables will be limited by burial of the cable beneath the sea floor (approximately 1 to 4 m (3.2 – 13.1 ft)). At the seabed, the magnetic-field was calculated to be 148 mG and the electric field was 2.5 mV/m (Exponent 2023). However, as the distance from the cable increases, both the magnetic and electric field decrease rapidly, to less than 1 mG and 0.1 mV/m, respectively (Exponent 2023). US Wind will use submarine cables that have electrical shielding and bury the cables in the seafloor, when practicable. Due to the limited spatial extent of the EMF produced by cable operation and the low level of risk of exposure of sea turtle species to EMF, population-level impacts to sea turtle behavior are not anticipated.

Habitat Alteration

Habitat alteration due to the installation of the submarine cable and the WTG, OSS and Met Tower foundations, is not expected to negatively impact sea turtle populations. WTG foundations and associated structures will function as artificial reefs and are likely to support increased fish and invertebrate populations in the vicinity of the Project area (Linley et al. 2007). Project structures will likely provide foraging habitat and shelter for sea turtles, which are known to utilize artificial reefs (Gitschlag, Herczeg, and Barcak 1997; Gitschlag and Herczeg 1994). Though commercial and recreational fishing interests may be drawn to the wind farm due to increased fish densities and sea turtles can be injured or killed by interactions with fisheries (Finkbeiner et al. 2011; Lewison, Freeman, and Crowder 2004), no population-level impacts to sea turtles are expected.

Vessel Traffic

Vessel traffic associated with Project O&M activities could endanger sea turtles (see Volume II, Section 10.2.1). Project vessels will follow NOAA Fisheries collision avoidance guidance, therefore the risk of harm to sea turtles from vessel strike is negligible. Vessel strike avoidance procedures would be the same as described and referenced above for the construction portion of the Project.

Entanglement and Marine Debris

Entanglement will not pose a risk to sea turtles during Project operation. Submarine cables will be buried approximately 1 to 4 m (3 to 13 ft) beneath the sea floor or covered with protective material (e.g. concrete mattresses) when target burial depths are not achievable. Similarly, the minimum diameter of the WTG foundation structures will be 8.0 m (26.2 ft) for each monopile, and the minimum diameter of the OSS foundation structures will be 8.0 m (26.2 ft) for each monopile, 2 m (6.6 ft) for each jacket foundation pile, and 10 m (32.8 ft) for jacket on suction buckets and do not pose an entanglement risk. Secondary entanglement, due to marine debris becoming snagged on WTG foundations, is a risk for sea turtles. However, risk of this occurrence is low as the structures are largely free of protrusions upon which such debris could attach.

Additionally, Clean Water Act and other federal regulations regarding marine debris will be followed during operations activities. Items that have the potential to become marine debris will be disposed of on shore. Operations activities are not anticipated to generate marine debris and will therefore not pose a risk to sea turtles.

10.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Removal of Project structures would result in the generation of underwater noise and would necessitate increased vessel traffic in the Project area. Impacts from these activities would be similar to those described above for the construction portion of the Project. Avoidance, minimization, and mitigation measures would be the same as described and referenced above for the construction portion of the Project.

10.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on sea turtles.

Pile Driving

- Implement sound attenuation technologies such as double bubble curtains and nearfield attenuation devices to reduce underwater pile driving noise by 10 dB, with a target of 20 dB.
- Establish a clearance zone prior to pile driving using visual monitoring for sea turtles. Once clearance zone is confirmed clear of protected species, pile driving will begin with minimum hammering at low energy for no less than 30 minutes (soft-start).
- Additional restrictions on pile driving will include: no simultaneous pile driving; no more than one monopile driven per day; daylight pile driving only unless health and safety issues require completion of a pile; and initiation will not begin within 1.5 hours of civil sunset or in times of low visibility when the visual clearance zone and exclusion zone cannot be visually monitored, as determined by the lead PSO on duty.
- Establish an exclusion zone using visual monitoring for sea turtles. Pile driving will be halted if species enters defined exclusion zone, with exceptions for health and safety considerations as well as technical feasibility.

- Visual clearance and exclusion zones will be monitored by PSOs which are individuals with a current NOAA Fisheries approval letter as a PSO.

Vessel Strike Avoidance

- Vessels will observe NOAA Fisheries collision avoidance guidance, such as establishing minimum separation distances from sea turtles.
- Trained observers will be present on crew vessels and other project vessels without PSOs.

Other Mitigation and Monitoring

US Wind will implement the following other mitigation and monitoring measures:

- US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.
- Submarine cables that have electrical shielding will be used and the cables will be buried in the seafloor, where practicable.
- Vessel operators, employees, and contractors will be briefed on marine trash and debris awareness elimination as described in BSEE NTL No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination"), per BOEM guidelines for marine trash and debris prevention.
- Vessels will adhere to United States Coast Guard (USCG) guidelines; follow applicable regulations related to the discharge of bilge water, gray water, and sanitary waste; maintain discharge permits, as appropriate; follow good maintenance and housekeeping procedures to prevent releases of oil and other chemicals to the sea; maintain up-to-date oil spill response plans to prevent, contain, and clean up any accidental spills.
- US Wind will locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches, where feasible. The use of HDD for cable installation under the Barrier Beach Landfalls will avoid impacts on beaches.
- Construction is anticipated to occur outside of turtle nesting season. Agency consultation and monitoring will be conducted as needed to mitigate disturbances.
- Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.

11.0 Terrestrial Species and Upland Habitats

11.1 Description of Affected Environment

The terrestrial portion of the Project area is in the Delmarva region and includes the proposed Interconnection Facilities, Onshore Export Cable Corridors 1a, 1b, 1c, and 2 and the O&M Facility. The Barrier Beach Landfalls are considered in Volume II, Section 6.0 as a coastal resource.

The proposed Interconnection Facilities are adjacent to the existing Indian River Substation in Sussex County, Delaware (Figure 6-6). The area in the vicinity of the proposed Interconnection Facilities includes areas of forest, the existing Indian River Substation and the nearby Indian River Power Plant. Associated infrastructure includes overhead powerlines, rail lines, and paved access roads. As it is expected that the proposed Interconnection Facilities will be installed within previously disturbed areas to the extent feasible, Project impacts to terrestrial species and upland habitats will be minimal. Additional Interconnection Facilities under consideration as options as described in Volume I, Section 2.6 are also addressed here.

The potential land-based Onshore Export Cable Corridors would be installed in existing Rights-of-Way (ROW) within previously disturbed lands to the extent feasible, see Figure 11-1. The land-based Onshore Export Cable Corridors are not discussed further in this section because disturbance of terrestrial species and habitat alteration is considered to have already occurred.

US Wind plans to construct a facility located pier side in the Ocean City, Maryland area for the O&M Facility, included a warehouse and crew support facility, and upgrades to existing pier structures. Construction related to the O&M Facility would occur on previously disturbed land and no dredging would be required for vessel berthing. The O&M Facility is not discussed further in this section because disturbance of terrestrial species and habitat alteration is considered to have already occurred from the development of the pre-existing facilities.

Several federal agencies and non-governmental organizations (NGO) have developed systems to classify and describe distinct regions and sub-regions of North America with respect to geography, geology, hydrology, vegetation and wildlife which are used in the section to describe terrestrial portions of the Project. The Interconnection Facilities are located in the Virginian Barrier Island and Coastal Marshes (63d) Level IV Ecoregion (Indian River Bay) which is part of the larger Middle Atlantic Coastal Plain (63) Level III Ecoregion under the United States Environmental Protection Agency (EPA) hierarchical classification system. The EPA defines Ecoregions as "areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Because they include large-scale geophysical patterns in the landscape that are linked to the faunal and floral assemblages and processes at the ecosystem scale, ecoregions provide a useful means for simplifying and reporting on more complex patterns of biodiversity" (USEPA 1999).

The Nature Conservancy (TNC) also classifies North America into ecoregions based on shared biotic and abiotic characteristics (Groves et al. 2002). The TNC system places the Interconnection Facilities in the Chesapeake Bay Lowlands (CBY) ecoregion. The U.S. Forest Service (USFS) classification system places most of Delaware, including the Interconnection Facilities, in the Outer Coastal Plain Mixed Forest Province (R.G. Bailey 1995). These forests are dominated by evergreen oaks and members of the laurel and magnolia families.

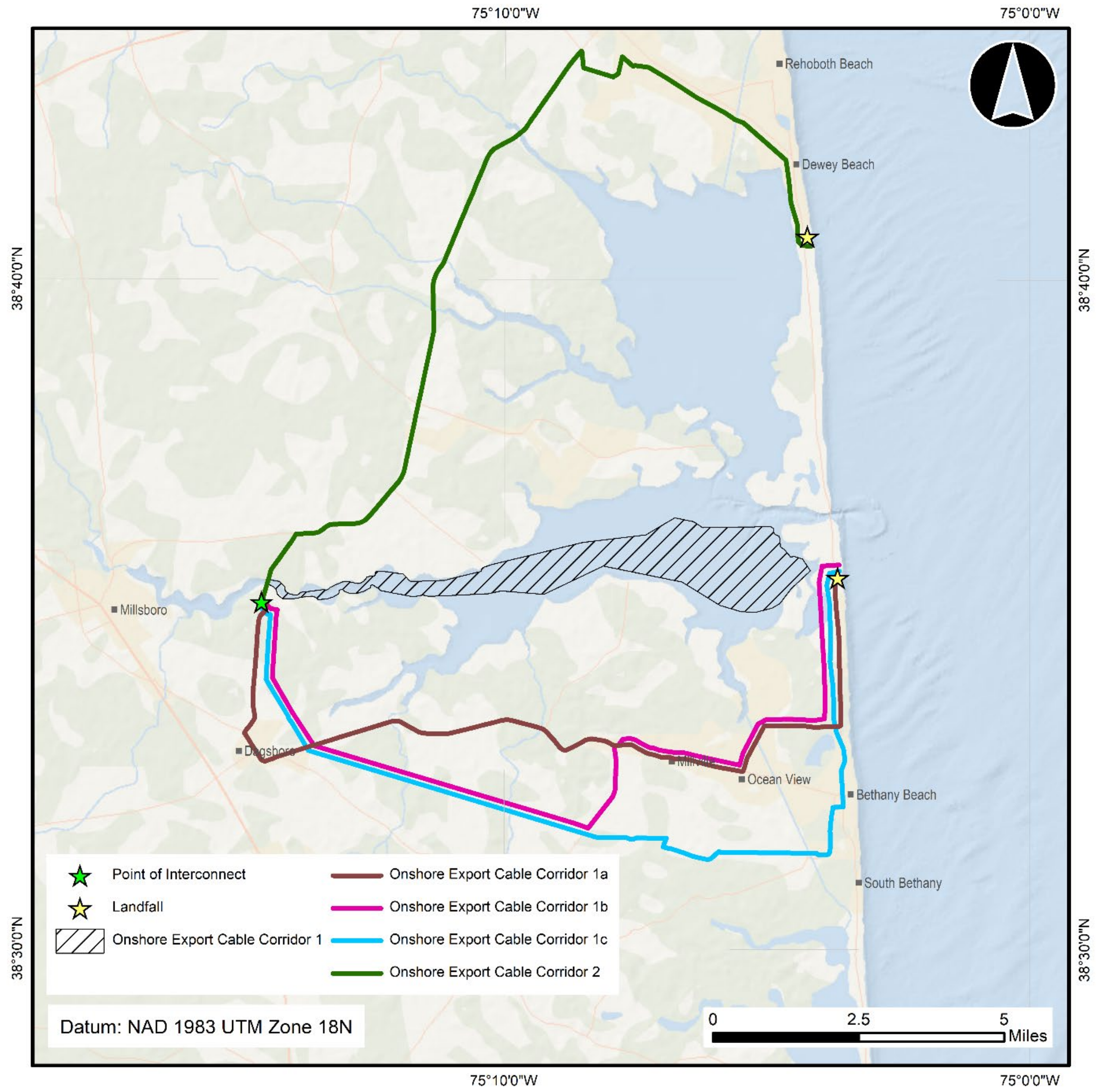

Figure 11-1. Land-based Onshore Export Cable Corridors

DNREC designates State Wildlife Areas (SWAs) through its general authority to manage and conserve all forms of regulated state wildlife. SWAs or refuges are any land or water body of the state, whether in public or private ownership, designated by DNREC in the interest of conservation of wildlife. According to DNREC and the United States Fish and Wildlife Service (USFWS), the Interconnection Facilities are not located in the vicinity of any state or federally owned conservation land (USFWS 2021a).

11.1.1 Vegetative and Wildlife Communities

The primary natural vegetative community types present in the vicinity of the Interconnection Facilities are: Southern Atlantic coastal plain mesic hardwood forest and North Atlantic coastal plain hardwood forest (DEDFW 2015). Generally, highly fragmented and dominated by a mix of hickories, oaks, and tulip poplar, Southern Atlantic coastal plain mesic hardwood forests often develop on moist, acidic, nutrient-poor soils in the Coastal Plain on a variety of landforms, including flatwoods, undulating uplands, ravines, and lower slopes. This is one of the common forested habitats in Delaware and it is not listed as a habitat of conservation concern.

North Atlantic coastal plain hardwood forests are found on acidic, sandy soils and are largely dominated by oaks, with pines occasionally as a codominant. An herbaceous layer is typically not well developed and is patchy to sparse throughout the forest floor. According to the Delaware Wildlife Action Plan, this habitat community is considered a habitat of conservation concern (DEDFW 2015).

The wildlife community in the vicinity of the Interconnection Facilities is expected to be typical of that associated with the two habitat community types described above. Both the Southern Atlantic coastal plain mesic hardwood forest habitat and the North Atlantic coastal plain hardwood forest habitat have relatively similar vegetation and physical characteristics and therefore would be expected to host a similar wildlife community. Examples of typical mammal species that may be found in these habitats include: white-tailed deer (*Odocoileus virginianus*), Eastern gray squirrel (*Sciurus carolinensis*) and red fox (*Vulpes vulpes*). Typical bird species that could occur in both forest types include: red tailed hawk (*Buteo jamaicensis*), broad-winged hawk (*Buteo platypterus*), barred owl (*Strix varia*), downy woodpecker (*Dryobates pubescens*), Carolina chickadee (*Poecile carolinensis*), blue-winged warbler (*Vermivora cyanoptera*), Tennessee warbler (*Leiothlypis peregrine*), and blue jay (*Cyanocitta cristata).* Some examples of reptile and amphibian species that may be found in both forest types include: American toad (*Anaxyrus americanus*), Cope's gray tree frog (*Hyla chrysoscelis*), wood frog (*Lithobates sylvaticus*), Eastern garter snake (*Thamnophis sirtalis*) and Eastern box turtle (*Terrapene carolina*) (DEDFW 2015; Dove, Nyman, and editors 1995). These lists are intended to provide examples of representative wildlife species that could be expected to occur in these habitat types and are not exhaustive.

11.1.2 Rare, Threatened, and Endangered Species

Based on correspondence and consultation with the USFWS and DNREC Division of Fish and Wildlife, no federally listed species have been identified in the vicinity of the proposed Interconnection Facilities (DNREC 2017b). DNREC has noted the existence of a nearby bald eagle nest, which is discussed in more detail in Volume II, Section 6.1.1 (DNREC 2017b). Federally and state listed species potentially occurring in the vicinity of the Interconnection Facilities are noted in Table 11-1 and discussed in more detail in Volume II, Section 6.1.1.

Table 11-1. Federally and State-listed Terrestrial Species Potentially Occurring in the Vicinity of the Interconnection Facilities

Common Name	Scientific Name	Federal Status	DE State Status	MD State Status
Common Tern^{BR}	*Sterna hirundo*	-	E	E
Royal Tern	*Thalasseus maximus*	-	-	E
Bald Eagle	*Haliaeetus leucocephalus*	-	E	-
Rufa Red Knot	*Calidris canutus rufa*	T	-	(T)

Table 11-1. Federally and State-listed Terrestrial Species Potentially Occurring in the Vicinity of the Interconnection Facilities

Common Name	Scientific Name	Federal Status	DE State Status	MD State Status
Eastern Black Rail	*Laterallus jamaicensis*	T	-	-
Northern Long-eared Bat	*Myotis septentrionalis*	E	E	T
Tricolored Bat	*Perimyotis subflavus*	Proposed E	-	-
Evergreen Bayberry	*Morella caroliniensis*	-	-	E
Seabeach Amaranth	*Amaranthus pumilus*	T	-	E
Swamp Pink	*Helonias bullata*	T	-	E

Source: DNREC 2017b
E = Endangered; T = Threatened; (T) = Appears likely to become endangered in MD; ^{BR} Breeding population only

Federal Candidate Species

Candidate species are those species for which sufficient information is available to support a proposal for listing as federally endangered or threatened, but for which preparation and publication of a proposal is precluded by higher priority listing actions by USFWS (50 CFR 424.15). As of December 2020, the monarch butterfly (*Danaus plexippus*) became a candidate for listing, due to decreasing population size as a result of habitat loss and fragmentation (USFWS 2021c).

11.2 Impacts

11.2.1 Construction

Construction of the Interconnection Facilities entails new US Wind Substations along with a temporary construction laydown area, and related infrastructure.

The following section describes potential impacts to terrestrial habitats and wildlife species that may occur during construction of the Interconnection Facilities.

Habitat Alteration

The construction of the Interconnection Facilities will result in habitat alteration and impacts are anticipated to be minor. Habitat alteration will generally entail the conversion of currently vegetated, pervious areas to non-vegetated, impervious areas. This habitat alteration will in turn result in an incremental loss of habitat available for use by wildlife species commensurate with the degree of alteration. US Wind Substations, consisting of new substations and an access road with a combined footprint of up to 10.3 acres may result in varying degrees of forested habitat loss and require tree and vegetation clearing. Existing disturbed areas will be used for the construction laydown area and access roads where feasible.

Onshore export cables traversing Onshore Export Cable Corridor 1 would exit Indian River Bay via HDD to the US Wind Substations. HDD activities would take place within the footprint of the Interconnection Facilities and would not require any additional clearing. As discussed in Volume

II, Section 13.0, the northern long-eared bat has not been identified as being present in the vicinity of the Interconnection Facilities, however it may occur in Delaware and eastern Maryland. Bats tend to use coastal systems, such as barrier islands (specifically Assateague Island), as stopovers during seasonal migrations, which is further discussed in Volume II, Section 13.1.1. The USFWS has established a recommended seasonal time of year (TOY) restriction for tree clearing activities between June 1 and July 31 in areas where the federally-listed northern long-eared bat may occur. Project related tree clearing activities will be avoided during this TOY restriction period.

The Project was sited to avoid rare and sensitive terrestrial habitats to the greatest extent practicable. DNREC recommends the following measures (DNREC 2023b):

- No tree clearing at the substation landfall April 1 through July 31.

Noise

Construction of the Interconnection Facilities will generate noise that may temporarily displace wildlife. Noise impacts are considered negligible to minor. Any increase in noise levels during construction will be temporary and limited.

Vehicle Traffic

The use of construction-related vehicles and equipment at the Interconnection Facilities may result in impacts to wildlife in the vicinity due to increased noise, emissions and the potential for vehicle strikes. Vehicle strikes may result in mortality of individual wildlife; however most mobile species would be expected to temporarily relocate from areas of active construction. Given the infrequent nature of vehicle strikes, this potential impact is expected to be negligible.

Air Emissions and Routine and Accidental Releases

Routine releases are chemical releases that would be expected to occur during construction and primarily include engine emissions from construction-related vehicles and equipment. Engine emissions are an unavoidable result of the use of construction vehicles and equipment for any construction project and are not specific to the proposed Project. However, methods to reduce engine emissions will be implemented during construction of the proposed Project, including restricting engine idling. Air quality impacts associated with the generation of vehicle emissions at the Interconnection Facilities will be negligible and temporary in nature.

Accidental releases could occur during construction from the HDD operations (in the case of an accidental frac-out of bentonite) and the use of construction vehicles and equipment. A construction SPCC Plan will be developed and implemented in accordance with applicable local, state, and federal requirements. The SPCC Plan will identify control measures proposed to prevent spills of fuel, oil, lubricants, and other chemicals as well as best management practices to be implemented to prevent and contain chemical releases into the environment. Given the nature of construction-related equipment and methods proposed at the Interconnection Facilities, if an accidental release did occur the impacts associated with such a release would be negligible and temporary.

11.2.2 Operations

The following section will discuss potential impacts to terrestrial habitats and wildlife species that may occur during operation of the proposed Project.

Noise

Noise generation at the Interconnection Facilities is expected to be negligible during operations. Operations are not expected to result in an increase in background noise levels in the vicinity of the proposed Interconnection Facilities. At optional Interconnection Facilities locations, operations are not expected to significantly increase background noise levels. Periodic maintenance and inspection activities may result in an increase in noise; however, the incremental increase in noise levels resulting from these activities would be negligible and temporary in nature. US Wind plans to conduct an acoustic assessment of operational noise related to the US Wind Substations to support local permitting.

Vehicle Traffic

The Interconnection Facilities will not be staffed on a regular basis; therefore, vehicle traffic during operations is expected to be limited to periodic maintenance and inspection activities. There is a potential for vehicle strikes of wildlife during these activities; however, given the expected intermittent use of vehicles at the site and the relatively infrequent nature of vehicle strikes, this impact would be negligible.

Lighting

Artificial lighting during the night has the potential to alter the behavior of some wildlife species; however, lighting-related impacts can be minimized by using best management practices (BMPs). Examples of BMPs to minimize the adverse impacts of artificial lighting include not lighting the facility at night except in the case of an emergency that requires an immediate response, and the use of down-shielded light fixtures to reduce the visibility of light by birds, bats, and insects flying above the facility. Lighting during operation of the Interconnection Facilities is not expected to result in a significant increase in the existing ambient light conditions in the area. The existing Indian River Power Plant and Indian River Substation already contribute to artificial lighting in the vicinity of the proposed Interconnection Facilities; the incremental increase in artificial lighting during the operation of the proposed Interconnection Facilities will therefore be negligible. At Interconnection Facilities under consideration, operations are not expected to result in a significant increase in the existing ambient light conditions in the area.

Air Emissions and Routine and Accidental Releases

Routine releases are chemical releases that would be expected to occur during inspections and maintenance of the Project and primarily include engine emissions from vehicles and equipment. Engine emissions are an unavoidable result of the use of vehicles and equipment and are not specific to the proposed Project. However, methods to reduce engine emissions will be implemented during the operations and maintenance, including restricting engine idling. Vehicle use at the facility would occur infrequently for routine inspection and maintenance purposes. Air quality impacts associated with the generation of vehicle emissions at the Interconnection Facilities during operations will be negligible and temporary in nature.

Accidental releases of chemicals could occur during operations. Such releases would most likely entail the release of oil-filled equipment within the US Wind Substations or a release of fuel, oil, or other chemicals during routine maintenance of the facility. The US Wind Substations will be designed to include built-in containment to prevent the accidental release of chemicals into the environment. An SPCC Plan will be developed for the facility and will be implemented in the event of an accidental release.

11.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Terrestrial species and habitats may be exposed to impacts during decommissioning in a similar manner as during construction. At the time of decommissioning, the Project proponent will review best practices with the USFWS and BOEM to avoid and minimize potential impacts to these resources.

11.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on terrestrial species and upland habitats.

- Previously disturbed areas will be used for the construction laydown area and access roads where feasible.
- Tree clearing activities at the US Wind substations required for Project construction are not planned between April 1 through July 31 to avoid or minimize impacts to potentially mature forest and the northern long-eared bat summer maternity period.
- Methods to reduce engine emissions will be implemented during construction and operation of the proposed Project where practicable, including restricting engine idling.
- Project-specific SPCC Plan will be prepared prior to construction and for operations activities.
- US Wind will develop a Stormwater Pollution Prevention Plan (SWPPP) for onshore construction activities, as appropriate.
- Lighting-related impacts will be minimized by using best management practices (BMPs) where feasible. Examples of BMPs to minimize the adverse impacts of artificial lighting will include not lighting the facility at night except in the case of an emergency that requires an immediate response, and the use of down-shielded light fixtures to reduce the visibility of light by birds, bats, and insects flying above the facility.

12.0 Marine Birds

This section discusses the marine bird species that may occur in the Project area, the potential impacts to these species that may result from Project activities, and proposed measures to be implemented during construction, operation, and decommissioning of the Project to avoid or minimize the potential impacts.

Avian species associated with the coastal, near-shore environment that may be affected by Project activities are discussed in Volume II, Section 6.0. Terrestrial bird species that may be affected by Project activities are discussed in Volume II, Section 11.0. An Avian Risk Assessment is included as Appendix II-N1.

12.1 Description of Affected Environment

Marine birds are avian species adapted to life in the marine environment, which is characterized by relatively deep, offshore waters generally located 5.5 km (3 NM) or more from the coast. Marine birds may be distinguished from coastal birds, which are adapted to life in relatively shallow, nearshore waters and associated habitats along shorelines, and from terrestrial birds (or “land birds”) that primarily occur in terrestrial habitats inland from the coast. While some marine bird species may be found in coastal areas, marine birds are the species most likely to regularly occur offshore. Many marine bird species spend much of their life cycle at sea, coming to land only during the nesting season. Marine birds include species of loons, grebes, tubenoses, pelicans, cormorants, geese, ducks, eagles, ospreys, falcons, oystercatchers, plovers, sandpipers, turnstones, surfbirds, phalaropes, jaegers, skuas, gulls, terns, alcids, kingfishers, and herons.

The marine bird community in the mid-Atlantic consists of species that breed outside of the region and spend all or part of the non-breeding season in the region (such as gannets and alcids), and of species that breed in coastal areas in the region and take advantage of marine habitats for foraging or resting (such as gulls and terns). Additional description of the marine bird community in the Lease area and an avian risk assessment are provided in Appendix II-N1.

Metocean Buoy Monitoring

US Wind has deployed the Metocean Buoy within the Lease area for a planned 2-year metocean data collection campaign during the site assessment term of the Lease. The Metocean Buoy and its associated seabed mounted TRBM have been equipped with a suite of wildlife monitoring sensors as provided in the related Metocean Buoy SAP approved May 5, 2021. One sensor is a telemetry receiver designed to detect the nanotags for certain species of birds that have been previously tagged. The other sensor is an acoustic recorder for the detection of diurnal and nocturnal calls of various migrating bird species within the Lease area.

12.2 Impacts

As discussed in Appendix II-N1, the overall risk of adverse impacts to marine birds from the construction, operation, and decommissioning of the Project is influenced by two primary considerations: (1) the nature of the potential impact-producing factors and (2) the potential for exposure of birds to those impact-producing factors. The second of these, the potential for exposure of birds to impact-producing factors, is discussed in Appendix II-N1. This section discusses the potential impacts during Project construction, operation, and decommissioning to marine birds, as well as the proposed measures to avoid or minimize these potential impacts. This analysis assumes 100% WTG operation as a conservative estimate, which is consistent with the Project Design Envelope approach for the COP. Marine birds could potentially be impacted by factors that occur in the offshore environment, including within the Lease area and along a portion of the Offshore Export Cable Corridors. Project-related activities in the coastal and terrestrial environments are not likely to adversely affect marine birds but are also addressed in this section.

12.2.1 Construction

Impacts to marine birds during construction may result from activities related to installation of the WTGs, OSSs, Met Tower, inter-array cables, and export cables. In general, the primary potential impact to marine birds that could result from these activities is disturbance or displacement due to the generation of noise, the movement of vessels through the area, and the generation of artificial lighting. The nature of this potential impact is expected to be indirect, as the effects of noise, vessel traffic, and artificial lighting may alter the behavior of individual birds such that they are potentially displaced from or attracted to the Project area. Activities associated with construction will be temporary in duration, and any potential impacts associated with these activities will likewise be temporary. If disturbance or displacement of birds did occur, this impact would be considered negative, as it would entail an alteration of the natural behavior of individuals and cause them to expend energy that they otherwise would not have in the absence of the Project. The extent of potential disturbance/displacement impacts associated with construction activities is expected to be localized to the immediate vicinity of the Project area.

Noise

Noise will be generated in the offshore environment during construction by pile driving operations, vessels (including cable installation and other vessels), and other construction related activities. Noise generated during construction has the potential to result in disturbance and/or displacement of individual birds in the vicinity of noise-generating activities. Pile driving operations are likely to be the most significant noise generating activity in the offshore environment and the one most likely to result in disturbance or displacement of marine birds due to the high intensity of the sound produced and the intermittent frequency of the activity. Pile driving may also result in the displacement of avian prey (especially fish, see Volume II, Section 8.0) from the vicinity of the activity, which may negatively impact foraging success of marine birds in the area. Noise associated with vessel operations is unlikely to result in disturbance or displacement of marine birds due to the constant and low intensity of the sound, the existing operation of vessels in the offshore environment, and the transient nature of the activity. Therefore, the impacts of noise generated during construction on marine birds are expected to be negligible to minor.

Vessel Traffic

A variety of marine vessels will be used during construction in the offshore environment. Vessels will be used during construction to transport personnel and equipment between the Lease area and shore; to install the WTGs, OSSs, Met Tower, inter-array cables, and export cables; and for other purposes. The use of vessels in the offshore environment has the potential to result in micro-scale disturbance of individual birds and has the potential to attract marine birds. Micro-scale disturbance may occur if an individual bird is sitting on the water in the direct path of a vessel and is forced to relocate to avoid the vessel. In this scenario, the individual would likely swim or fly a short distance to avoid the path of the vessel and then continue with its previous behavior (i.e., feeding, resting, etc.); individuals would not be expected to be displaced from the wider area by the use of vessels.

The use of vessels in the marine environment may also result in attraction of some marine birds. Gulls in particular are frequently attracted to and follow commercial fishing vessels in search of food; this behavior often extends to non-fishing vessels as well. The potential attraction of seabirds, especially gulls, to vessels used during construction may be considered an adverse impact as it results in an alteration to the behavior of the individual birds that may affect foraging and cause an expenditure of energy that would otherwise not occur. However, this impact is expected to be temporary and restricted to the immediate vicinity of the activity, and therefore is considered a negligible impact.

Lighting

Artificial lighting may be generated by activities conducted in the offshore environment during construction, including the use of vessels and lighting of temporary structures. Artificial lighting has the potential to indirectly impact seabirds by attracting individuals to lighted structures or vessels and thus may increase the risk of collision (Boehlert and Gill 2010). The potentially attracting effects of artificial lighting may be more pronounced at night or during inclement weather, when visibility is generally poorer and the ability of birds to avoid structures may be reduced. This effect is more likely to be of concern during operation and the potential impacts of artificial lighting during construction are expected to be negligible.

12.2.2 Operations

Impacts to marine birds during operations may result from several factors. The primary potential impact of concern is mortality or injury resulting from collision with WTGs (rotating blades or towers). Other potential impacts include disturbance and/or displacement due to noise or vessel traffic, the potential attracting effects of artificial lighting, and displacement due to the presence of the wind energy facility.

Noise

Noise will be generated in the offshore environment during operations primarily by the rotating turbine blades, and secondarily by the operation of vessels used for routine inspections of the facility and by activities related to maintenance or repair of Project infrastructure. Noise generated during operations is unlikely to result in disturbance and/or displacement of birds. Noise associated with the operation of vessels in the marine environment is not expected to result in disturbance or displacement of marine birds. Similarly, noise associated with activities related to maintenance or repair of Project infrastructure are expected to have a low potential for disturbance or displacement impacts due to the infrequent nature of these activities and the likely low intensity of noise associated with them. Rotating turbine blades will generate a constant, low-intensity sound over the operational life of the Project; however, there is little evidence to suggest that this impact has the potential to result in displacement of birds from the Project area. Where avoidance behavior of birds around offshore wind energy facilities has been documented, this is more likely due to the desire to avoid the WTG structures themselves than displacement resulting from increased noise levels in the vicinity of the facility. Therefore, the impacts of noise generated during operations on marine birds are expected to be negligible.

Vessel Traffic

The use of vessels during operations is likely to be functionally the same as during construction in the context of potential impacts to marine birds. This activity would be expected to occur less frequently than during construction, but over a longer period of time. The use of vessels in the offshore environment during operations is expected to result in negligible impacts to marine birds.

Vessel traffic through the Lease area is expected to be reduced once the WTGs are operational as current vessel traffic will be rerouted to a proposed Traffic Separation Scheme extension (see Volume II, Section 16.0)

Lighting

During operations, WTG nacelles will include aviation obstruction lighting as required by FAA regulations. Marine birds and other birds passing through the Lease area during migration may be attracted to sources of artificial light, especially at night or during periods of inclement weather. Birds attracted to artificial light sources on the WTGs may be at higher risk of collision with the WTGs, especially given that this attracting effect is most likely to occur at night or in inclement weather when birds may be less likely to detect and avoid the structure. As artificial lighting has the potential to attract birds to operating WTGs and hence increase collision risk, the significance of this impact is considered to be negligible to minor.

The potential attracting impacts of artificial lighting may be reduced by minimizing the number, intensity, and duration of lighting; using red or green lighting instead of white lighting; using flashing or strobing lights instead of steady-burning lights; using flashing lights with the lowest flash rate practicable; minimizing direct lighting of the water’s surface; and employing the use of down-shielding devices to limit the visibility of lights from above (Hötker, Thomsen, and Jeromin 2006; BOEM 2013). These measures will be implemented during the operations period when it is safe to do so and when they conform to FAA regulations regarding avian obstruction lighting of structures, BOEM Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development (BOEM 2021b) and USCG requirements for lighting while using lighting technology (e.g., low-intensity strobe lights) that minimize impacts on avian species (USCG 2017).

Visible Structures

The most significant physical alteration to the marine environment during operations will be the presence of the WTG structures. The physical presence of the WTG structures in the offshore environment may result in two distinct yet related impacts to marine birds: displacement and collision-related mortality or injury. These potential impacts are discussed below. For this section and those that follow, it was assumed that the WTGs would be operating 100% of the time, as is consistent with a Project Design Envelope approach.

Displacement

Displacement occurs when birds alter their movements to avoid the Project. Displacement effects may then represent a form of habitat loss, in that the area within the Project is “unavailable” to birds displaced by its physical presence. Studies of offshore wind energy facilities in Europe have demonstrated clear avoidance behavior among several marine bird groups (Fox et al. 2006; Lindeboom et al. 2011; Krijgsveld et al. 2011); marine birds that use the mid-Atlantic region would similarly be expected to largely avoid the Project. While birds may effectively experience habitat loss as a result of displacement caused by the presence of the WTGs, this effect is not expected to result in significant adverse impacts to individuals or populations. The overall size of the Project is small in the context of the mid-Atlantic OCS and is not known to provide unique resources to marine birds that would not be provided by nearby areas of the OCS. Additionally, the Lease area does not provide critical habitat for any federally-listed species.

Displacement is related to the risk for collision-related mortality or injury in that birds that avoid the Project are by definition at a lower risk for collision with the WTGs than birds that tend not to avoid the Project. Species or groups that are more likely to avoid (and hence be displaced by) the Project would be expected to be less likely to be at risk for collision, while species or groups that are less likely to avoid the Project may be at a higher risk for collision. Since collision with the WTGs is likely to result in mortality or serious injury to individuals, the effects of displacement on marine birds may help to prevent collisions by reducing the frequency by which marine birds enter the Project area.

Pre- and post-construction aerial digital surveys will be conducted to monitor for avoidance and displacement of marine birds as a result of the Project's construction. Pre-construction survey flights began in May 2022. Details concerning this work can be found in the Avian Monitoring Plan for the Project, provided as Appendix II-N2. Survey reports are posted to https://remote.normandeau.com/uswind_home.php.

Collision

Collision with WTGs is widely recognized as the most significant potential impact to birds from the operation of offshore wind energy facilities. Collision with WTG towers or rotating blades is likely to result in mortality or serious injury of individuals, and thus may represent a form of habitat degradation. While avian collisions at offshore wind energy facilities have been documented, the nature of the offshore environment makes studying collision rates and quantifying impacts more difficult than at onshore wind energy facilities. The potential for collision for a given marine bird species is influenced by several factors, including the frequency of occurrence in the Lease area, average flight elevation, how likely the species is to avoid the Project as a whole or WTGs individually, weather conditions, WTG design and lighting characteristics, and other factors (Drewitt and Langston 2006; Fox et al. 2006). In general, the potential for collision at offshore facilities is understood to be lower than at onshore facilities due to the lower density of birds in the offshore environment, greater opportunities to detect (due to the lack of topographic features that could interfere with birds' ability to visually detect WTGs) and avoid (due to the lack of landform or other features that could restrict maneuverability) the Project, habitat homogeneity, and the flight patterns and behaviors of marine birds (i.e., relatively direct flight at a constant elevation) versus some terrestrial birds (i.e., soaring, kettling, and flying along ridges and other landforms). Studies of bird interaction with offshore wind energy facilities in Europe have not documented population-level impacts due to collision-related mortality, and generally find that birds are able to avoid the WTGs.

Most of the impact avoidance and minimization measures for collisions proposed in the literature are focused either on increasing the visibility of the WTGs, and in turn the likelihood that birds will avoid them, or reducing the potential attracting effects of WTGs. The inability to see moving turbine blades may impact birds. To reduce the risk of collisions, a standard single paint pattern will be used and the WTG and tower paint colors will be selected in accordance with BOEM Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development (BOEM 2021b).

Potential measures to reduce the attracting effects of WTGs are related to lighting and perching opportunities. Opportunities for reducing the attracting effects of aviation obstruction lighting of WTGs are summarized in Volume II, Section 12.2.1. Anti-perching measures may be installed on the deck/access platform of WTGs to discourage birds from resting on and congregating around the structures. Other authors suggest the use of visual or auditory deterrents to discourage flight through the WTG array (Drewitt and Langston 2006); however, few examples of implementation of these measures are available and their effectiveness is unclear. Therefore, visual and auditory deterrents will not be implemented unless additional data suggests they may be useful in reducing collision risk.

12.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Birds may be exposed to impacts during decommissioning in a similar manner as during construction. US Wind will review best practices with BOEM and USFWS at the time of decommissioning to avoid and minimize potential impacts to marine birds.

12.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on marine birds.

- Measures that minimize lighting impacts on avian species will be implemented where feasible, as approved by FAA, BOEM, USCG and other regulatory agencies.
- US Wind is currently performing preconstruction aerial, digital surveys to monitor for avoidance and displacement of avian species (See Appendix II-N2). Additional surveys will be completed post-construction.
- Avian monitoring equipment, including nanotag antennas and acoustic sensors, have been installed on the Metocean Buoy.
- Anti-perching measures may be installed on the deck/access platform of the WTGs to discourage birds from resting on and congregating around the structures.
- At least 180 days prior to the start of commissioning of the first WTG, US Wind would distribute a Compensatory Mitigation Plan for piping plovers, rufa red knot, and roseate tern to BOEM, BSEE, and USFWS for review and comment. BOEM, BSEE, and USFWS would review the Compensatory Mitigation Plan and provide any comments on the plan to US Wind within 60 days of its submittal. US Wind would resolve all comments on the Compensatory Mitigation Plan to BOEM, BSEE, and USFWS's satisfaction before implementing the Plan and before commissioning of the first WTG.
    - The Compensatory Mitigation Plan would provide compensatory mitigation actions to fully offset the impact of the incidental take of piping plover, rufa red knot, and roseate tern. The Compensatory Mitigation Plan would require that the compensatory mitigation be implemented by the fifth year of WTG operation.
- US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.

The Compensatory Mitigation Plan would include:

(1) a quantification of the level of offsets to fully offset the impact of the incidental take expressed in the ITS, based on scientifically recognized techniques and methodologies for each of the impacted species; piping plover, rufa red knot, and the roseate tern.

(2) detailed description of the mitigation actions for each species (e.g., nest protection, predator control, habitat enhancement or restoration, etc.).

- Piping plover examples: Habitat enhancement, predator control, reduction of disturbance at wintering sites, etc.
- Rufa red knot examples: habitat restoration, reduce displacement from peregrine falcons, red tide rehabilitation, etc.
- Roseate tern examples: habitat maintenance or restoration at nesting colonies, establishment of buffer zones around staging areas, etc.

(3) the specific location for each mitigation action.

(4) a timeline for completion of the mitigation measures.

(5) details of the mitigation mechanisms (e.g., conservation bank, in-lieu fee, applicant-proposed mitigation).

(6) best available science linking the compensatory mitigation action(s) to the projected level of collision mortality; and

(7) monitoring and reporting to ensure the effectiveness of the mitigation actions in offsetting take.

US Wind commits to reviewing the effectiveness of the plan with BOEM, BSEE and USFWS at regular (5 year) intervals thereafter or as new information becomes available, during which alternative and adaptive strategies might be considered.

13.0 Bats

13.1 Description of Affected Environment

Up to ten species of bats are present in Delaware and Maryland during at least a portion of the year (Table 13-1) (DNREC 2012a; MDDNR 2015a). All ten species breed in Delaware and Maryland and are present from the spring through the late summer or fall. Following the completion of their annual reproductive cycle, the four species in the genera *Nycticeius*, *Lasiurus*, and *Lasionycteris* (the "tree bats") migrate out of the area to more southerly wintering grounds (Cryan 2003). By contrast, the six species in the genera *Eptesicus*, *Myotis*, and *Perimyotis* (the "cave bats") remain in the mid-Atlantic region and begin moving into local winter hibernacula (primarily caves and mines). Among the cave bats are the federally threatened northern long-eared bat (*Myotis septentrionalis*) (DNREC 2012a) (80 FR 17973).

Table 13-1. Bats of Delaware and Eastern Maryland

Common name	Scientific name	Federal Status
Cave Bats		
Big brown bat	*Eptesicus fuscus*	
Eastern small-footed bat	*Myotis leibii*	
Little brown bat	*Myotis lucifugus*	
Northern long-eared bat	*Myotis septentrionalis*	Endangered
Eastern pipistrelle (Tri-colored bat)	*Perimyotis subflavous*	
Tree Bats		
Evening bat	*Nycticeius humeralis*	
Hoary bat	*Lasiurus cinereus*	
Eastern red bat	*Lasiurus borealis*	
Silver haired bat	*Lasionycteris noctivagans*	

Source: DNREC (2012b), MDDNR (2015b), 50 CFR Part 17

While the specific migration patterns of bats are not well-documented, many species are known to travel along linear landscape features such as rivers and topographic ridges during daily movements and migration, suggesting a preference for overland migration routes. Bats are also known to migrate along the coast. In the mid-Atlantic, eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), and silver-haired bats (*Lasionycteris noctivagans*) migrate through Assateague Island National Seashore, a barrier island off the coast of Maryland (J.B. Johnson, Gates, and Zegre 2011).

<u>Metocean Buoy Monitoring</u>

US Wind has deployed the Metocean Buoy within the Lease area for a planned 2-year metocean data collection campaign during the site assessment term of the Lease. The Metocean Buoy and its associated seabed mounted TRBM have been equipped with a suite of wildlife monitoring sensors as provided in the related Metocean Buoy SAP approved May 5, 2021. This includes a bat acoustic sensor mounted on the Metocean Buoy which monitors the nocturnal calls of migrating bat species within the Lease area.

13.1.1 Onshore Occurrence

Bats use a variety of natural and anthropomorphic terrestrial habitats during their active period between spring and fall. All bat species that occur in the mid-Atlantic region feed primarily on insects captured in flight and are typically attracted to areas where large numbers of flying insects may be found. These include areas of open water (streams and ponds), clearings, forest canopies, agricultural areas, and around streetlights and other artificial light sources. Depending on the species, summertime diurnal roosting sites may include buildings and other man-made structures or trees beneath loose or peeling bark, in cavities, or among foliage on branches. In the fall, tree bats begin their relatively long-distance migrations to more southerly portions of their range, where they may remain active throughout the year. Cave bats, by contrast, complete relatively short-distance migrations from summer habitats to local hibernacula, where they overwinter until the following spring (DNREC 2012a).

Analysis by Johnson et al. (2010) examined seasonal bat activity along the Atlantic Coast at Assateague Island. By using three Anabat II detectors spread throughout the island, it was determined that bats were using Assateague Island during migration activity but the study did not specify the extent of the use of Assateague Island by bats. Silver-haired bats (*Lasionycteris noctivagans*) used the barrier island as a stopover during migration, while hoary bats (*Lasiurus cinereus*) and eastern red bats (*Lasiurus borealis*) were either migrants or residents year-round. The analysis concluded that bats may be attracted to offshore structures as a resting or mating area, but since the results represented an index of bat activity, not a count, it would be difficult to assess or predict the number of bats affected by offshore wind farms.

DNREC has installed acoustic bat detectors in six locations in the Indian River Bay area (Figure 13-1) and collected data during the 2019–2021 summer breeding season (DNREC 2021). Based on an analysis of the recorded bat calls, DNREC estimates that there is a 90–100% likelihood that *Myotis* were present in 2020 in the vicinity of the detector noted by the blue X on Figure 13-1 and that Northern long-eared bats are potentially present in the area.

13.1.2 Offshore Occurrence

Most information on offshore bat activity in the mid-Atlantic comes from the New Jersey Ecological Baseline Study which includes survey results for bats over the New Jersey WEA offshore New Jersey out to 37 km (20 NM) (NJDEP 2010). Shipboard acoustic surveys using Anabat II detectors were conducted in March, April, May, June, August, September, and October of 2009. No bats were detected during the March, April or June surveys, and one bat (either a big brown bat or silver-haired bat) was detected in May. Detection frequency increased in the late summer to early fall, with eight nights of bat detections during the August, September, and October surveys. Eastern red bat was the most frequently detected species during this period with 19 identifiable recordings, followed by six detections of big brown/silver-haired bats (recordings not identifiable to species), three recordings of *Myotis* species, one recording of a hoary bat, and 25 unidentifiable records. The mean detection distance from shore was 10.6 km (5.2 NM) and the farthest distance was 19.2 km (10.4 NM) (NJDEP 2010).

Figure 13-1. DNREC Bat Detector Locations Summer 2020

In an effort to understand where and when bats occur offshore (beyond 5.5 km (3 NM) from land), an acoustic survey of bat activity on islands, offshore structures, and coastal sites in the Gulf of Maine, mid-Atlantic, and Great Lakes regions was conducted between 2012 to 2014 (Stantec Consulting Services 2016). While research vessels detected bats up to 130 km (70 NM) from land (east of New Jersey), the study documented a statistically significant decline in bat activity as distance from shore increased across the three study areas. Furthermore, the results showed pronounced seasonal patterns and strong influence of weather variability on bat activity depending on region. The study suggests that because of the absence of suitable offshore roost habitat, bats only occur offshore during periods of migration and foraging; as a result, they are presumably less frequent offshore than at terrestrial sites. While the study did not quantify the number of bats present in the offshore environment during different times of year, the results of the study suggest the potential for bats to occur in the vicinity of offshore wind energy facilities.

During the recent Mid-Atlantic Baseline Studies (MABS), twelve presumed eastern red bats were visually observed in the month of September off the coast of New Jersey, Delaware, and Virginia. All observations occurred between 16 and 70 km (9.1 and 22.6 NM) from shore, averaging 30 km

(16.2 NM) (S.K. Hatch et al. 2013). Flight elevation for six of the twelve bats was estimable; of these, five were flying over 200 m (660 ft) above sea level (S.K. Hatch et al. 2013). US Wind is collecting data regarding the presence of bats offshore by taking advantage of resources deployed in the Lease area and along the Offshore Export Cable Corridors.

US Wind has deployed a long-term acoustic detector on the Metocean Buoy to gather pre-construction data on the presence of bats in the Lease area. The acoustic detector mounted on the Metocean Buoy monitors for and records the nocturnal calls of bats of any bats passing through the Lease area, which can be used to identify the bat species. The Metocean Buoy is expected to be deployed for up to two years (May 2021-May 2023).

US Wind has also deployed acoustic detectors on the vessels engaged in completing the 2021 HRG and geotechnical survey campaigns all around the Lease area and all along the Offshore Export Cable Corridors. The acoustic detectors mounted on the survey vessels, which have been monitoring the ultrasonic calls of bats throughout the 2021 offshore surveys, provide nocturnal call data which can be used to identify the bat species and using recorded vessel positioning data, their location. The most frequently detected bat was identified as the Eastern Red Bat (*Lasiurus borealis*), representing 51% of bats identified to species or species group. The results of this survey show that as distance from shore increases, number of bat species and bat detections decrease. Bat detections in the Lease area represented approximately 9% of all bat detections. The highest density of bat detections occurred in late summer, which coincides with seasonal migratory bat patterns.

The bat data being collected by the Metocean Buoy and the survey boat acoustic detectors will be used to assess the presence of bats within the Lease area and along the Offshore Export Cable Corridors pre-construction. Based on the pre-construction monitoring results, US Wind will evaluate the need for post-construction bat monitoring. If it is determined that post-construction bat monitoring is warranted by the results of the pre-construction bat monitoring, a bat monitoring plan will be developed, prior to the issuance of the final environmental impact statement.

13.1.3 Rare, Threatened, and Endangered Species

As discussed in Volume II, Section 13.1, one federally-listed bat species may occur in Delaware and eastern Maryland: the federally threatened northern long-eared bat. The endangered NLEB was subject to a 4(d) rule under ESA 8 FR 1900 (Table 5.13-1). However, on November 30, 2022, the USFWS published a final rule to the FR (87 FR 73488) to uplist the status of the NLEB from threatened to endangered. The final rule listing this species as endangered was set to go into effect 60 days from publishing in the FR on January 30, 2023 (50 CFR Part 17). On March 31, 2023, the NLEB was officially listed as endangered under the ESA (see Table 13-2).

Table 13-2. Federally and State-Listed Bat Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Federal Status	DE State Status	MD State Status
Northern long-eared bat	*Myotis septentrionalis*	E	-	-
Source: 50 CFR Part 17 **E** = Endangered; **T** = Threatened				

Northern Long-eared Bat

The northern long-eared bat (NLEB) is a medium-sized bat that has been listed as endangered at the federal level due to summer habitat loss or degradation, impacts to hibernacula, and white-nose syndrome. White-nose syndrome poses the most severe and immediate threat to NLEB and is the primary reason for the species listing (USDOI and USFWS 2018c).

Northern long-eared bats are widely distributed in the eastern United States and Canada, with the exception of the far southeastern United States (USDOI and USFWS 2018c). During summer months reproductive females roost singly or in colonies in wooded areas, while non-reproductive females and males roost in cooler places such as caves and mines (DNREC 2012a; USDOI and USFWS 2018c). Typically, NLEB migrate to their hibernacula sites (caves and abandoned mines) in August and September, and then enter hibernation around October and November. In April, the bats emerge from hibernation and migrate back to their summer habitat where they feed on insects. Suitable summer habitat for NLEB includes a wide variety of forested habitats, adjacent and interspersed non-forested habitats (i.e., emergent wetlands, adjacent edges of agricultural fields, old field, and pastures), forests and woodlots containing potential roosts (live trees and/or snags ≥3" diameter at breast height (dbh) with exfoliating bark, cracks, crevices, and/or cavities), and other wooded areas with variable amounts of canopy closure (DNREC 2012a; USDOI and USFWS 2018c).

Based on a review of the USFWS IPaC online database, NLEB is not expected to occur in the vicinity of the onshore substations or the offshore export landfall. However, suitable habitat is present and it is possible that NLEB could occur in the area.

13.2 Impacts

This section discusses the potential impacts to bat species that may occur during Project construction, operation, and decommissioning. Bats could potentially be impacted by activities that occur in the offshore environment, including within the Lease area and along the Offshore Export Cable Corridors. Project-related activities in the coastal and terrestrial environments may also affect bats.

13.2.1 Construction

Habitat Alteration

The area in the vicinity of the Interconnection Facilities is comprised primarily of forested habitats, and due to the relatively general nature of many bat species' habitat preferences, may provide suitable habitat for one or more bat species. Construction impacts in the vicinity of the Interconnection Facilities are discussed in more detail in Volume II, Section 11.0 and include vegetation clearing and grubbing. These activities may have the potential to degrade the suitability of the area as habitat for bats. However, given the relatively small size of the footprint of the Interconnection Facilities and the large area of roosting and foraging habitat that will remain available for use by bat species in the immediate vicinity, the effect of this potential impact is considered negligible.

The USFWS has established a recommended seasonal TOY restriction for tree clearing activities in areas where the federally listed northern long-eared bat may occur. This tree clearing TOY restriction recommended for northern long-eared bat is expected to be protective of other bat species which may occur in the area. To avoid or minimize impacts to northern long-eared bat during the summer maternity period, the USFWS recommends tree clearing activities occur between August 1 and May 30. The Project will adopt this tree clearing TOY restriction.

The Project was sited to avoid impacts to bats and their habitat. DNREC recommends the following measures (DNREC 2023b):

- No tree clearing at the substation landfall April 1 through July 31.
- A habitat assessment and bat survey at the US Wind Substations location.

Noise

Construction of the Interconnection Facilities will generate noise that has the potential to result in disturbance or displacement of bats during the construction period. However, noise generating construction activities will generally take place during daylight hours when bats are inactive in their diurnal roosts. Construction activities are not expected to occur at night when bats are actively foraging, and thus are unlikely to interfere with the ability of bats to echolocate or result in significant disturbance or displacement of bats from the vicinity of the Interconnection Facilities. In addition, the area is currently impacted by noise generated by the existing Indian River Power Plant and Indian River Substation. Therefore, the effect of this potential impact is considered negligible.

Lighting

Construction of the Interconnection Facilities may generate artificial lighting that has the potential to result in disturbance or displacement of bats during the construction period. However, construction activities will generally take place during daylight hours when bats are inactive in their diurnal roosts. Construction activities are not expected to occur at night, when bats are actively foraging, and thus are unlikely to interfere with bat behavior or cause disturbance or displacement effects. In addition, the area in the vicinity of the proposed Interconnection Facilities is currently exposed to artificial lighting generated by the existing Indian River Power Plant and Indian River Substation. Therefore, the effect of this potential impact is considered negligible.

13.2.2 Operations

Lighting

Artificial lighting will be generated by both the Interconnection Facilities as well as offshore by the WTGs, OSSs and the Met Tower during operations (see Volume II, Section 16.3). Artificial lighting generated by the Interconnection Facilities may attract insects, which in turn may attract foraging bats, thus increasing the risk of collision with electrical infrastructure and other above-ground structures. However, artificial lighting generated by the existing Indian River Power Plant and Indian River Substation already exists in the area, and the additional lighting generated by the Interconnection Facilities is not expected to significantly increase the degree of this existing effect.

A similar attraction effect of artificial lighting could also occur at the WTGs; however little work has been done to study the effects of offshore lighting on migratory bat species. In a synthesis of studies of bat fatalities at onshore wind energy facilities, Arnett et al. (2008) found that WTG lighting or lack thereof did not influence bat mortality. This conclusion was also supported by a later study at an onshore wind energy facility in Iowa (Jain et al. 2011). While bat use of the offshore environment is poorly understood, a small number of studies have documented migratory bat species flying offshore during the migratory period, as discussed in Volume II, Section 13.1.2. The potential impacts on bats of artificial lighting generated by WTGs in the offshore environment has not been studied. Based on data from several onshore wind energy facilities, the artificial lighting is not expected to increase the risk of collision and mortality of bats. Therefore, the effect of this potential impact is considered negligible.

Visible Structures

For this section, it is conservatively assumed that the WTGs would be operating 100% of the time, as is consistent with a maximum Project Design Envelope approach. The operation of the WTGs in the offshore environment may pose a collision risk for migratory bat species that occur offshore during the migratory period. Direct mortality of bats at North American onshore wind energy facilities has been widely documented; however little work has been done to study the potential impacts of existing offshore wind energy facilities on migratory bat species. At onshore wind energy facilities, factors such as time of year, local topography, and weather conditions appear to be significant predictors of bat fatality rates (Arnett et al. 2008; Horn, Arnett, and Kunz 2008; Baerwald and Barclay 2011; Jain et al. 2011); of these, time of year is likely to be most significant in the offshore environment. Studies of onshore wind energy facilities also suggest that specific behaviors of bats may increase risk of collision mortality. Bats may approach rotating and non-rotating WTGs with repeated fly-bys. At operational WTGs, bats may follow or become trapped in blade-tip vortices, often resulting in collision (Horn, Arnett, and Kunz 2008). Relatively few bat species and no federally-listed species use the offshore environment. Bat occurrence offshore is intermittent and the probability of collision with a WTG is relatively low, therefore the potential impact of operating WTGs in the Lease area is considered to be negligible.

Stantec (2016) suggests offshore WTGs would provide an opportunity to deploy acoustic detectors, nanotag receiving towers, and other technologies allowing remote, long-term monitoring of bats. US Wind will evaluate potential post-construction bat monitoring opportunities.

13.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 4.6 m (15 ft) below the mudline. Bats may be exposed to impacts during decommissioning in a similar manner as during construction. At the time of decommissioning, the Project proponent will review best practices with the USFWS and BOEM to avoid and minimize potential impacts to bats.

13.3 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on bats.

- Following consultation with DNREC, US Wind would extend the restriction of tree clearing activities at the US Wind Substations location required for Project construction to April 1 through July 31 to avoid or minimize impacts to northern long-eared bat during the summer maternity period.
- US Wind will conduct a bat habitat assessment and bat survey at the US Wind Substations location.
- The Metocean Buoy has been equipped with a bat acoustic recorder to monitor for the nocturnal calls of bats within the Lease area for up to two years.
- Acoustic recorders to collect incidental bat calls offshore have been deployed on survey vessels throughout the Lease area and along the Offshore Export Cable Corridors.

- US Wind will compile a comprehensive wildlife survey and observation information database to include surveys, PSO data, and other wildlife monitoring records. Data will be made available to government, research, and environmental groups, among others. Information is provided on the following website: https://remote.normandeau.com/uswind_home.php.

14.0 Cultural, Historic, and Archaeological Resources

This section summarizes the information gathered by US Wind regarding cultural resources that may be affected by the Project to assist BOEM in meeting its obligations under Section 106 of the National Historic Preservation Act (NHPA).

Cultural, historic, and archaeological resources are defined by the regulations implementing Section 106 (36 CFR § 800.16) which states:

Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

As the lead federal agency for the Project, BOEM will initiate Section 106 consultation with the State Historic Preservation Offices (SHPOs). This section was prepared to support BOEM's National Environmental Policy Act of 1969 (NEPA) and NHPA review of the COP, in accordance with 30 CFR Part 585.627(a)(6). Recommended approaches for assessing impacts to historic properties during the wind energy permitting process is provided by BOEM in Guidelines for Providing Archaeological and Historical Property Information Pursuant to 30 CFR Part 585 (BOEM 2020). Historic property identification was based on standard practices within each discipline.

14.1 Preliminary Area of Potential Effects (PAPE)

This section was prepared to support BOEM's review of the COP through the NEPA and NHPA review processes, in accordance with 30 CFR § 585.627(a)(6). The Lease area encompasses approximately 32,256 ha (79,706.31 ac). The Offshore Export Cable Corridor survey covered approximately 3,009.63 ha (7,436.95 ac) from the Lease area to the inshore landing location. The PAPE is based on the maximum project design envelope (PDE) (see Volume I Section 1.1.3). The minimum avoidance zones for archaeological resources are 50 m (164 ft).

Area of potential effects is defined per 36 CFR 800.16(d) as:

Area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

This includes per Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585 (BOEM 2020):

- The depth and breadth of the seabed potentially impacted by any bottom-disturbing activities;
- The depth and breadth of terrestrial areas potentially impacted by any ground disturbing activities;

- The viewshed from which renewable energy structures, whether located offshore or onshore, would be visible; and
- Any temporary or permanent construction or staging areas, both onshore and offshore.

14.1.1 Federal Waters

The Lease area and the offshore export cable corridors in federal waters cover approximately 35,265.49 ha (87,142.93 ac) offshore the Maryland coastline (Figure 14-1). The Offshore Export Cable Common Corridor in Federal waters is 39.78 km (24.72 mi) in length and 600 m (0.37 mi) wide. The Federal section of Offshore Export Cable Corridor 1 is 4.39 km (2.73 mi) in length and 600 m (0.37 mi) wide. The Federal section of Offshore Export Cable Corridor 2 is 17.19 km (10.68 mi) in length and 600 m (0.37 mi) wide. The Lease area is 24 km (14.91 mi) in length and 18 km (11.18 mi) wide at widest/longest points.

US Wind is considering industry standard three-bladed upwind offshore Wind Turbine Generators (WTGs) models with individual nameplates of up to 18 Megawatt (MW). The WTG's will be installed on monopile foundations (Table 14-1). The WTG monopile foundations are large diameter coated steel tubes driven into the seabed. The diameter, weight, length, and wall thickness of the monopile will vary based on water depth, geotechnical (GT) conditions, metocean conditions and WTG size. Seabed disturbance resulting to jacking and anchoring will be confined to a 300-m (984.25 foot [ft]) radius centered on the installation location. Installation will be conducted using either a jack-up installation vessel and/or dynamically positioned (DP) crane vessel (see Volume I Section 3.3.2).

US Wind proposes to deploy up to four (4) OSSs, one for each grouping of approximately 300 to 400 MW of WTG capacity (Table 14-1). Monopile foundations (similar to WTG foundations) or jacket foundations are being considered for the OSSs. Dredging equipment from a vessel may be used to create a firm and level seafloor base in the footprint of the foundation, if needed to provide a level surface for the suction buckets or post-piled jackets (see Volume I Section 3.4.1.1).

The inter-array cables connect the WTGs to the OSSs and will primarily run in a north to south direction (Table 14-1). The cables will connect between 4 and 6 WTGs in a string. The cables then run in an east to west direction as required to connect the WTG strings to the OSSs. Based on the PDE layout, up to 245 km (152 mi) of inter-array cable will be used for the proposed Project. A pre-lay grapnel run will be conducted to remove debris that could impact the cable lay/burial along the cable route. US Wind does not anticipate conducting seabed levelling or pre-trenching,; however, it may be required. US Wind would micro-site cables around boulders and would not remove or relocate boulders. The inter-array cables will be installed from a DP cable installation vessel utilizing a towed or self-driving jet plow for the direct installation and burial of the cable. The jet plow uses high-pressure water to temporarily fluidize and displace the sediment along the cable route. A mechanical cutting/trenching tool or conventional cable plow may be used depending on soil conditions. The inter-array cables will be buried between 1 to 2 m (3.3 to 6.6 ft), but no deeper than 4 m (13.1 ft) (see Volume I Section 3.6.4).

The Project will also construct a meteorological tower that will serve as a full time MET ocean station to monitor the prevailing northwest and southwest wind directions; the data from which will be used to support long-term project operations and monitoring (Table 14-1). The Offshore PAPE (Figure 14-1) includes two alternate Met Tower locations that were evaluated but have since been abandoned. See COP Volume I Section 2.4.1 for further discussion of Met Tower locations. The

Proposed Location of the Met Tower, the furthest west structure along the southern-most row, has been evaluated and is retained. The alternate Met Tower locations, which are WTG locations, have been reviewed as part of the potential WTG footprint.

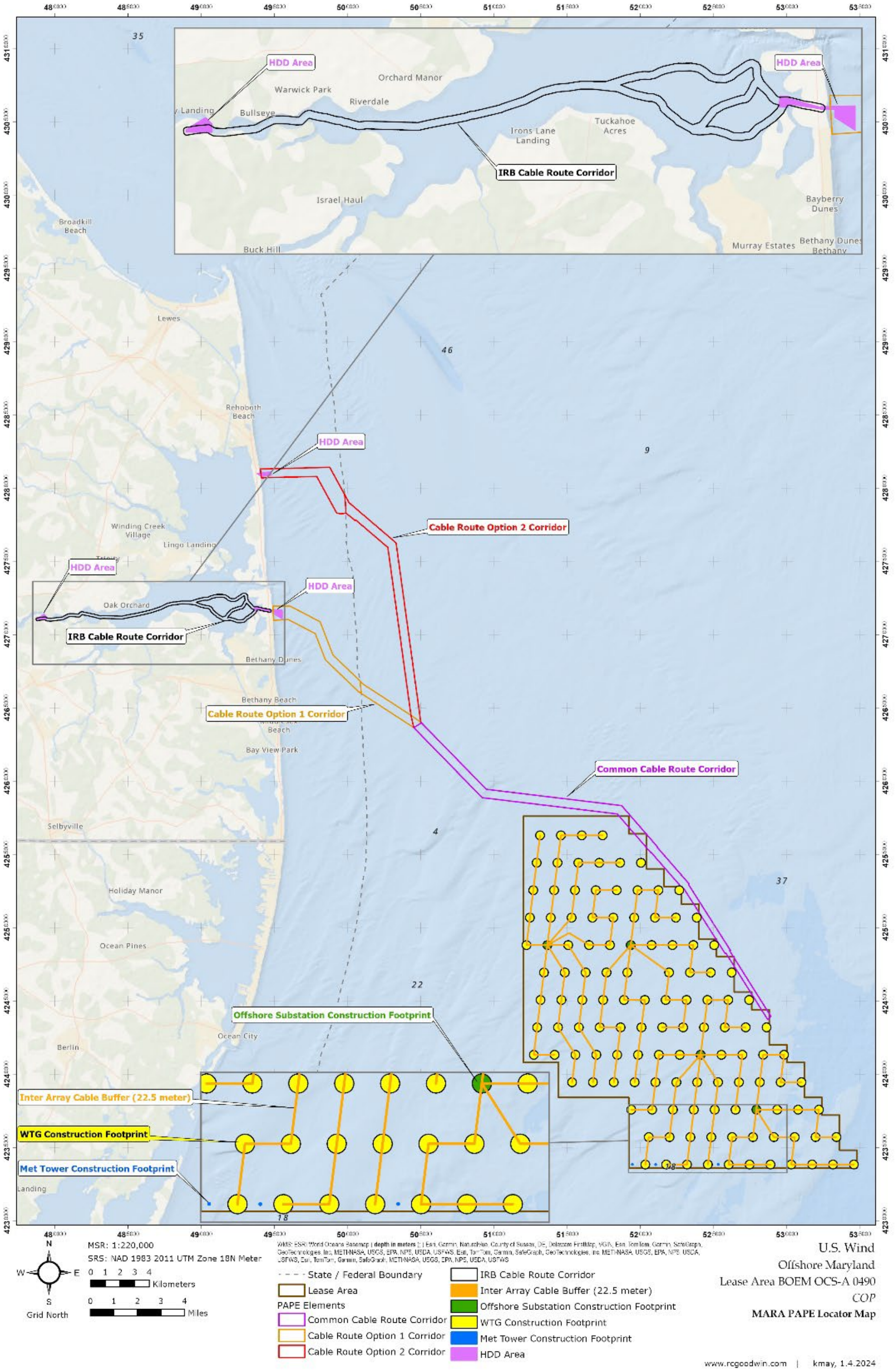

Figure 14-1. Map of the Offshore PAPE

Table 14-1. PAPE for Direct Effects

Foundations and Scour Protection		Maximum Number of Foundations	Maximum number of piles/buckets per Foundation	Max Area of Direct Disturbance Per pile/bucket meters squared (m^2)	Max Depth of Disturbance Per pile/bucket (m)	Max area of Scour Protection per Foundation (m^2)	Max area of Jack-up Disturbance per Foundation during Installation (m^2)	Max Area of Disturbance per Foundation Impacted by Anchoring / Mooring (m^2)	Max Depth of Disturbance per Foundation Impacted by Jacking / Anchoring / Mooring (m)
WTGs	Monopile	121	1	113	50	905	242,00	60,500	To be Determined (TBD)
OSSs	Monopile	4	2	95	40	760	8,000	2,000	TBD
	Jacket on Suction Bucket		8	177	15	0	8,000	2,000	TBD
	Jacket with Pin Piles		8	13	80	101	8,000	2,000	TBD
	Large-Pile Jacket		8	7	80	57	8,000	2,000	TBD
Met Tower	IBGS Jacket	1	3	3	53	0	2,000	500	TBD
HDD		**Maximum Number of HDD Exit Pit Locations**	**Maximum Depth of Duct Below Grade (m)**	**Maximum Size of Gravity Cells (m^2)**	**Max Depth of Disturbance per HDD Impacted by Jacking / Anchoring / Mooring (m)**				
HDD Atlantic	Gravity cells	4	18	600	TBD				
HDD Old Basin Cove	Gravity cells		15	600	TBD				
HDD Deep Hole	Gravity cells		12	600	TBD				
Cables		**Maximum Corridor Width (m)**	**Max Depth of Disturbance (m)**						
Offshore Export Cables and Inter-Array Cables*	Offshore Export Cable Common Corridor	600	4						
	Offshore Export Cable Corridor 1 (3Rs Beach)	600	4						
	Offshore Export Cable Corridor 2 (Tower Road)	600	4						
	Inter-Array Cables	TBD	4						

*Decommissioning plan is to remove buried cables to 5m (15 ft) below mud line.

A full description of the PDE parameters can be found in Volume I Section 1.1.3 Table 1-1.

14.1.2 State Waters

The Preliminary Area of Potential Effects (PAPE) in state waters covers 1,605.04 hectares (ha) (3,966.15 acres [ac]) (Figure 14-2). The offshore export cable corridors on the Atlantic side in state waters cover approximately 1,168.74 ha (2,888.01 ac) and will connect the Lease area to inshore locations through Indian River Bay at 3Rs Beach (3Rs) and Tower Road. Indian River Bay PAPE has an area of 436.31 ha (1,078.14 ac). The State section of Offshore Export Cable Corridor 1 is 8.44 km (5.24 mi) in length and 600 m (0.37 mi) to 1.08 km (0.67 mi) wide. The State section of Offshore Export Cable Corridor 2 is 7.23 km (4.49 mi) in length and 600 m (0.37 mi) to 870 m (0.54 mi) wide. The Indian River Bay corridor is 23.19 km (14.4 mi) in length and 200 m (0.12 mi) wide.

Two 600 m (1,968 ft) wide offshore export cable corridors from the OSSs to the planned landfall at 3R's Beach or Tower Road (Barrier Beach Landfalls) are being considered with up to four offshore export cables (Tables 14-2 and 14-3). US Wind proposes up to four offshore export cables for the Project. A single offshore export cable will run from each OSS (up to four) to the transition vault at the landing location where it would continue as an onshore export cable to the Point of Interconnection. A pre-lay grapnel run will be conducted to remove debris that could impact the cable lay/burial along the cable route. US Wind anticipates that a jet plow will be utilized to bury the cable to target depths of approximately 1 to 3 m (3.3 to 9.8 ft), not exceeding 4 m (13.1 ft) due to the sandy seabed observed along the offshore export cable corridor. A trenching tool may be required in areas with harder bottoms (see Volume I Section 3.6.2).

Table 14-2. PAPE for direct effects

HDD		Maximum Number of HDD Exit Pit Locations	Maximum Depth of Duct Below Grade (m)	Maximum Size of Gravity Cells (m^2)	Max Depth of Disturbance per HDD Impacted by Jacking / Anchoring / Mooring (m)
HDD Atlantic	Gravity cells	4	18.2	600	To be determined (TBD)
Indian River Bay					
HDD Old Basin Cove	Gravity cells	4	15	600	TBD
HDD Deep Hole	Gravity cells	4	12	600	TBD
Cables		**Maximum Corridor Width (m)**	**Max Depth of Disturbance (m)***		
Offshore Export Cables*	Offshore Export Cable Common Corridor	600	5	-	-
	Offshore Export Cable Corridor 1 (3Rs)	600	5	-	-

Cables		Maximum Corridor Width (m)	Max Depth of Disturbance (m)*		
	Offshore Export Cable Corridor 2 (Tower Road)	600	5	-	-
*The maximum depth of disturbance during cable installation activities is 4 m; however, the decommissioning plan is to remove buried cables to 5 m (15 feet [ft]) below mud line.					

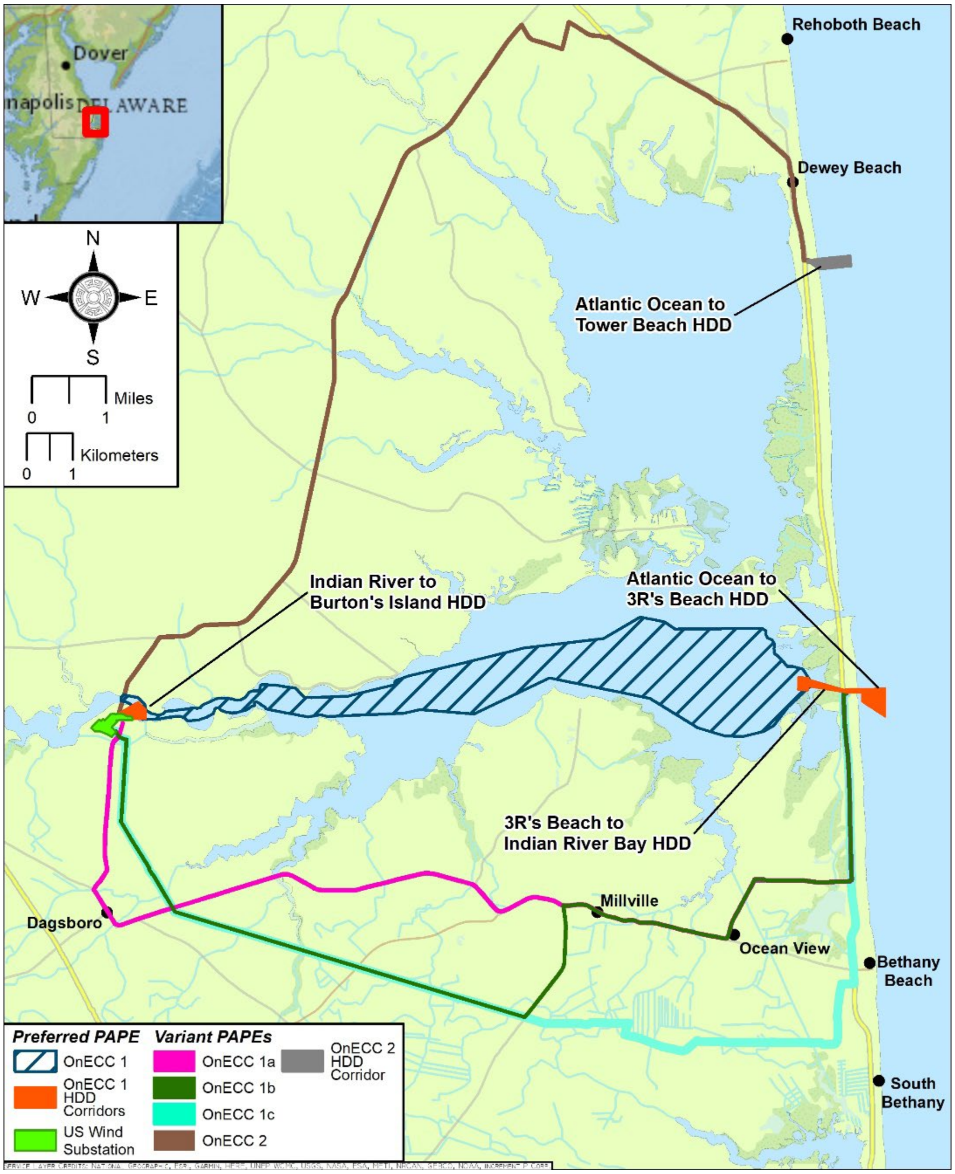

Figure 14-2. Map of the Onshore PAPE and Variant PAPE as defined in the TARA

Table 14-3. Summary of PDE parameters

Cables	Description
Offshore Export Cables	4 – 230-275 kilovolts (kV) Alternating Current submarine
Maximum Length of Offshore Export Cables (4 Total)	235 km (146 mi)
Onshore Export Cables	Up to 4 – 3-phase 230-275 kV or 12 single phase
Maximum Length of Onshore Export Cables (4 Total)	156 km (96 mi)

14.1.3 *Barrier Beach Landing Locations*

Two proposed landfalls are proposed for the project. The preferred landfall is located at 3R's Beach in Delaware and is associated with Onshore Export Cable Corridor 1 and variant Onshore Export Cable Corridors 1a, 1b, and 1c. An alternate landfall location is proposed at Tower Road Beach, Delaware and is associated with the variant Onshore Export Cable Corridor 2 route. The proposed terrestrial impact at the chosen landing location would incorporate horizontal directional drilling and installation of a subsurface transition vault. The anticipated terrestrial PAPE for the preferred 3R's Beach landfall is approximately 4.36 acres (1.77 hectares). The anticipated terrestrial PAPE for alternate Tower Road Beach landfall is approximately 7.6 acres (3.1 hectares).

14.1.4 US Wind Substations

The US Wind Substations property on Burton's Island, Delaware is the Point of Interconnection for the Project. US Wind is proposing to construct new substations adjacent to the existing Delmarva Power and Light Indian River Substation. The disturbance for the proposed facility is anticipated to encompass approximately 13 acres (5.26 hectares) of the parcel. Terrestrial archaeological investigation of the US Wind Substations property incorporated 28.01 ac (11.34 ha) of the parcel in order to verify that the development would not impact any archaeological resources.

14.1.5 *Onshore Export Cable Corridors 1a, 1b, 1c, 2*

Four variant routes connecting the Lease area to the US Wind Substations are also under consideration if the preferred Onshore Export Cable Corridor 1 route through Indian River Bay is determined to be not feasible. Three of the variants (1a, 1b, and 1c) incorporate the same landfall as the Onshore Export Cable Corridor 1 route at 3R's Beach but connect to the US Wind Substations Property completely via land routes south of the Indian River. The fourth variant (Onshore Export Cable Corridor 2) incorporates the alternate Tower Road Beach landfall but similarly follows a land route that approaches the US Wind Substations Property from the north.

The variant PAPE for all of the alternative routes includes a 50-foot (15-meter) buffer along each variant cable route centerline. All of the variant onshore cable routes would exit their respective landfall transition vaults and be buried in or buried directly adjacent to previously disturbed infrastructure right-of-ways along the designated corridor. The right-of-ways selected may include but would not be limited to previous infrastructure construction such as utility lines, transmission corridors, and Delaware Department of Transportation road easements. For the onshore cable route installation, a trench would be excavated in the ROW to install a duct bank approximately 80-105 inches (203-267 centimeters) wide and approximately 30 – 90 inches (76-228 centimeters) high, depending on the configuration, with an up to 18 inches (45 centimeters) of additional excavation on either side of the duct bank during construction. Up to four cables would be installed in duct banks of cement-bound sand in either horizontal or vertical configuration. The duct banks would be buried such that the top of the bank is a minimum of 36 inches (91 centimeters) below grade.

14.1.6 Onshore Maryland (O&M Facility Footprint)

The O&M Facility component of the Project would consist of quayside facilities near the intersection of the Ocean City Harbor and Sinepuxent Bay. The facilities would be developed through the combination of two adjacent properties and provide approximately 107 m (350 ft) of quayside buildable land that is approximately 43 m (142 ft) deep. The O&M Facility is anticipated to include three buildings (main office building, secondary warehouse building, and a crew support building), parking, laydown yard, and an approximately 191-m (628-ft) long fixed pier for the mooring of up to four crew transfer vessels. The main office building and crew support buildings may be up to three stories, although would not exceed the 14-m (45-ft) local building height limit. The terrestrial PAPE for the O&M Facility is approximately 1.7 acres (0.7 hectares) (Table 14-4).

Table 14-4. Onshore components of the PAPE

	Terrestrial Project Component	Distance/ Area
Preferred PAPE		
Established Project Components	*O&M Facility*	1.7 ac (0.7 ha)
	US Wind Substations	28.01 ac (11.34 ha)
Preferred Onshore Export Cable Corridor 1 Cable Route Components	*Atlantic Ocean-3Rs Beach HDD*	4.36 ac (1.77 ha)
	3R's Beach-Indian River Bay HDD	8.71 ac (3.53 ha)
	Indian River-Burton's Island HDD	7.81 ac (3.16 ha)
Variant PAPEs		
Cable Route Variants	*Onshore Export Cable Corridor 1a (cable route)*	16 mi /99.7 ac (26 km/40.4 ha)
	Onshore Export Cable Corridor 1b (cable route)	16.5 mi/99.7 ac (26.5 km/40.4 ha)
	Onshore Export Cable Corridor 1c (cable route)	17 mi/104.4 ac (27 km/42.3 ha)

Table 14-4. Onshore components of the PAPE

	Terrestrial Project Component	Distance/ Area
	Onshore Export Cable Corridor 2 (cable route)	18 mi/107.6 ac (29 km/43.5 ha)
	Onshore Export Cable Corridor 2 Landfall: Atlantic Ocean-Tower Beach HDD	7.6 ac. (3.1 ha)

14.1.7 Maryland (Visual)

Two PAPEs for visual effects were utilized in Maryland: one for visual effects to offshore project components, the WTGs, and one for visual effects to onshore project components, the proposed on-shore substations. In both instances, a Study Area was identified to account for maximum possible visibility. A PAPE was then identified within the Study Area. The identification of the PAPE will be overviewed separately, first for the offshore project components followed by the onshore project component.

14.1.7.1 Visual PAPE for Offshore Project Components

The Study Area for visibility to offshore project components utilized a circumference of 43-mi from the nearest WTGs and included Worcester County, Maryland. A PAPE was then refined via computer modeling. Ultimately, the PAPE was determined by using LiDAR data to include building height, terrain, and vegetative cover datasets to identify where views of turbines would be obscured, greatly reducing the area of potential visibility within the Study Area. The PAPE generally encompasses the coastal shoreline of Ocean City, Maryland, as well as the overwater areas and western shores of inland bays (Figure 14-3).

The investigation into historic properties with potential visual effects identified 22 properties within the PAPE in Maryland. These properties, all over 45-years of age, either were unevaluated and considered eligible for the purposes of the project, determined eligible for listing in the NRHP, or listed in the NRHP. As a result of the investigation, two historic properties were identified as subject to visual effects from the Offshore Project Components: the U.S. Life-Saving Station Museum and U.S. Coast Guard Station at Ocean City. These resources are sited directly on the Ocean City coastline with largely unobstructed views of the Atlantic Ocean and the Project, located roughly 11-mi to the east.

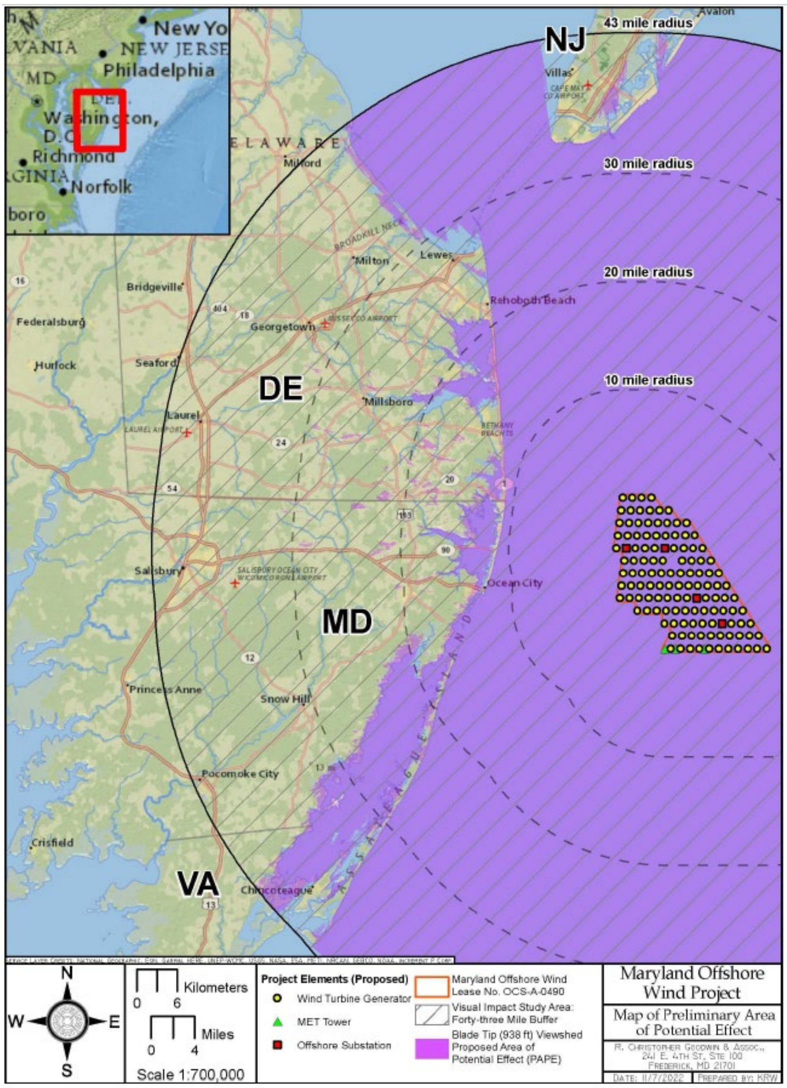

Figure 14-3. Visual PAPE for Offshore Project Components in Delaware, Maryland, New Jersey, and Virginia.

14.1.7.2 Visual PAPE for Onshore Project Components

The Study Area for visibility to the onshore project components utilized a circumference of 0.5-mi from the proposed O&M Facility at West Ocean City, Maryland. As the proposed O&M Facility currently is in planning stages, visibility modeling was not available to determine a PAPE. Rather, field visibility studies undertaken during August 2023 identified viewsheds toward the proposed facility and areas of obstruction due to built resources, vegetation, and terrain. Ultimately, a revised APE roughly 0.3-mi in circumference from the proposed O&M Facility was determined (Figure 14-4).

Field analysis and archival research identified 28 resources over 45-years of age within the PAPE with partial or full visibility to the proposed O&M Facility site. The field verified PAPE encompasses a mid- to late-twentieth century landscape comprising a commercial harbor and single-family detached dwellings. No properties were identified as significant or retaining integrity sufficient for listing in the National Register of Historic Properties (NRHP) Criteria for Evaluation (36 CFR 800). Further, the maximum footprint and height of the proposed O&M Facility is not anticipated to introduce new elements to the viewshed of these resources. Rather, the proposed O&M Facility will be one element of a commercial harbor which has undergoing a continuous pattern of demolition and redevelopment. In a November 15, 2023, letter to BOEM, the Maryland Historical Trust (MHT) concurred with the finding of no adverse effect.

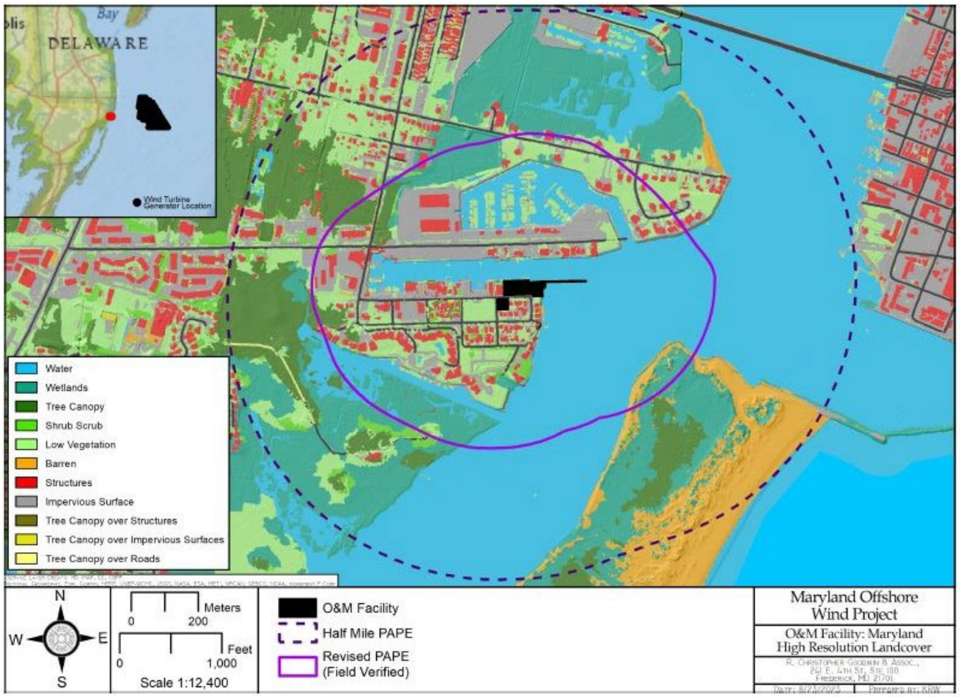

Figure 14-4. **Half-mile PAPE and Revised Field Verified PAPE for O&M Facility at West Ocean City, Maryland.**

14.1.8 Delaware (Visual)

Two PAPEs for visual effects were utilized in Delaware: one for visual effects to offshore project components, the WTGs, and one for visual effects to onshore project components, the proposed on-shore substations. In both instances, a Study Area was identified to account for maximum possible visibility. A PAPE was then identified within the Study Area. The identification of the PAPE will be overviewed separately, first for the offshore project components followed by the onshore project component.

14.1.8.1 Visual PAPE for Offshore Project Components

The Study Area for visibility to offshore project components utilized a circumference of 43-mi from the nearest WTGs and included Sussex County, Delaware. A PAPE was then refined via computer modeling. Ultimately, the PAPE was determined by using LiDAR data to include building height, terrain, and vegetative cover datasets to identify where views of turbines would be obscured, greatly reducing the area of potential visibility within the Study Area. The PAPE generally encompasses the coastal shoreline of Sussex County, as well as the overwater areas and western shores of inland bays (see Figure 14-3 in 14.1.7.1).

The investigation into historic properties with potential visual effects identified 119 properties within the PAPE Delaware. These properties, all over 45-years of age, either were unevaluated and considered eligible for the purposes of the project, determined eligible for listing in the NRHP, or listed in the NRHP. As a result of the investigation, one historic district was identified as subject to visual effects from the Offshore Project Components: Fort Miles Historic District. This resource is sited directly along the Cape Henlopen coastline with largely unobstructed views of the Atlantic Ocean and the Project, located roughly 22-mi to the southeast.

14.1.8.2 Visual PAPE for Onshore Project Components

The Study Area for visibility to the onshore project components utilized a circumference of 5-mi from the proposed substations near Millsboro, Delaware. As visibility modeling was available and previously identified Nanticoke sites are within the vicinity, a 5-mi Study Area was selected to account for maximum visibility and sensitivity. A PAPE was then determined by a Bare Earth Visibility model. This model accounts for vegetation, existing buildings, and curvature of the earth all overlaid within the 5-mi Study Area (Figure 14-5).

Twelve properties accessible from the public right-of-way (ROW) over 45-years of age were identified within the PAPE. Surveyed properties were constructed during the early- to mid-twentieth century. The PAPE encompasses a primarily rural landscape with agricultural and industrial operations and single-family residences. A summary historic context was developed for twentieth century agricultural and suburban trends in Sussex County. No properties within the PAPE were identified as meeting the NRHP Criteria for Evaluation (36 CFR 800); therefore, no properties are recommended for listing in the NRHP.

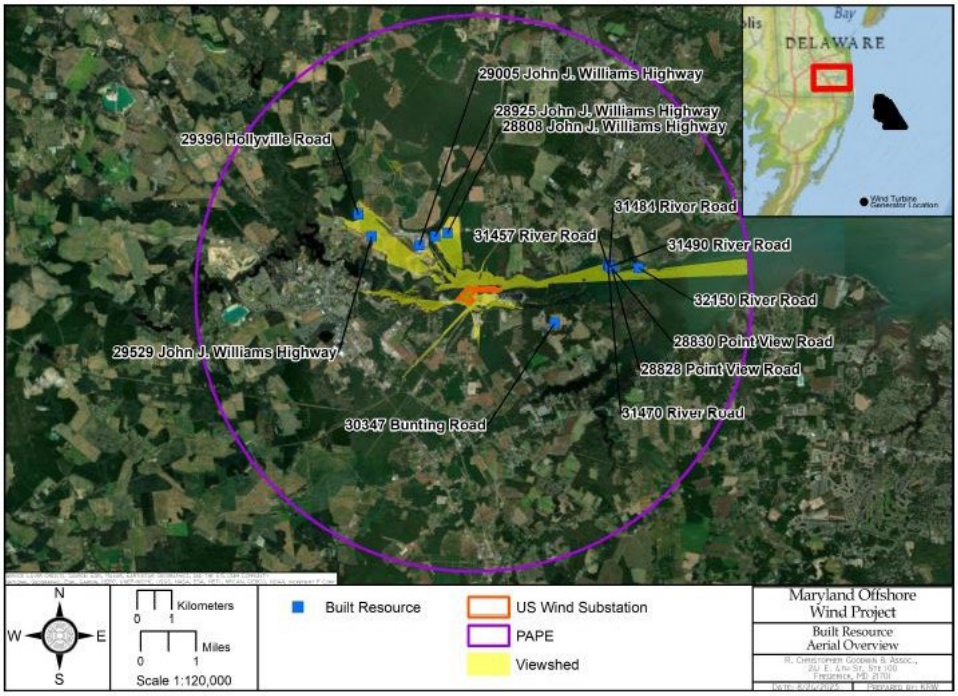

Figure 14-5. Study Area and PAPE for Onshore Project Components at Sussex County, Delaware.

Offshore Marine Archeological Resources: Research Methodology & Surveys

This section was prepared to support BOEM's review of the COP through the NEPA and NHPA review processes, in accordance with 30 CFR § 585.627(a)(6).

R. Christopher Goodwin & Associates, Inc. (RCG&A) prepared a two volume marine archeological assessment, "Marine Archaeological Resources Assessment for the Maryland Offshore Wind Project Located on the Outer Continental Shelf Block OCS-A 0490 and Offshore Maryland and Delaware" (Appendix II-I1). This assessment considered high-resolution geophysical (HRG) surveys of the Lease area, Offshore Export Cable Corridors, and Onshore Export Cable Corridor 1, which were conducted in 2021 and 2022. Volume I encompassed the Project areas that fall within federal waters, inclusive of approximately 32,256 ha (79,706.31 ac) in the Lease area and 3,009.63 ha (7,436.95 ac) in the Offshore Export Cable Corridors. Volume II contained the portions of the Offshore Export Cable Corridors that fall into state waters, which encompass 1,168.74 ha (2,888.02 ac) between the Three Nautical Mile limit and the Atlantic side of the barrier island, and Onshore Export Cable Corridor 1 in Indian River Bay, which encompassed 679.1 ha (1,677.9 ac). The PAPE for marine archaeological resources was analyzed under the supervision of the Qualified Marine Archaeologist (QMA), pursuant to 30 CFR § 585 and BOEM guidelines. From the data, 13 shipwrecks were identified in the Lease area, along with 14 Ancient Submerged Landforms (ASLFs). Five shipwrecks were identified within the Offshore Export Cable Corridors, with four of these wrecks falling within state waters and outside of the preliminary Area of Potential Effect. The evaluation of ASLFs was informed by the geotechnical campaigns, including cone penetrometer test (CPTs), boreholes and vibracores (VCs). Boreholes provided dateable samples to determine which landforms were likeliest to contain preserved archaeological materials.

The revised Marine Archaeological Resource Assessment was conducted to assist in compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA) (54 USC 304108), and its implementing regulations in 36 CFR 800, entitled "Protection of Historic Properties" and 36 CFR Parts 60 and other related Parts, entitled "National Register of Historic Places." The work will also assist BOEM in its application of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321), Archaeological and Historic Preservation Act of 1974 (16 USC 469); the Abandoned Shipwreck Act of 1987 (43 U.S.C. 2101-2106); and that the work is consistent with BOEM's Guidelines for Providing Archaeological and Historic Property Information (BOEM 2020). Survey efforts for state waters have been coordinated at the state level with Delaware's State Historic Preservation Office (DE SHPO). US Wind complied with Lease stipulations under Section 4.2, Archaeological Survey Requirements, including providing notice to applicable tribes for pre-survey meetings.

US Wind engaged with consulting parties, including Native American Tribes, to discuss the potential for seabed disturbance and associated effects to identified marine archaeological resources and options to avoid, minimize or mitigate any adverse effects to NRHP eligible resources. All potential resources have been assigned minimum avoidance zones as the principal measure of preservation, which are 50 m (164 ft) from the archaeological resources. Avoidance will be achieved primarily through micro-siting, except in the case of Target 8, which will be avoided through construction planning around its avoidance area.

Disturbance to the seafloor during construction activities has the potential to encounter and cause significant, long-term and adverse effects to unidentified submerged cultural resources. Although remote sensing surveys conducted in accordance with current professional standards for cultural resource identification are expected to be highly effective in identifying submerged cultural resources, the possibility of encountering an unidentified and unanticipated submerged cultural resource is always present during dredging and construction activities. As a result, US Wind will implement an Unanticipated Discoveries Plan, including archaeological resource identification training.

A public, non-technical summary of the marine archeological resource assessment is provided as Appendix II-I1a.

Terrestrial Archeological Resources: Research Methodology & Surveys

BOEM recommends that the identification of historic properties “within onshore terrestrial areas” be “conducted and reported following the guidance published by the affected State Historic Preservation Office (SHPO) and provided through the consultation with the affected SHPO” (BOEM 2020). R. Christopher Goodwin & Associates, Inc conducted the Phase IA archaeological sensitivity assessment of the entire Terrestrial PAPE and Phase IB archaeological survey of the preferred PAPE in accordance with *Archaeological Survey in Delaware* (DHCA 2015) and *Standards and Guidelines for Archaeological Investigations in Maryland* (Shaffer and Cole 1994).

A desktop review of the terrestrial portions of the project was initiated in January 2022 and a work plan for Phase I archaeological survey was submitted to BOEM and Delaware SHPO in June 2022. The preferred and variant onshore routes were refined and sensitivity model was developed and archaeological survey of the substation area was conducted in January and February 2023. The TARA was submitted in April 2023 and updated to address comments in August 2023.

The Project has the potential to impact terrestrial archeological sites or historic built resources through disturbance or displacement from construction and operations onshore at the Barrier Beach Landfalls, Onshore Export Cable Corridors, US Wind Substations locations, and the O&M Facility. RCG&A has prepared a Terrestrial Archaeology Resource Assessment (Appendix II-I2) for the maximum Area of Potential Effect, including a February 2023 Phase I site investigation at the location of US Wind Substations, to identify potential cultural resources and avoidance and minimization measures. Due to ongoing land negotiations, a shift in the US Wind Substations resulted in a portion of the revised APE that was not included in the initial Phase I site investigation. Supplemental Phase I survey was completed in February 2024 and included in the report.

US Wind planned onshore Project elements in areas currently disturbed and at locations that avoid known terrestrial archeological resources to the greatest extent practicable. Avoidance will be confirmed during construction by implementation of an approved Onshore Construction Monitoring Plan as well as archeological and tribal monitors, as appropriate. Similar to marine resources, although the terrestrial archaeological Phase I investigations thoroughly examined the Project PAPE, there remains a potential to encounter unidentified and unanticipated cultural resources during project implementation. Therefore, US Wind will implement an Unanticipated Discoveries Plan, including archaeological resource identification training.

A public, non-technical summary of the terrestrial archeological resource assessment will be provided as Appendix II-I2a.

14.2 Visual Impacts to Historical Resource Analysis

BOEM’s Guidelines for Providing Archaeological and Historical Property Information Pursuant to 30 CFR Part 585 (BOEM 2020) provides recommended approaches for assessing impacts to historic properties during the wind energy permitting process. The guidelines state that a Historic Resources Visual Effects Analysis (HRVEA) should be conducted in a manner acceptable to the relevant SHPO for the state(s) within the areas that will have a view of the Project's onshore or offshore components (see Appendices II-I3 and II-I4). The timing of the surveys is discussed in these appendices.

14.2.1 Offshore HRVEA

Volume II, Section 15.0 and the Historic Resources Visual Effects Analysis (Appendix II-I3) addresses visual and viewshed impacts to historic resources from the offshore Project components based on desktop analyses and field work conducted through 2022 and 2023 which was informed by BOEM and SHPO comments and direction. The APE for visual effects considered the maximum theoretical visibility of the Project area and the maximum turbine blade tip height relative to the curvature of the earth, optimal visibility conditions, and terrain.

14.2.2 Onshore Built Resources Report

The Onshore Built Resources report (Appendix II-I4) addresses visual and viewshed impacts to historic resources from the onshore Project components, including the US Wind Substations and the O&M Facility. Surveys were completed in December 2022 for the substation and August 2023 for the O&M Facility.

14.3 Mitigation and Monitoring

Proposed mitigation and monitoring measures are based on the results of the Marine Archaeology Resource Assessment (Appendix II-I1), the Terrestrial Archaeology Resource Assessment (Appendix II-I2), the Historic Resources Visual Effects Analysis (Appendix II-I3), and the Onshore Built Resources Report (Appendix II-I4). The avoidance and mitigation measures identified below reflect resources identified to date and proposed protections. US Wind will assess additional avoidance or mitigation measures if they arise under the Section 106 consultation process.

- The results of HRG and geotechnical surveys have been used to identify potential marine cultural resources and preserved submerged landforms. US Wind will avoid impacts to potential marine cultural resources and submerged landforms by ensuring a 50-meter buffer and through micro-siting Project elements. Construction will be planned around established avoidance areas.
- Mitigation measures commensurate with potential adverse effects to historic properties impacted by views to the Project are proposed in a Historic Preservation Treatment Plan, through continuing coordination with SHPOs and consulting parties.
- Planning has taken into account previously recorded cultural resources and areas of high archaeological probability, as well as the extent of prior disturbance, in order to minimize project impacts to known or potential archaeological resources. US Wind will avoid potential terrestrial cultural resources identified, to the extent practicable. A draft Historic Property Treatment Plan is included with the Terrestrial Archaeology Resource Assessment (Appendix II-I2) for BOEM's consultation with consulting parties. US Wind anticipates treatment of cultural resources will incorporate a phased approach to additional evaluation and treatment of the portions of the site that will be impacted by the Project. Treatment will include

enhanced Phase II Evaluation of the affected portions of the site, consultation to assess effects, and mitigation if those areas are determined eligible for the NRHP. All evaluation and mitigation fieldwork shall be completed prior to construction at the US Wind Substations property.

- US Wind will develop an Unanticipated Discovery Plan to be implemented during onshore and offshore construction. Draft Unanticipated Discovery Plans are included in both the Marine Archaeology Resource Assessment (Appendix II-I1) and Terrestrial Archaeology Resource Assessment (Appendix II-I2) for BOEM's consultation with consulting parties.
- US Wind will continue to coordinate with the appropriate SHPOs and Native American tribes to refine measures to minimize and mitigate impacts to potential cultural resources generally and if particular resources are identified.
- Temporary avoidance measures will be implemented during construction at the onshore US Wind substation location, including the export cable corridors, which will include protective barrier fencing to avoid an archaeological historic property to the greatest extent practicable. Cultural and tribal monitoring would be implemented as necessary.
- US Wind developed a Monitoring Plan to be implemented during construction and is developing a Historic Property Treatment Plan in coordination with BOEM and consulting parties.

15.0 Visual Resources

A Visual Impact Assessment for the Project can be found in Appendix II-J1.

The Visual Impact Assessment examined the visual impact of the offshore Project components (WTGs, OSSs, Met Tower) and the onshore components (US Wind Substations, O&M Facility) as relates to the existing visual character. Aspects discussed included existing visual policies and regulations and the effect on user groups, landscape/seascape character setting, environmental justice areas, and visually sensitive natural resources in the study area.

15.1 Description of Affected Environment

A Visual Study Area (VSA) for the Project was established that extends 69 km (43 mi) as a radius buffer around the WTGs. For daytime observations, this study area is conservative as meteorological conditions will likely reduce the visual threshold distance dramatically in daytime and nighttime conditions. The resulting VSA is 20,373 km^2 (7,866 mi^2) in area and encompasses 144 km (106 mi) of oceanfront shoreline in Maryland, Delaware, Virginia, and New Jersey (excluding Delaware Bay). Approximately 4,574 km^2 (1,766 mi^2) (22 percent) of the area is landward of the shoreline (i.e., the shoreward study area). The balance of the VSA is area within the Atlantic Ocean. Section 17 provides more details on the specific oceanfront areas that may be affected by the visual impact from the Project.

The design envelope for the Project considers a range of different WTGs, with capacity ratings up to 18 MW, and OSSs, with capacity ratings of 400MW or 800MW. The total number of proposed WTGs deployed is 114 to 121. For the purposes of the visual assessment, an 18 MW offshore WTG was selected for evaluation, based on the assumption it would be the most visible. The WTGs were also assumed to be in the 121 potential locations under consideration and oriented in a grid pattern with spacing of approximately 1.02 NM (1.17 miles) N-S x 0.77 NM (0.89 miles) E-W apart. The WTGs will be connected to up to four OSSs where the voltage will be increased, and the power transmitted to the Interconnection Facilities via the offshore and onshore export cables. OSS designs used simulated a maximum height of 43 meters (144 feet) and 39 meters (128 feet) above MSL for the 400MW and 800MW substations, respectively.

The foundation of all WTGs would be painted yellow (RAL 1023) from the level of Mean Higher High Water (MHHW) to 15 meters (50 feet) above MHHW. Ladders at the foundation base of all turbines would be painted in a color that contrasts with the recommended yellow for ease of identification for operations and maintenance personnel. All major upper WTG components would be painted with color no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey (BOEM 2021). The WTG paint color will be determined in consultation with BOEM, FAA, and USCG.

The WTGs are proposed to have aviation safety lighting consisting of two medium-intensity flashing red lights atop the nacelle and four low-intensity flashing red lights mid-tower around the tower in a ring. The medium and low intensity flashing red lights will be configured to flash simultaneously. The OSSs are proposed to have two medium intensity flashing red obstruction aviation lights, four low-intensity flashing red obstruction lights in a ring, and a helicopter hoist status light. Navigation lighting is anticipated on the WTGs and OSSs. A revised version of Appendix II-K2 provides a proposed Project lighting and marking scheme, subject to further review and discussion with BOEM, FAA, and USCG.

The proposed onshore facilities will consist of up to three US Wind substations and interconnection to the Indian River substation located adjacent to the Indian River Power Plant near Millsboro, Delaware. The US Wind Substations are proposed to be located east and northeast of the substation with the submarine cable entering the US Wind Substations underground, then transitioning to an overhead configuration to make the short connections to the Indian River Substation. The proposed additional facilities are consistent with the existing substation visual character and appearance in terms of components and height, however, at the request of BOEM, were evaluated in the VIA.

The proposed O&M Facility would be located near the Ocean City Inner Harbor, an area characterized by industrial development, maritime industrial use, and commercial activities. The Facility would consist of a quayside for crew transfer vessels and material on- and off-loading, as well as a warehouse, administrative building, and other supporting facilities. The VIA evaluated the visual impacts of the O&M Facility to the surrounding area.

15.2 Visual Impact Analysis

The Visual Impact Assessment describes the process summarized in the subsequent sections in detail, provided as Appendix II-J1.

15.2.1 Landscape and Seascape Character Areas

Various land cover types exist within the VSA and may be impacted visually by the Project. The most prominent cover type is open water, which includes the Atlantic Ocean, an area that has an unobstructed view of the Project. Open water also includes inland bays, lakes and ponds, which encompasses the parts of Delaware Bay, Rehoboth Bay, Indian River Bay and others along the Delaware and Maryland coastline. These areas can be bordered by wetlands, forests, and forested wetlands. The VSA also includes various levels of development, including agricultural land, rural residential areas, developed open space, urban fringe, and commercial and industrial centers. Some of these developed areas fall along the coastline behind coastal beaches, which are popular locations for tourism and recreation throughout New Jersey, Delaware and Maryland.

Visual impacts on landscape and seascape character areas may vary within each area and between distinct areas of the same type, depending on the magnitude of impact and on the variation in sensitivity. Ranges of magnitude and sensitivity for each area within the VSA are provided in Table 15-1, along with the resulting impact ranges obtained by using BOEM’s visual impact matrix. Character areas would only be impacted by the Project if it is visible over the horizon. Therefore, the results in Table 15-1 represent a worse-case scenario.

Table 15-1. Visual Impact Level Matrix for Landscape Similarity Zones

LSZ Name	LSZ Susceptibility	LSZ Value	Sensitivity Rating (low, medium, high)	LSZ Geographic Extent	LSZ Size/Scale	Duration/ Reversibility	Magnitude Rating (large, medium, small)	Overall Impact Level (major, moderate, minor, negligible)
Atlantic Ocean	High	High Tourism, recreation area, maritime use, historic resources	High High Susceptibility + High Value	Large 6,076 mi^2 (15,737 km^2) 99.6%	Large Expansive panoramic views with few vertical elements. High contrast with Project structures.	Fair Long-term/ Reversible	Large Large Geographic Extent + Large Size/Scale + Long-term	**Major** **High Sensitivity + Large Magnitude**
Inland Bays, Lakes, and Ponds	Medium to High	High Tourism, recreation, natural resource and conservation areas	High Medium to High Susceptibility + High Value	Large 173 mi^2 (448 km^2) 77.2%	Small to Medium Project views obstructed by barrier islands and other terrain.	Fair Long-term/ Reversible	Medium to Large Large Geographic Extent + Small to Medium Size/Scale + Long-term	**Moderate to Major** **High Sensitivity + Medium to Large Magnitude**
Forest and Forested Wetlands	High	Medium Tourism, recreation, wildlife and restoration areas	High High Susceptibility + Medium Value	Small 2.7 mi^2 (7.0 km^2) 0.4%	Small Tall vegetation blocks most of Project, located primarily inland.	Fair Long-term/ Reversible	Small Small Geographic Extent + Small Size/Scale + Long-term	**Minor** **The nature of the high sensitivity rating at this LSZ does not warrant an increase in overall impact level.**
Agricultural Land	High	Low Economic	Medium High Susceptibility + Low Value	Small 13 mi^2 (34 km^2) 2.5%	Small Views limited by distance and intervening objects and/or terrain. If visible, high contrast with Project	Fair Long-term/ Reversible	Small Small Geographic Extent + Small Size/Scale + Long-term	**Minor** **Medium Sensitivity + Small Magnitude**

Table 15-1. Visual Impact Level Matrix for Landscape Similarity Zones

LSZ Name	LSZ Susceptibility	LSZ Value	Sensitivity Rating (low, medium, high)	LSZ Geographic Extent	LSZ Size/Scale	Duration/ Reversibility	Magnitude Rating (large, medium, small)	Overall Impact Level (major, moderate, minor, negligible)
					structures.			
Developed Open Space	High	Medium Recreation, residential	High High Susceptibility + Medium Value	Small 2.1 mi^2 (5.4 km^2) 2.1%	Medium Mix of clear ocean views and views obstructed by intervening objects and/or terrain. If visible, high contrast with Project structures.	Fair Long-term/ Reversible	Small Small Geographic Extent + Medium Size/Scale + Long-term	**Minor** **The nature of the high sensitivity rating at this LSZ does not warrant an increase in overall impact level.**
Wetlands	High	High Tourism, recreation, natural resource and conservation areas	High High Susceptibility + High Value	Medium 40 mi^2 (104 km^2) 44%	Small Views of Project limited due to low elevation and variable vegetation heights. If visible, high contrast with Project structures.	Fair Long-term/ Reversible	Small Medium Geographic Extent + Small Size/Scale + Long-term	**Minor** **The nature of the high sensitivity rating at this LSZ does not warrant an increase in overall impact level.**
Rural Residential Development (Low Intensity Developed Area)	High	Low to Medium Recreation, residential	Medium to High High Susceptibility + Low to Medium Value	Small 2.3 mi^2 (6.0 km^2) 3.0%	Small to Large Views limited by intervening objects, although Project may be	Fair Long-term/ Reversible	Small to Medium Small Geographic Extent + Small to Large Size/Scale + Long-term	**Minor to Moderate** **Although there are areas of high sensitivity within this LSZ, the nature of sensitivity and the**

Table 15-1. Visual Impact Level Matrix for Landscape Similarity Zones

LSZ Name	LSZ Susceptibility	LSZ Value	Sensitivity Rating (low, medium, high)	LSZ Geographic Extent	LSZ Size/Scale	Duration/ Reversibility	Magnitude Rating (large, medium, small)	Overall Impact Level (major, moderate, minor, negligible)
					visible over them. If visible, high contrast with Project structures.			**small affected area do not warrant elevation to a Major overall impact.**
Urban Fringe (Medium Intensity Developed Area)	High	Low to Medium Recreation, residential, commercial	Medium to High High Susceptibility + Low to Medium Value	Small 2.9 mi^2 (7.5 km^2) 6.0%	Small to Large Views limited by intervening objects, although Project may be visible over them. If visible, high contrast with Project structures.	Fair Long-term/ Reversible	Small to Medium Small Geographic Extent + Small to Large Size/Scale + Long-term	**Minor to Moderate** **Although there are areas of high sensitivity within this LSZ, the nature of sensitivity and the small affected area do not warrant elevation to a Major overall impact.**
Commercial and Industrial Centers (High Intensity Developed Area)	Medium to High	Low to High Recreation, economic	Low to High Medium to High Susceptibility + Low to High Value	Small 1.6 mi^2 (4.1 km^2) 8.4%	Small to Large Mix of clear ocean views and views obstructed by intervening objects and/or terrain. If visible, high contrast with Project structures.	Fair Long-term/ Reversible	Small to Medium Small Geographic Extent + Small to Large Size/Scale + Long-term	**Minor to Moderate** **Although there are areas of high sensitivity within this LSZ, the nature of the high sensitivity at this LSZ does not warrant an increase in overall impact level.**
Beaches	High	High Tourism, recreation, natural resource	High High Susceptibility + High Value	Large 7.8 mi^2 (20 km^2) 60%	Large Unobstructed ocean views. High contrast	Fair Long-term/ Reversible	Large Large Geographic Extent + Large Size/Scale +	**Major** **High Sensitivity + Large Magnitude**

Table 15-1. Visual Impact Level Matrix for Landscape Similarity Zones

LSZ Name	LSZ Susceptibility	LSZ Value	Sensitivity Rating (low, medium, high)	LSZ Geographic Extent	LSZ Size/Scale	Duration/ Reversibility	Magnitude Rating (large, medium, small)	Overall Impact Level (major, moderate, minor, negligible)
		and conservation areas			with Project structures.		Long-term	
Low Vegetation	High	High Tourism, recreation, natural resource and conservation areas	High High Susceptibility + High Value	Small 0.2 mi^2 (0.5 km^2) 1.5%	Small to Large Mix of clear ocean views and views obstructed by intervening objects and/or terrain. If visible, high contrast with Project structures.	Fair Long-term/ Reversible	Small to Medium Small Geographic Extent + Small to Large Size/Scale + Long-term	**Minor to Moderate** **Although sensitivity is high, the geographic extent of visual change is extremely limited and the size and scale of change in this LSZ does not merit elevation to a Major overall impact rating.**

15.2.2 Selected Viewpoints

Study area views in the direction of the Project were photographically documented in the field and coordinates were recorded. Locations were chosen from the field documentation to be used as viewpoints for the visual simulations. These viewpoints were selected to provide representative views of the Project from viewpoints ranging the entire coastal area adjacent to the Project. Simulations in Delaware and Maryland represent views in which the Project is visible while simulations in New Jersey and Virginia represent views at the farthest reaches of the viewshed. Simulations have been prepared for each viewpoint to represent different lighting conditions and time of day; early morning, mid-day and afternoon.

The viewpoints chosen for the visual simulations were as follows:

- KOP 1: Ocean City Pier, Atlantic Hotel, Ocean City Beach, Maryland (Ocean City Boardwalk)
- KOP 3: Assateague Island National Seashore, Assateague Island, Maryland
- KOP 15: Bethany Beach Boardwalk and Wreck Site, Bethany Beach, Delaware
- KOP 6: 84th Street Beach, Ocean City, Maryland
- KOP 25: Assateague Island, Toms Cove Visitor Center, Chincoteague, Virginia
- KOP 21: Cape May Lighthouse, Cape May, New Jersey
    - 21a: Cape May Beach
    - 21b: Cape May Lighthouse Observation Deck
- KOP 20: Delaware Seashore State Park, Dewey Beach, Delaware
- KOP 22: Fort Miles Historic District, Cape Henlopen State Park, Delaware
- KOP 19: Indian River Life Saving Station, Rehoboth Beach, Delaware
- KOP 4: Mansion House NRHP and Public Landing, Snow Hill, Maryland
- KOP 24: Rehoboth Beach Boardwalk, Rehoboth Beach, Delaware
- KOP 23: Wildwood Boardwalk, Wildwood, New Jersey

Impacts to selected locations would depend on numerous factors, such as project magnitude, viewing angle, motion or lighting, duration of view, and atmospheric conditions. Review of the visual simulation images, along with photos of the existing view, allowed for a comparison of the aesthetic character of each view with and without the Project. Table 15-2 summarizes the impact to each selected viewpoint.

Table 15-2. Existing and Proposed Views at Key Observation Points

Key Observation Point Name	Representative LSZ	Existing View	KOP Sensitivity Rating	View with Proposed Project	Visibility Rating
KOP 23: Wildwood Boardwalk	Beaches, Commercial and Industrial Centers (High Intensity Developed Area)	Boardwalk/beach location in Wildwood, NJ. Approx. 58.5 km (36.3 mi) north of nearest WTG location. This beach view is near the northern extent of the Project's limit of visibility. Visual elements include a large sandy beach extending from the foreground to the midground (over 1,000 feet to the water), a strip of ocean and waves in the midground, and the distant ocean, horizon and sky in the background. High sensitivity to visual change due to lack of competing focal points, but less dominant ocean view given the distance from the water. User groups: Local residents, recreationists, and business employees.	High	The existing view would be altered in a 12.6° horizontal extent with the addition of 62 WTGs to the south. No OSS or nacelles would be visible above the horizon. A maximum of 37% of the nearest WTG height would be visible.	1
KOP 21a: Cape May Beach	Beaches, Developed Open Space	Beach access walkway at Cape May State Park, NJ. Approx. 53.9 km (33.5 mi) north of nearest WTG location. Visual elements include beach and dunes in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to expansive views and lack of competing focal points. User groups: Recreationists.	High	The existing view would be altered in a 13.5° horizontal extent with the addition of 92 WTGs to the south. No OSS would be visible above the horizon. Nacelles of 12 WTGs would be visible. A maximum of 53% of the nearest WTG height would be visible.	2
KOP 21b: Cape May Lighthouse Observation Deck	Rural Residential Development (Low Intensity Developed Area), Urban Fringe (Medium Intensity Developed Area)	Observation deck of Cape May Lighthouse, NJ. Approx. 54.0 km (33.6 miles) north of nearest WTG location. This elevated view is available to tourists who climb the lighthouse during operating hours. Visual elements include the lighthouse safety railings in the immediate foreground, ground-level houses, roads, parking lots, and beachfront in the midground, and the ocean, sky, and horizon in the background. High sensitivity to visual change due to tourism significance, very expansive views, and lack of competing focal points in the ocean.	High	The existing view from the observation deck would be altered in a 14.6° horizontal extent with the addition of 121 WTGs to the south. No OSS would be visible above the horizon. Nacelles of 87 WTGs would be visible. A maximum of 79% of the nearest WTG height would be visible.	3

Table 15-2. Existing and Proposed Views at Key Observation Points

Key Observation Point Name	Representative LSZ	Existing View	KOP Sensitivity Rating	View with Proposed Project	Visibility Rating
		User groups: Recreationists.			
KOP 22: Fort Miles Historic District, Cape Henlopen	Developed Open Space	Historic military site at Cape Henlopen State Park, NJ. Approx. 40.1 km (24.9 mi) northwest of nearest WTG location. Visual elements include walkways and railings in the foreground; grassy areas, vegetation, and fort buildings in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to historic significance but more visual clutter and competing visual elements besides the ocean. User groups: Local residents and recreationists.	High	The existing view would be altered in a 16.1° horizontal extent with the addition of 121 WTGs to the southeast. No OSS would be visible above the horizon. Nacelles of 86 WTGs would be visible. A maximum of 81% of the nearest WTG height would be visible.	2
KOP 24: Rehoboth Beach Boardwalk	Beaches, Commercial and Industrial Centers (High Intensity Developed Area)	Beach location in Rehoboth, DE Approx. 35.2 km (21.9 mi) northwest of the nearest WTG location. Visual elements include beach and dunes in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to expansive views, but with competing focal points. User groups: Local residents, recreationists, and business employees.	High	The existing view would be altered in a 18.0° horizontal extent with the addition of 121 WTGs to the southeast. No OSS would be visible above the horizon. Nacelles of 93 WTGs would be visible. A maximum of 83% of the nearest WTG height would be visible.	2
KOP 20: Delaware Seashore State Park	Beaches	Beach location from a state park in DE. Approx. 31.4 km (19.5 mi) northwest of the nearest proposed WTG location. Visual elements include beach and dunes in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to conservation significance, expansive views, and lack of competing focal points. User groups: Local residents, recreationists, and maritime users.	High	The existing view would be altered in a 20.7° horizontal extent with the addition of 121 WTGs to the southeast. No OSS would be visible above the horizon. Nacelles of 109 WTGs would be visible. A maximum of 87% of the nearest WTG height would be visible.	3
KOP 19: Indian River Life Saving Station	Beaches	Beach location and historic site. Approx. 27 km (17 mi) northwest of the nearest WTG location. The viewpoint is near a National Register Historic Site. Visual elements include beach and dunes in the	High	The existing view would be altered in a 22.4° horizontal extent with the addition of 121 WTGs to the southeast. No OSS would	3

Table 15-2. Existing and Proposed Views at Key Observation Points

Key Observation Point Name	Representative LSZ	Existing View	KOP Sensitivity Rating	View with Proposed Project	Visibility Rating
		foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to historic significance, expansive views, and lack of competing focal points. User groups: Local residents and recreationists.		be visible above the horizon. Nacelles of 117 WTGs would be visible. A maximum of 90% of the nearest WTG height would be visible.	
KOP 15: Bethany Beach Boardwalk & Wreck Site	Beaches, Urban Fringe (Medium Intensity Developed Area)	Beach location in DE. Approx. 19.9 km (12.4 mi) northwest of the nearest proposed WTG location. The foreground of this view to the southeast is comprised of beach front. Visual elements include beach and dunes in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to expansive views and lack of competing focal points. User groups: Local residents, recreationists, and business employees.	High	The existing view would be altered in a 31.8° horizontal extent with the addition of 121 WTGs to the southeast. All 121 nacelles and 2 OSS would be visible. A maximum of 97% of the nearest WTG height would be visible.	5
KOP 6: 84th Street Beach, Ocean City	Beaches, Commercial and Industrial Centers (High Intensity Developed Area)	Beach location in Ocean City, MD. Approx. 17.4 km (10.8 mi) west of nearest WTG location. Visual elements include beach and beachgoers in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. KOP has expansive views and low activity in early morning hours with an increasing amount of recreational activity and related visual clutter during the day, but viewer sensitivity to change is high. User groups: Local residents, recreationists, and business employees.	High	The existing view would be altered in a 50.9° horizontal extent with the addition of 121 WTGs directly east. All 121 nacelles and 3 OSS would be visible. A maximum of 98% of the nearest WTG height would be visible. This KOP has the lowest distance to the nearest WTGs and the most directly seaward view of the Project area, resulting in a significant change to the seascape.	5
KOP 1: Ocean City Pier, Atlantic Hotel	Beaches, Commercial and Industrial Centers, (High Intensity Developed Area)	Pier and boardwalk location at Ocean City Beach. Approx. 21 km (13 mi) west of the nearest proposed WTG location. Visual elements include the beach and pier in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. Some limited visual clutter, motion, and lighting elements at this KOP	High	The existing view would be altered in a 51.2° horizontal extent with the addition of 121 WTGs directly east. All 121 nacelles and 3 OSS would be visible. A maximum of 97% of the nearest WTG height would be	5

Table 15-2. Existing and Proposed Views at Key Observation Points

Key Observation Point Name	Representative LSZ	Existing View	KOP Sensitivity Rating	View with Proposed Project	Visibility Rating
		reduce the sensitivity to visual change somewhat compared to less developed KOPs. User groups: Local residents, recreationists, and business employees.		visible. The visual change introduced by the WTGs at this KOP would be one of the largest in magnitude of the KOPs studied given the higher horizontal extent of the new visual elements.	
KOP 3: Assateague Island National Seashore	Beaches	National Seashore in Maryland. Approx. 6.4 km (16.4 mi) southwest of the nearest proposed WTG location. Visual elements include beach and dunes in the foreground, waves and ocean in the midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to conservation significance, expansive views, and lack of competing focal points. User groups: Local residents and recreationists.	High	The existing view would be altered in a 39.5° horizontal extent with the addition of 121 WTGs to the northeast. All 121 nacelles and 1 OSS would be visible. A maximum of 90% of the nearest WTG height would be visible.	4
KOP 4: Mansion House	Inland Bays, Lakes and Ponds, Urban Fringe (Medium Intensity Developed Area)	Public wharf location on inland bay. Approx 42.3 km (26.3 mi) southwest of the nearest WTG location. The KOP is adjacent to a National Register Historic Site located on the Chincoteague Bay, with views of the Atlantic Ocean and the Project Area partially obstructed by Assateague Island. The foreground of this view is the waters of the Chincoteague Bay, with less wave activity than would be observed in the Atlantic Ocean but otherwise similar uses including boating and fishing. The midground consists of the waters of the bay, and the background includes the horizon, barrier islands, and ocean beyond. Medium sensitivity to proposed changes on the other side of the barrier islands, given the intervening visual clutter, including many vertical elements such as trees, houses, and other structures. User groups: Local residents, recreationists, and maritime users.	Medium	The existing view would be altered in a 30.7° horizontal extent with the addition of 121 WTGs to the northeast, many of which may be screened from view by Assateague Island. No OSS would be visible above the horizon. Nacelles of 76 WTGs are theoretically visible above the horizon, but only approximately 40 nacelles would be visible when accounting for screening by intervening landforms and vegetation. A maximum of 67% of the nearest WTG height would be visible.	2
KOP 25: Assateague Beach, Toms Cove Visitor Center	Beaches	Beach site in national seashore area. Approx. 64.0 km (39.7 miles) southwest of the nearest WTG location, near the limit of visibility of the Project due to curvature of the earth. Visual elements include beach and dunes in the foreground, waves and ocean in the	High	The existing view would be altered in a 19.7° horizontal extent with the addition of 58 WTGs to the northeast. No OSS or turbine nacelles would be visible. A	1

Table 15-2. Existing and Proposed Views at Key Observation Points

Key Observation Point Name	Representative LSZ	Existing View	KOP Sensitivity Rating	View with Proposed Project	Visibility Rating
		midground, and distant ocean, horizon, and sky in the background. High sensitivity to visual change due to conservation significance, expansive views, and lack of competing focal points. User groups: Recreationists.		maximum of 24% of the nearest WTG height would be visible. This location would experience one of the lowest levels of visual change due to the distance from the Project area (and resulting earth curvature effect) and the relatively small vertical scale and horizontal extent of the WTGs. The angle at which the WTGs could be seen is also farther north than the primary seaward view angle at this beach location.	

15.3 Impacts

The primary impacts to visual resources during construction would be from the vessels and equipment involved in transporting Project components to the staging area and then to the Project area. This equipment will include large jack-up barges and other large transport vessels, as well as mobile cranes, cable laying vessels, and tugboats. There will be an increase in vessel traffic associated with the transport of Project components and personnel, but large vessel activity is not uncommon in this region and impacts to visual resources will be minor and temporary. The use of lighting during construction has not yet been determined and will be decided in consultation with construction contractors and applicable local agencies.

Post-construction impacts to visibility from the transmission interconnection will be negligible, because the offshore and onshore export cables will be submarine or underground. The US Wind Substations will be consistent with the existing infrastructure’s visual character and appearance in terms of components and height. Therefore, negligible visual impacts will occur in the immediate vicinity of the cable landfall and existing substation. The visual impact of the US Wind Substations is discussed in Appendix II-J1.

Impacts to visual resources due to the maximum potential buildout of the O&M Facility would range from minor to moderate, due to the construction of this facility in a developed working waterfront in the West Ocean City Inner Harbor. There are existing buildings in the surrounding landscape, some of which are taller than the maximum height of the proposed structures (i.e., the Colonel Jack Taylor Boathouse, owned by MDNR Natural Resources Police), causing the proposed structures to blend with the surrounding landscape. From viewpoints close to the facility, there would be a major change to the existing landscape and the facility would be prominent based on its proximity to the viewer. However, US Wind’s O&M Facility will be consistent with the character and appearance of the surrounding area. Simulations of the maximum potential buildout of the O&M Facility are provided in Appendix II-J1 as Appendix A2.

When viewed from coastal vantage points, WTGs appear low on the distant horizon and these areas already have significant elements within their existing visual environment, such as flying banners and advertising boats. When detectable, the somewhat regular vertical form of the tubular towers will contrast with the horizontal form of the water/sky horizon. The proposed neutral off-white color of the turbine tower, nacelle and blades will be viewed against the background sky. When the WTGs are backlit, the degree of visual contrast is more noticeable than if viewed in a front- or side-lit condition. Color contrast decreases as distance increases and will diminish or disappear completely during periods of haze, fog or precipitation.

From the shoreline, the proposed WTGs will be the tallest visible elements on the horizon, though at a far distance and will appear shorter than passing vessels. From most foreground and mid-ground vantage points (from vessels on the ocean), the WTGs will be perceived as the main visual element. When viewed from vantage points on land, the WTGs perceived scale and presence are considerably reduced. Inland views are typically screened by dunes, low hills, and existing vegetation or buildings.

When visible from inland locations, views will typically include existing coastal light sources that include commercial and residential building sources, streetlights and vehicle headlights. The WTG lights in the night sky would be expected to be noticeable from certain beach areas and coastal areas when in operation and under certain atmospheric conditions. When visible, they will appear low on the horizon and will appear to vary in intensity due to the slow flash rate, intermittent shadowing as rotating blades pass in front of the light source, and the atmospheric conditions.

From offshore locations (i.e., on recreational vessels, charter boats, fishing vessels, or commercial vessels), views would consist mainly of the Project, the open ocean, and other offshore vessels. Views of the Project itself would vary based on the viewers proximity to the Project. Atlantic OCS views would be dominated by the Project components, with its prominence decreasing as viewers neared the shoreline. Components may be obscured from view during foggy conditions or inclement weather but would become visible as viewers approached the Project area.

Visual impacts depend on the distance from shore, earth curvature, and atmospheric conditions that could screen some or all of the foundation, and portions of the tower, nacelle, and rotor. Overall, visual impacts to coastal onshore viewers (e.g., beachgoers, hikers and bikers, office workers) of WTGs in daylight would be expected to be minor to major. Impacts to offshore viewers (e.g., fishers, charter boat crews, freight transport, recreational boaters) would be expected to be moderate to major, based on the viewers' proximity to the WTGs. When the aviation lights are activated, these lights would likely be visible on clear nights from the shoreline. Weather conditions such as fog, haze, clouds or precipitation would greatly limit the visibility of the WTGs and lighting from the shore. WTGs are expected to have no visual impact at night when the FAA lights are off. When the FAA lights on the WTGs are on during the night, the impact would be moderate to major, particularly when no other artificial light source is present. However, an ADLS Efficacy Analysis (included within Appendix II-J1 as Appendix E) concluded the use of an ADLS-controlled lighting system would result in a more than 99% decrease in the length of time the FAA lights would be lit compared to illumination during all nighttime hours. Based on an evaluation of historical flight data near the Lease area, lights would be on for approximately 5 hours, 46 minutes, and 22 seconds over the course of a year.

In addition to the Visual Impact Assessment (Appendix II-J1), a Historic Resources Visual Effects Analysis is provided as Appendix II-I3.

15.4 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on visual resources.

- US Wind commits to use aircraft detection lighting system (ADLS), if commercially feasible and approved by BOEM in consultation with FAA, USCG and other agencies. An FAA-approved vendor will be used to implement the ADLS for the Project, which is feasible per Chapter 10 of the updated Marking and Lighting Advisory Circular (70/7460-1M, November 2020).
- The Project will minimize aviation lighting impacts, such as aiming lighting upward and using the longest permissible off cycles, in consultation with the FAA and BOEM.
- Lighting and marking will be implemented in consultation with FAA, BOEM, USCG and other regulatory agencies.
- Uniform spacing of WTGs and OSSs.

- Use an FAA-recommended paint color that is not pure white (RAL 9010) for any WTG components visible from shore. The WTG paint color will be determined in consultation with BOEM, FAA, and USCG.
- All offshore and onshore export cables are planned to be buried, or in locations where burial may not be achievable, protected to the greatest extent practicable.
- US Wind will coordinate with BOEM to prepare and implement a scenic and visual resource monitoring plan that monitors and compares the visual effects of the wind farm during construction and operations/maintenance (daytime and nighttime) to the findings of the VIA and verifies the accuracy of the visual simulations (photo and video).
- The monitoring plan would include monitoring and documenting the meteorological influences on actual wind turbine visibility over a duration of time from selected key observation points, as determined by BOEM and US Wind.
- In addition, US Wind would include monitoring the operation of ADLS in the monitoring plan. US Wind will monitor the frequency that the ADLS is operative, documenting when (dates and times) the aviation warning lights are in the on position and the duration of each event. Details for monitoring and reporting procedures will be included in the plan.
- The design and installation of artificial night lighting at the O&M facility would use sustainable outdoor lighting specifications that minimize impact to natural night skies while providing a safe work environment in accordance with local, state, and federal regulations. Sustainable night lighting practices are not intended to conflict with or supersede artificial night lighting requirements to secure a safe nighttime work environment for onshore support of offshore wind energy of activities.

16.0 Navigation and Military Activities

16.1 Offshore Navigation

The waters around the Project area are utilized by a mix of commercial shipping, military, fishing and recreational vessels. As part of the environmental review for the establishment of the Maryland WEA in the Mid-Atlantic region, BOEM excluded an area of concern for potential navigational impacts identified by the USCG within the Maryland WEA (*See* Mid-Atlantic, Final Environmental Assessment, p. vi (Jan. 2012)). The analysis concluded that none of the Mid-Atlantic WEAs overlapped with the existing USCG Traffic Separation Scheme (TSS) (*Id.* At p. 152). Under the Ports and Waterways Safety Act, the USCG must reconcile the need for safe access routes with other reasonable uses of the area involved (46 U.S.C. 470003). The USCG has conducted an Atlantic Coast Port Access Route Study (ACPARS) as part of BOEM's "Smart from the Start" offshore wind energy initiative (See Final ACPARS Report, 82 FR 16510 (April 5, 2017)).

The USCG announced a new Port Access Route Study (PARS) on May 5, 2020 (85 FR 26695)(USCG 2020) for the seacoast of New Jersey including the offshore approaches to the Delaware Bay. The USCG published a draft report on the New Jersey PARS on September 24, 2021 (86 FR 53089) (USCG 2021). In the draft report, the USCG proposes to extend the existing TSS along the eastern side of the Lease area and continuing to the southeast 5 NM (11 km) beyond the boundary of the Lease area (Figure 16-1). On March 24, 2022, the USCG announced the completion of the New Jersey PARS (87 FR 16759). This announcement reported the study's recommendation that the existing TSS approaching the Delaware Bay be extended past the Lease area. On September 9, 2022, the USCG published the Consolidated Port Approaches and International Entry and Departure Transit Areas Port Access Route Studies (CPAPARS) (87 FR 55449), which was updated March 10, 2023 (88 CFR 15055). This report summarizes the findings of the four regional studies completed along the Atlantic coast and provides recommendations to updating navigational routes (USCG 2023).

DNV prepared a Navigation Safety Risk Assessment (NSRA) for the Project to evaluate the potential for risks to navigation from the construction, operation, and decommissioning of the Project. A copy of the NSRA is provided in Appendix II-K1. USCG guidance "Navigation and Vessel Inspection Circular No. 01-19 (NVIC 01-19)" was used in the preparation of the NSRA (USCG 2019). The NSRA serves as the outline and basis for evaluating the potential impact of the Project on the marine transportation system, including navigation safety, traditional uses of waterways and USCG missions. The NSRA also identifies reasonable methods of controlling or mitigating potential Project impacts.

The NSRA prepared for the Project evaluates the current TSS and the benefits of the TSS extension proposed in the USCG's September 2021, NJ PARS draft report. The TSS extension reduced by approximately half the modeled frequency of a cargo, carrier, or tanker vessel striking, or alliding with, a Project structure at speed.

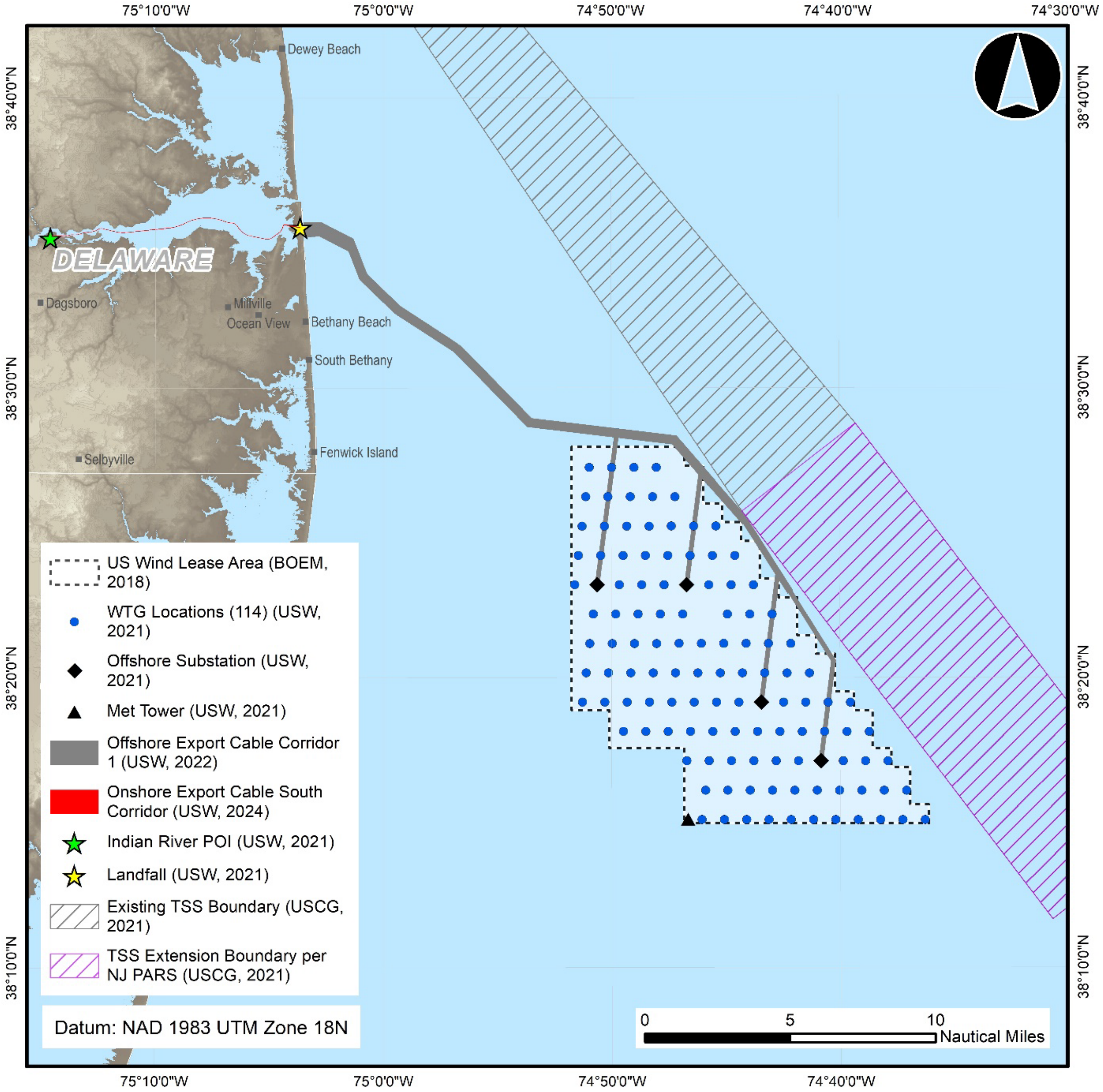

Figure 16-1. Proposed Project Layout with TSS Extension

For the NSRA, the 2019 Automatic Identification System (AIS) vessel traffic data served as the most recent, representative source of marine traffic data available for a full one-year period. To understand general vessel traffic patterns in the waters surrounding the Lease area, AIS tracks were plotted to illustrate vessel transit routes and densities. The vessel traffic data analysis revealed different vessel type routes when comparing cargo ships, tankers, and towing vessel traffic. Based on the AIS data included in the NSRA, US Wind concludes the highest densities of vessel traffic in the Traffic Survey Area are the entrance to Delaware Bay, the Ocean City Inlet, and within the two TSS Approaches (Delaware Bay Eastern Approach and Southeastern Approach). Other patterns show an inshore, coastwise tug-tow route that crosses the TSS and follows the coast as well as generally north-south routes well offshore. Commercial fishing traffic appears in the data as both transit routes to and from the ports of Ocean City, Maryland and Cape May, New Jersey.

As described in the NSRA, a future case model was developed using the Marine Accident Risk Calculation System (MARCS) to estimate the increase in the number of marine accidents that may result from the Project. Figure ES-1 in the NSRA shows the Project and NSRA study boundaries. The main results of the modeling indicated that the risk of collision increases from a small baseline level to approximately 1 accident every 25 years, primarily due to the assumed increase in vessel traffic generated by the Project. The risk of allision would increase, as would be expected due to new structures in the Lease area, however, the overwhelming majority of the increased allision frequency involves smaller ships navigating in the Lease area with low severity consequences for the vessels and the structures. The risk of higher severity consequence powered allisions of large vessels is expected to be approximately 1 allision every 520 years.

In 2024, additional analysis of alternate Met Tower locations described in COP Volume I Section 2.4.1 was included. Should the Met Tower be located in an alternate position currently planned for a WTG, the allision risk would be equal to or slightly lower than a WTG in the same position.

According to the NSRA, the MARCS modeling provides a reasonable and conservative maximum estimate of the additional risk that could result from the presence of the Project assuming the additional transits added to AIS adequately represent the actual traffic. If the number of transits were half of the number in the model, one would expect the risk would reduce significantly. The adoption of mitigation measures, such as use of AIS technology within the Lease area, could further decrease the Project's risk for collision or allision.

The results of the MARCS modeling presented in the NSRA demonstrated the significant potential benefit of the proposed 1 NM (1.9 km) buffer between Project structures and the proposed TSS boundary in reducing allision risk for large vessels with the Project and significantly decreasing the navigational safety risk associated with the Project. The MARCS modeling presented in the NSRA was also conducted with and without the proposed 1 NM (1.9 km) buffer between Project structures and the adjacent TSS to assess the potential reduction in navigational risk that may be associated with adopting such a buffer zone. The modeled allision frequency per structure per year for drift allisions with large vessels decreased approximately 7% with the 1 NM (1.9 km) TSS buffer implemented. The modeled allision frequency per structure per year for higher severity consequence powered allisions with large vessels decreased approximately 30% with the 1 NM (1.9 km) TSS buffer implemented. The modeled total allision frequency per structure per year for large vessels decreased approximately 11% with the 1 NM (1.9 km) TSS buffer implemented.

The impact of the Project on emergency rescue operations was also evaluated. The search pattern used by the USCG during search and rescue (SAR) operations may be impacted if the Project's offshore structures restrict possible flying and sailing search routes within the Lease area. The USCG is evaluating whether the lanes between WTGs provide sufficient access to conduct an air search, because the presence of the offshore structures makes it difficult to search for a small object such as a person in the water. US Wind is working with the USCG to identify mitigation measures that may increase mariner and responder situational awareness in the vicinity of the Lease area such as cameras, distinct markings on towers, and enhanced communication connectivity that may increase location certainty and reduce required search activity for mariners or objects with unknown locations.

The potential Project effects on vessel communications, marine radar and positioning systems were evaluated and it was determined that most instances of interference can be mitigated through the proper use of radar gain controls and AIS data transmission, favorable placement of vessel radar antennas and regular communication and safety broadcast from vessels operating in the Lease area. Numerous factors may impact marine radar and a post-construction analysis may be conducted to identify the effects on marine radar and to assess potential mitigation methods.

The offshore export cables and inter-array cables will be buried below the seabed. Buried cables present potential snagging risks for vessel anchors. Sufficient cable burial depth and cable protection, including concrete matting where necessary, and routing the offshore export cables to avoid anchoring sites will help protect the cables and OCS users from any potential contact with vessel anchors. US Wind routed the Offshore Export Cable Corridors to the south of anchorage grounds proposed by USCG in the November 29, 2019, Notice of Inquiry, request for comments, 87 CFR 16126 (see Figure 16-2), which was formally proposed in a Notice of Proposed Rulemaking March 22, 2022. The rule became effective on August 11, 2022 (87 CFR 41248). The formerly planned offshore export cable route, as shown on Figure 3-2, would have bisected the proposed anchorage area.

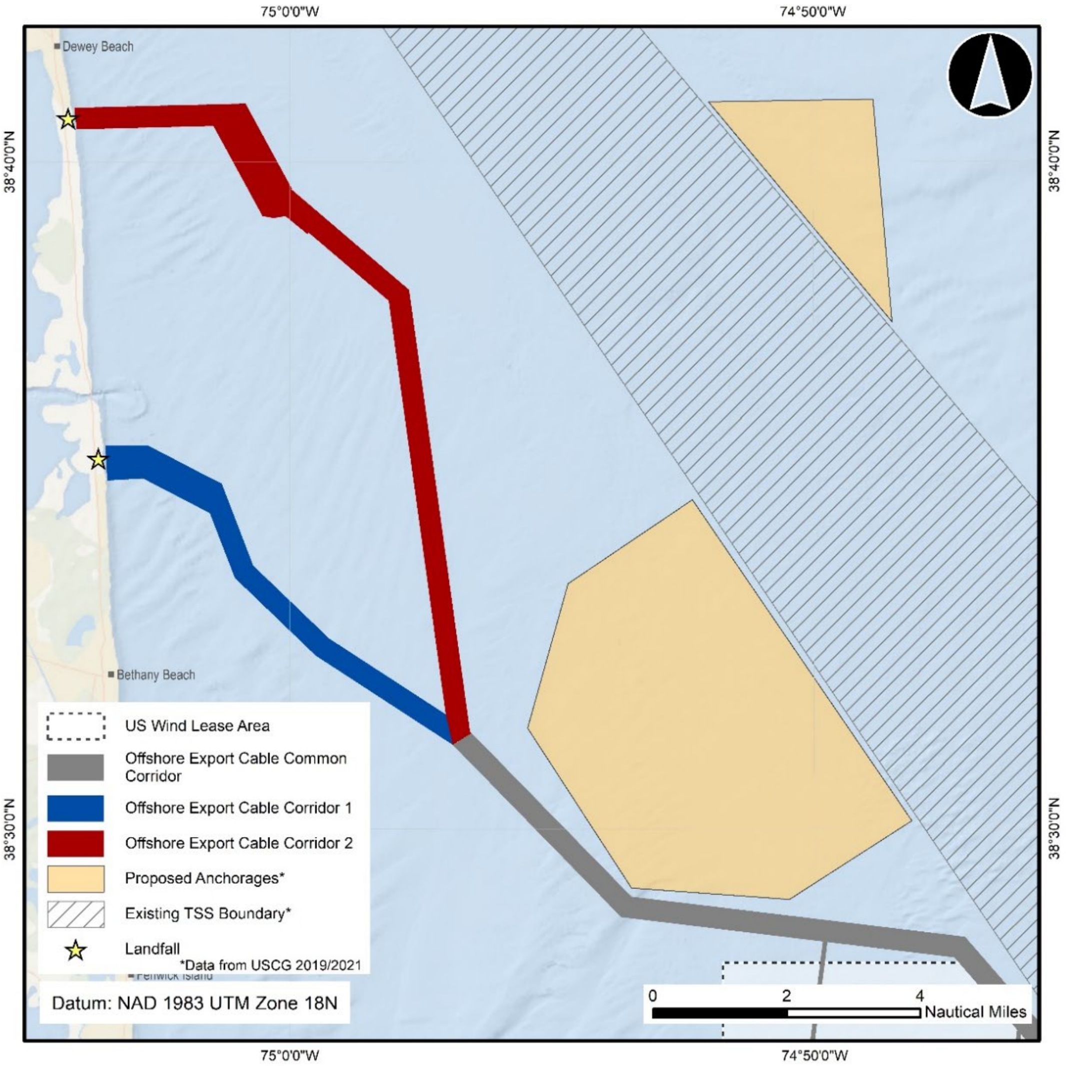

Figure 16-2. Location of Proposed USCG Anchorage Areas

A Cable Burial Risk Assessment based on the 2021-2022 geophysical and shallow geotechnical surveys in the Lease area has been provided in Appendix II-K5 and along the Offshore Export Cable Corridors in Appendix II-K7.

16.2 Onshore Navigation

16.2.1 Onshore Export Cable Corridors

The Indian River Inlet and Bay Federal Navigation Project is located within Indian River Bay and Indian River, terminating at Millsboro, Delaware (Figure 16-3). The ongoing project is considered general operation and maintenance of the existing navigation channel. The project provides a safe navigation channel for commercial, recreational and USCG use. Indian River Inlet is the only water access point into the Delaware Inland Bay area that includes Indian River Bay and Rehoboth Bay (USACE 2022). USACE does not maintain the Federal Navigation Channel west of Indian River Inlet. However, DNREC has dredged the portions of the channel through Indian River and proposes dredging the portions passing through Indian River Bay. DNREC maintains portions of the Channel by dredging and has designated the Channel a high priority for maintenance based on function and public stakeholder survey results.

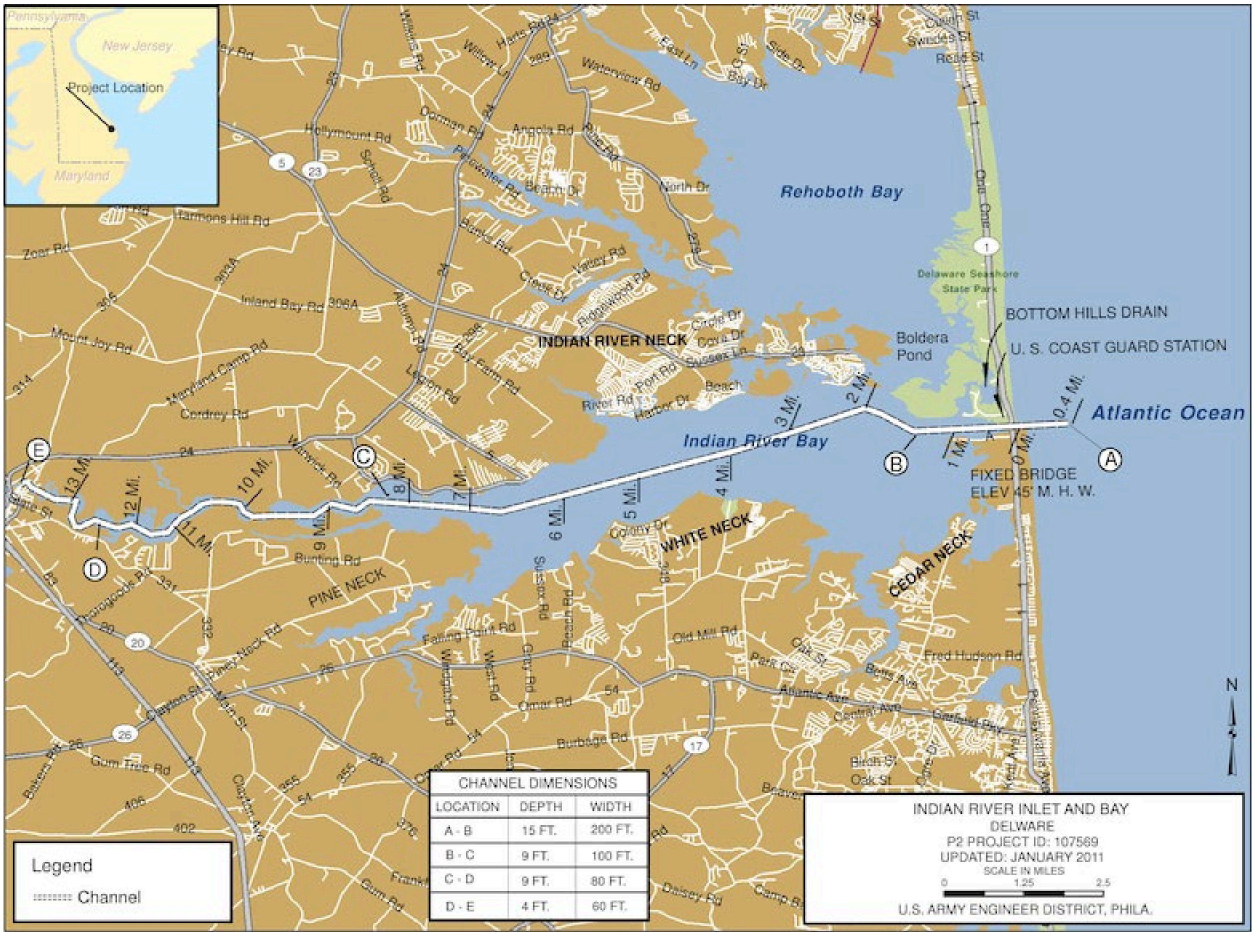

Figure 16-3. Indian River Inlet and Bay Federal Navigation Project (USACE 2022)

The Indian River Inlet and Bay Federal Navigation Channel begins 0.6 km (0.4 miles) offshore of the Indian River Inlet and proceeds through Indian River Bay and the Indian River until the highway bridge in Millsboro (USACE 2022). The channel varies from 61-18 m (200-60 ft wide) and 4.6-1.2 m (15-4 ft) deep as it proceeds inland (Figure 16-3).

In response to a draft Section 408 Review Request submitted to USACE on February 1, 2023, USACE directed US Wind to install export cables no less than 1.8 meters (6 feet) below the maintenance depth of the Channel. The Channel does not have a fixed location through much of Indian River Bay. A channel is marked each year by the U.S. Coast Guard by marker buoys indicating the deeper portions of the route for navigation. DNREC communicated to US Wind in recent meetings that US Wind's buried export cables should not impede the ability of future dredging projects for maintenance of the Channel. Based on feedback from USACE and DNREC, US Wind is planning to bury the export cables 4.9 m (16 ft) below MLLW in the vicinity of the Channel to properly protect the export cables and avoid conflict with maintenance activities if future dredging occurs.

To achieve the target burial depth US Wind and its contractors have determined dredging would be necessary in locations along the cable routes for barge access. Maximum dredging disturbance is assumed to be within 76m (249 ft) wide along the route. This footprint is within the 183-m (600 ft) area of temporary construction disturbance shown in Volume I Figure 3-13.

Dredging along the routes would be a maximum of 1.8 m (6 ft), varying from 1-6 ft (0.3-1.8 m) depending on location. Much of the route would be 1 m (3 ft) or less. Maximum volume of dredging, assuming all 4 cables installed in a single season, and across the entirety of the 249-ft width of the cable corridor, is found in Table 16-1.

Table 16-1. Bottom Disturbance Due to Dredging within Indian River Bay

Dredging	Location	Maximum Area of Dredging (m^2)	Total			
			m^2	ft^2	km^2	acres
Barge Access	Indian River Bay	157,884	157,884	1,699,468	0.16	39.01

16.3 Military Activities

16.3.1 Virginia (VACAPES) Operating Area (OPAREA)

The U.S. Navy Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES) was established in 1977 with the mission of scheduling, controlling, and overseeing military operating areas, training routes, and bombing ranges for the northeastern United States (Commander of U.S. Naval Forces, 2016). Naval Air Force Atlantic oversees 290,079 square km (112,000 square mi) of offshore air, surface, and sub-surface operating areas from Narragansett Bay, Rhode Island to Charlestown, South Carolina. Sailors provide air traffic control for more than 98,000 sorties per year while ensuring all operation aspects are deconflicted from more than 300 hazardous events per year, including missile exercises, unit level training, NASA rocket launches, gunnery evolution, or underwater detonation drills. In addition, the air traffic control mission includes separation of military and commercial flights along the East Coast (FACSFAC VACAPES, Fleet Area Control and Surveillance Facility, Virginia Capes 2018).

The Navy Operating Area (OPAREA) is located in the coastal and offshore waters of the western North Atlantic Ocean adjacent to Delaware, Maryland, Virginia, and North Carolina. The northernmost boundary of the VACAPES Range Complex is located 68.5 km (37 NM) off the entrance to Delaware Bay at latitude 38º45'N, the farthest point of the eastern boundary is 340.8 km (184 NM) east of Chesapeake Bay at longitude 72º41' W, and the southernmost point is 194.5 km (105 NM) southeast of Cape Hatteras, North Carolina, at latitude 39º19' N. The western boundary of the VACAPES Range Complex OPAREA lies 5.6 km (3 NM) from the shoreline at the boundary separating state and Federal waters (50 CFR §218.1). The total operational area encompasses approximately 94,875 square km (27,661 square NM) of surface waters (Virginia Capes Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) 2009). A figure showing the Project area in relationship to VACAPES, Military Training Routes (MTR) and Military Operating Areas (MOA) is provided below (Figure 16-4).

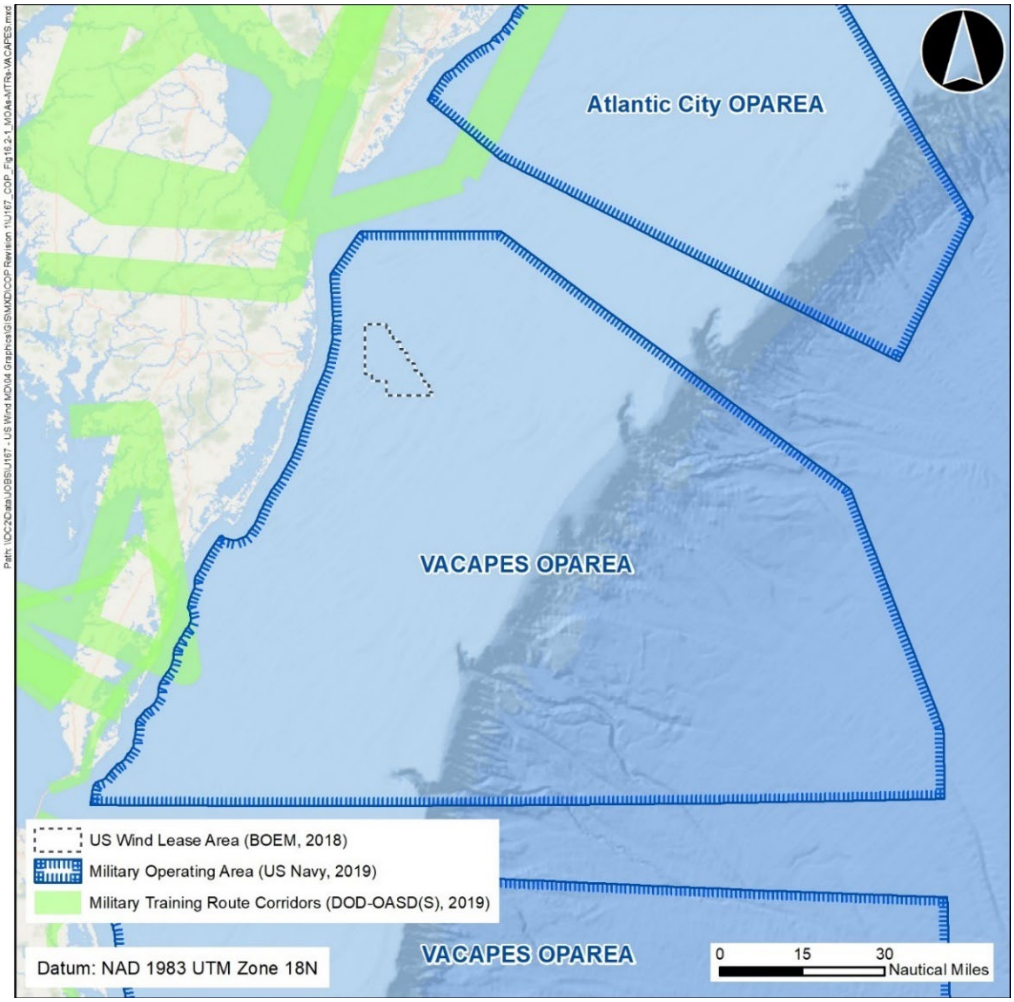

Figure 16-4. Project Relationship to VACAPES, MTRs and MOAs

US Wind has initiated consultations with U.S. Fleet Forces (USFF) N46 and Fleet Forces Atlantic Exercise Coordination Center (FFAECC) at NAS Oceana, Virginia. FFAECC coordinates all regional military/other agency activities (both sea and air) for the VACAPES Operating Area and ensures events are de-conflicted. US Wind has also sent a Request for Informal Review to the Military Aviation Assurance Siting Clearinghouse in 2020. A second Request for Informal Review sent the Clearinghouse in 2022 updated the Project Design Envelope and the potential NORAD impact was again identified. US Wind has separately consulted with NTIA and NOAA IOOS. A draft mitigation plan outline has been initiated with NOAA IOOS for high frequency radar impact mitigation/infill.

US Wind will continue to consult with Fleet Forces Command prior to any construction or decommissioning activity, regarding the location, density, and planned periods of activity, to minimize potential conflicts with DoD activities in the VACAPES OPAREA. During the US Wind survey activities conducted along the Offshore Export Cable Corridors in 2021, FFAECC requested that the G&G Contractor and survey Vessel Masters coordinate daily with FFAECC, avoid designated areas and comply with any of their requests during survey operations. As a result, US Wind is familiar with FFAECC requirements for Commercial Vessels Working in the VIRGINIA CAPES OPAREAS, will provide all Service Request Forms to FFAECC that are required prior to initiation of construction or decommissioning activities in the Lease Area, and will comply with all FFAECC directives, including any related to lighting or instrumentation, to avoid potential impacts during Project activities.

The Project is located below a variety of U.S. territorial and international airspace classifications, including some controlled and special-use airspace. The Project area is entirely within the Air Defense Identification Zone (ADIZ), in which all aircraft are subject to ready identification in the interest of national security. The majority of the Project area underlies both the Atlantic Low Control Area, which is designated as Class E controlled airspace above 518 m (1,700 ft), and the Virginia Capes Operating Area (VACAPES) “W-386,” which is a National Defense Operating Area off the mid-Atlantic coast that is used for various surface, subsurface, and air-to-surface exercises. The Obstruction Evaluation and Airspace Analysis (Appendix II-K4) includes an assessment of impacts to Military Training Routes and Military Operations Areas.

16.4 Lighting and Marking

Lighting and marking per FAA regulations regarding aviation obstruction lighting of structures and BOEM’s Lighting and Marking of Structures Supporting Renewable Energy Development (BOEM 2021b) will be installed on the WTGs, OSSs and the Met Tower. US Wind will place lighting and signage on applicable structures to aid navigation per USCG circular NVIC 01-19 Guidance on the Coast Guard’s roles and responsibilities for Offshore Renewable Energy Installations (USCG 2019) and comply with any other applicable USCG requirements. See Appendix II-K2 for the proposed Project lighting and marking scheme, subject to further review and discussion with BOEM, FAA, and USCG.

The WTGs are proposed to have aviation safety lighting consisting of two medium-intensity flashing red obstruction aviation lights atop the nacelle, four low-intensity flashing red obstruction lights mid-tower around the tower in a ring, and a helicopter hoist status light. The aviation lights will flash simultaneously at 30 flashes per minute (FPM). The structure aviation safety lights will be visible in all directions in the horizontal plane.

There will also be amber flashing navigation beacons of different intensities installed. All turbines will be marked conspicuously and distinctly for both day and night recognition. The foundation base of all turbines will be painted yellow (RAL 1023) all around from the level of Mean Higher High Water (MHHW) to 15 meters (50 feet) above MHHW. Ladders at the foundation base of all turbines will be painted in a color that contrasts with the recommended yellow for ease of identification for operations and maintenance personnel. The turbines and towers will be painted with color no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey. The amber flashing navigation lights will be energized from sunset to sunrise and from sunrise to sunset in restricted visibility. They will be visible in all directions from the horizontal.

Each WTG will be designated, marked and charted with a unique alphanumeric designation for quick recognition and reference by mariners and agencies for search and rescue, law enforcement, and other purposes. The bottom of the alphanumeric designation will be located at least 9 meters (30 feet) and no more than 15 meters (50 feet) above MHHW. They will be approximately 3 meters (10 feet) in height, will be visible above any service platforms in a 360-degree arc from the water’s surface, and will be applied with retro-reflecting paint to enhance visibility under low light conditions. Each WTG's unique alphanumeric designation will be duplicated below the service platforms.

The OSSs will each be equipped with two medium intensity flashing red obstruction aviation lights, four low-intensity flashing red obstruction lights in a ring, and a helicopter hoist status light. The aviation lights will flash simultaneously at 30 flashes per minute (FPM). The structure aviation safety lights will be visible in all directions in the horizontal. Each OSS will be marked with 6 or 10 second yellow flashing marine lanterns with 360° visibility and with a 2 NM operational range.

The Met Tower will be equipped with a white marine lanterns with an operational range of 10 NM. Perimeter structures, located on the corners or other significant peripheral points, will be marked with quick flashing yellow marine lanterns with 360° visibility and an operational range of at least 5 NM. Intermediate perimeter structures, located along the outside boundary, will be marked with 2.5-second flashing yellow marine lanterns with 360° visibility and an operational range of at least 3 NM. Inner boundary structures will be marked with 6 or 10 second yellow flashing marine lanterns with 360° visibility and with a 2 NM operational range. Lights servicing the same structure designation will be synchronized. The Met Tower lighting scheme is anticipated to be the same regardless of location (proposed location or alternate location), pending final design and USCG and other agency approvals.

Directional fog signals will be placed on alternating perimeter structures. Each device will sound a 4-second prolonged blast at intervals not to exceed 30 seconds with a range of 2 NM. Each device will be capable of Mariner Radio Activated Sound Signal activation by keying VHF radio frequency 83A 5 times within 10 seconds and continue to sound its signal for 45 minutes after VHF activation.

There will be aviation visibility meters and Mariner Radio Activated Sound Signals and marine visibility meters on perimeter structures. AIS transponders will be placed on alternating perimeter structures capable of transmitting signals marking the locations of all structures within the facility, subject to approval by the USCG.

Aircraft Detection Lighting Systems (ADLS) is planned for the Project if technically feasible, commercially available, and approved for use by FAA, BOEM, and USCG. FAA obstruction lighting on the WTGs would only illuminate when aircraft are approaching the Lease area, as described in Chapter 10 of the Marking and Lighting Advisory Circular (70/7460-1M, Nov 2020). Use of ADLS would significantly reduce the amount of time FAA obstruction lights would be lit. Capitol Air Space Group completed an Aircraft Detection Lighting System Efficacy Analysis, which is provided within Appendix II-J1, as Appendix E. Use of ADLS in the Project woud reduce nighttime FAA lighting by 99%, with the WTGs lit with obstruction FAA lights less than 6 hours in a year based on prior flight information. An FAA-approved vendor will be used to implement the ADLS for the Project, which is feasible per Chapter 10 of the updated Marking and Lighting Advisory Circular (70/7460-1M, November 2020).

16.5 Aviation

The airport closest to the Project area is the Ocean City Municipal Airport (KOXB). This non-towered airport is located approximately 17 NM (31 km) west of the Lease Area. The Salisbury-Ocean City Wicomico Regional Airport offer air service a few miles outside Snow Hill. The NASA Goddard Space Flight Center's Wallops Flight Facility (WFF) is located approximately 36 NM (67 km) from the Lease Area. NASA conducts science, technology, and educational flight projects from WFF aboard rockets, balloons, and UAV's, using the Atlantic waters for operations on almost a daily basis (USDOI and BOEM 2012).

US Wind conducted an Obstruction Evaluation and Airspace Analysis to identify potential risks associated with the placement and/or height of the WTGs, OSSs and the Met Tower, provided as Appendix II-K4. US Wind also conducted an Air Traffic Flow Analysis to determine the number of instrument flight rules operations potentially affected by the placement and/or height of the WTGs, provided as Appendix II-K6. The analysis concluded that the number of flights that could have been receiving radar vectoring services within the affected airspace is well below the threshold for a significant volume of IFR operations.

16.6 Radar

The Lease area is located within the range of a long-range radar facility at Dover Air Force Base and the WFF radar facility. Three of the four OSSs and associated WTGs are located within range of these facilities. The WFF radar facility is used to track launch and flight activities conducted by NASA and its partners. The radar may be used to track air-to-air, air-to-surface, surface-to-air, and surface-to-surface missile exercises, gunnery exercises, aircraft flights and rocket launches. When the Wallops Island radar is not in use for range support activities, it may be released to the FAA (USDOI and BOEM 2012).

The Military Aviation and Installation Assurance Siting Clearinghouse (Clearinghouse) was established in 2011 and provides a timely, transparent, and repeatable process that can evaluate potential impacts of renewable energy projects and other projects with military activities, and explore mitigation opitions, while preserving the DoD mission through collaboration with internal and external stakeholders.

The Clearinghouse formal review process applies to projects filed with the FAA obstruction evaluation process and addresses all energy projects greater than 61 meters (199 feet) above ground level, proposed for construction within military training routes or special use airspace, whether on private, state, or Federal property. All energy project proponents are encouraged to seek informal reviews as early as possible to identify potential compatibility concerns in advance.

On April 23, 2020, US Wind submitted a Request for Informal Review to the Clearinghouse. The results of the informal review indicated that ten WTGs in the northwestern portion of the Lease area were of NORAD concern. A second Request for Informal Review, submitted January 24, 2022, to the Clearinghouse updated the Project Design Envelope and the potential NORAD impact was again identified. On May 22, 2023, the FAA issued Determinations of No Hazard to Air Navigation for the WTG array. Based on issuance of the Determinations of No Hazard, no mitigation agreement with DoD is anticipated at this time.

US Wind conducted studies of potential interference of proposed WTGs with commercial air traffic control radar systems, national defense radar systems, high frequency coastal radars and weather radar systems. The proposed WTGs will be within line of sight of two Air Route Surveillance Radar and Airport Surveillance Radar locations. In addition, the proposed WTGs are within line of sight or within the instrumented range of six high frequency radar locations. The proposed WTGs are greater than 15 km (8 NM) from three navigation aid sites, and no further analysis of potential impacts was necessary. No impacts to weather radars are expected. The Radar Impact Evaluation is provided as Appendix II-K3.

16.7 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on navigation and military activities.

- US Wind commits to use aircraft detection lighting system (ADLS), or equivalent technology such as light dimming, if commercially feasible and approved by BOEM in consultation with FAA, USCG and other agencies. Use of ADLS would reduce nighttime obstruction lighting by 99% compared to not using ADLS. An FAA-approved vendor will be used to implement the ADLS for the Project, which is feasible per Chapter 10 of the updated Marking and Lighting Advisory Circular (70/7460-1M, November 2020).
- Uniform spacing of WTGs and OSSs of 1.02 NM (1.89 km) N/S and 0.77 NM (1.43 km) E/W.
- A proposed 1 NM (1.9 km) buffer zone between Project structures and the TSS outer boundary.
- Coordinate with the appropriate regulatory agencies and other stakeholders during construction to provide timely and effective communications regarding planned vessel movements and construction activities.
- Work with USCG to establish and maintain safety zones around active construction areas, and mark areas with highly visible marking and lighting.
- Bury submarine cables at least 1.8 m (6 ft) below the maintenance depth of the Indian River Bay federal navigation channel.
- Use existing transit lanes for construction and maintenance vessels to the extent practicable.
- Route Offshore Export Cable Corridors to avoid USCG proposed anchorage.
- Lighting and marking will be implemented following guidelines as practicable and in consultation with FAA, BOEM, USCG and other regulatory agencies.
- Monitor Project operations continuously and maintain Project emergency contact channels with the USCG and other relevant agencies and stakeholders.
- US Wind will work with the USCG to identify measures that may increase mariner and responder situational awareness in the vicinity of the Lease area such as cameras, distinct markings on towers, and enhanced communication connectivity.
- Develop emergency procedures for potential vessel allisions with Project structures and other maritime emergencies, such as search and rescue, in consultation (e.g., coordinated drills) with relevant agencies and stakeholders. Establish appropriate chain of command with US Coast Guard and Maryland Department of Natural Resources to respond to emergencies in a timely, efficient manner and address ongoing issues. Procedures and potential equipment packages to benefit mariners, e.g. WTG cameras or data connectivity enhancements, will be developed through stakeholder outreach.
- Meteorological and ocean observations from the Met Tower will be made available to the public.

17.0 Socioeconomics

Socioeconomic resources discussed in this section are varied, from employment and transportation infrastructure to tourism and commercial fishing. The majority of socioeconomic resources are evaluated at the county level. US Wind proposes construction vessels will primarily utilize a port in Baltimore County, Maryland, associated with the Project's staging and marshalling area, and the O&M Facility is proposed in Worcester County, Maryland. The Barrier Beach Landfalls and Interconnection Facilities are located in Sussex County, Delaware. Offshore the presence of WTGs, OSSs, and the Met Tower in the Lease area and associated submarine cables may affect activities in nearby counties. Figure 17-1 illustrates the locations of the potentially affected counties.

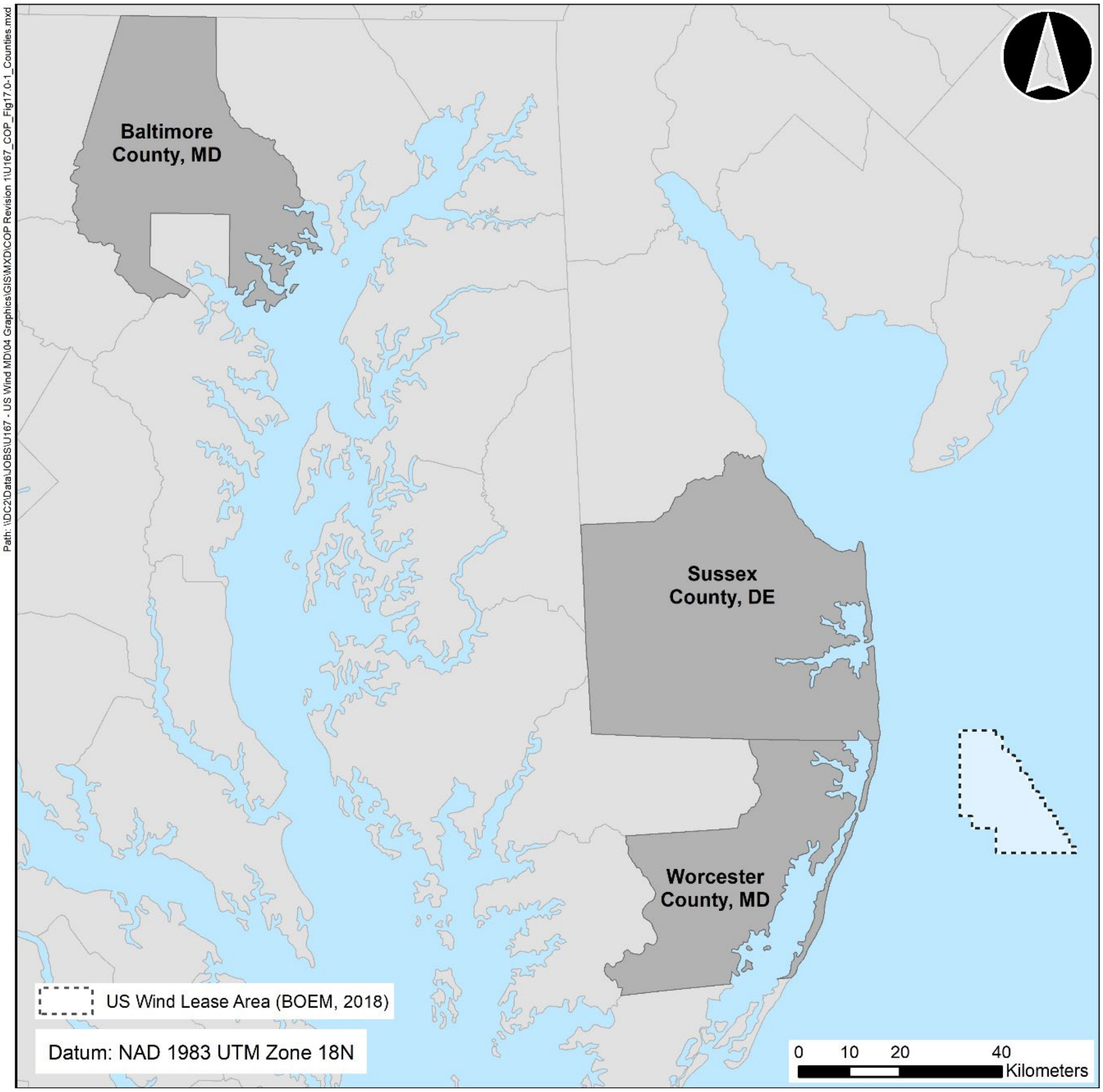

Figure 17-1. Counties potentially affected by the Project

17.1 Demographics, Economy, and Employment

17.1.1 Description of Affected Environment

This section describes the populations and economic status of the counties within the Project area. Population data are primarily derived from the U.S. Census Bureau (USCB). Industry data are primarily derived from the National Ocean Economics Program (NOEP), which reports financial data in 2012 dollars. NOEP provides statistics for the "ocean economy" (or "ocean-based industries"), comprised of industries that use ocean resources, such as marine fisheries, transportation, and offshore mining, and for all industries that conduct business in coastal counties (the "coastal economy"). Many of the statistics referenced in this section are also listed in Table 17-1.

Table 17-1. Demographic, Economic and Employment Statistics for Counties in the Project Area

Location	Estimated Population (2019)	Median Income 2015-2019	Per capita Income 2015-2019	Employment (2019)	Unemployment (2019)
Sussex County, DE	234,225	$63,162	$35,491	74,351	4,501
State of Delaware	**973,764**	**$68,287**	**$35,450**	**413,410**	**26,481**
Baltimore County, MD	827,370	$76,866	$40,105	335,413	25,391
Worcester County, MD	52,276	$63,499	$38,080	19,535	1,246
State of Maryland	**6 million**	**$84,805**	**$42,122**	**2,380,865**	**164,396**
United States	**328 million**	**$62,843**	**$34,103**	**132,989,428**	**8,713,400**
Sources: (USCB 2019a, 2019b)					

<u>Sussex County, Delaware</u>

More than 970,000 people resided in Delaware as of July of 2019. Of these people, 24% lived in Sussex County (USCB 2019a). Forty-five percent of the residents of Sussex County lived in the Inland Bays watershed, which encompasses the Barrier Beach Landfalls and Interconnection Facilities, as of 2015 (DCIB 2016). Population growth in the Inland Bays watershed accelerated in the 1990's with the population doubling between 1990 and 2010 (DCIB 2016). Sussex County's population swells significantly during the summer season, with County officials estimating that 400,000 people reside there from June through August (MacArthur 2017). At $63,162 and $68,287 respectively, the median household income in Sussex County and in the State of Delaware exceeded the nationwide median household income of $62,843 for the five-year period of 2015-2019 (USCB 2019a). Per capita income exhibits the same trend, at $35,491 in Sussex County, $35,450 in Delaware, and $34,103 nationwide (USCB 2019a).

More than 400,000 Delaware residents are employed, and approximately 74,000 of them live in Sussex County. The unemployment rate in Sussex County was lower than the national unemployment rate in 2019, at 4.3% and 5.3%, respectively. The construction industry is more significant in Sussex County than it is at the state or national level, accounting for 9.8% of the county's employment compared to 6.9% of employment in Delaware and 6.6% in the U.S. as a whole (USCB 2019b).

Between 2008 and 2018, the ocean economy employed between 5,930 and nearly 12,000 people in Sussex County. Over this 10-year period, these industries generated a minimum gross domestic product (GDP) of $307 million in 2008 and nearly $479 million in 2018. Tourism is the largest contributor, employing 97% of the people who were working in the ocean economy in Sussex County in 2018 and exceeding the combined GDP for ocean-based industries. Fisheries are a relatively small part of the county's ocean economy, employing fewer than 100 people and producing a GDP of 5 million in 2018 (NOEP 2020).

Sussex County's coastal economy employs nearly 79,000 people and generated a GDP of $10.5 billion in 2020. Manufacturing is the largest sector of the county's coastal economy, with a GDP of $2.9 billion in 2020. Construction accounted for about $634 million dollars of the 2020 coastal GDP in Sussex County (NOEP 2020).

Baltimore County, Maryland

More than 6 million people lived in Maryland as of July of 2019. More than 827,000 of these people resided in Baltimore County. At $76,866, median household income in Baltimore County between 2015 and 2019 was lower than median household income in the State of Maryland, at $84,805. Per capita income exhibits the same trend, at $40,105 in Baltimore County and $42,122 in Maryland. Median and per capita income exceeded nationwide values in both geographies for 2015-2019 (USCB 2019a).

More than 2 million Maryland residents are employed, and approximately 330,000 of them live in Baltimore County. Unemployment rates in both Baltimore County and the State of Maryland were lower than national unemployment rates in 2019, at 4.8% and 5.1%, respectively.

In Baltimore County, the ocean economy has been relatively steady since 2008. Tourism and recreation also dominate the ocean economy, employing more than 5,000 people and producing a GDP exceeding $173 million in 2018. With a workforce exceeding 600 people and a GDP of $42 million in 2018, transportation is another important sector in the ocean-based economy of Baltimore County. The ocean-based construction industry is about a third as large as the transportation industry, employing less than 200 people and generating a GDP of $13 million in 2018 (NOEP 2020).

The coastal economy of Baltimore County is dominated by the financial sector, which employed more than 28,000 people and produced a GDP exceeding $20 billion in 2020. At a GDP of $5.2 billion, education and health services offered the most jobs in 2020, employing more than 93,000 people. The construction industry employed less than 24,000 people and produced a GDP of $3.0 billion during the same time (NOEP 2020).

Worcester County, Maryland

Although more than 6 million people lived in Maryland as of July of 2019, only 52,276 lived in Worcester County. While Ocean City's population mushrooms to over 300,000 people in the summer, its full-time residents number just under 7,000 people (Britannica ; Maryland Demographics). Still, among the County's four incorporated towns, it holds the highest number of full-time residents. It remains the County's only coastal municipality.

At $63,499, median household income in Worcester County between 2015 and 2019 was lower than median household income in the State of Maryland, at $84,805. Per capita income exhibits the same trend, at $35,450 in Worcester County and $42,122 in Maryland. Median and per capita income exceeded nationwide values in both geographies for 2015-2019 (USCB 2019a).

Nevertheless, Worcester, along with Talbot County, are two of the wealthiest counties on Maryland's Eastern Shore with Worcester County having a school system renowned as the best in the state (Federal Reserve Bank of St. Louis).

More than 2 million Maryland residents are employed, and nearly 20,000 of them live in Worcester County. In 2019, the unemployment rate in Worcester County was below state and national unemployment rates at 4.9%. An important part of this county's employment equation is the preponderance of tourism-related jobs during the bustling summer months when the county's unemployment rate is at its lowest (U.S. Bureau of Labor Statistics 2022). Locals often take advantage of this, tolerating long summer hours in exchange for equally long winter "vacations" November through March.

Ocean-based industries in Worcester County experienced steady growth between 2008 and 2018. Tourism and recreation dominate the County's ocean economy, contributing more than $411 million in GDP and employing almost 8,000 people in 2018. Ocean City is not the only driver. An important part of the tourism numbers derive from the County's nature and heritage tourism draw with many campgrounds nestled within Worcester's more than 100,000 acres of permanently protected land (M.D.o.N.R. MDDNR 2022b). More than 1 million people visit Assateague Island National Seashore every year (N.P.S. NPS 2022). Assateague State Park and Pocomoke River State Park are also significant drivers of this brand of tourism.

Moreover, according to USDA, Worcester County agriculture, in the form of crops and forestry produced just under $85 million in income. The construction industry also produced a GDP of more than two million dollars in 2018 and generated more than 1,000 jobs but a GDP of only $91 million in 2020 (NOEP 2020).

Employing more than 7,000 people and generating a GDP of $471 million in 2020, leisure and hospitality dominates Worcester County's coastal economy. The financial industry and trade, transportation, and utilities also contributed GDP in excess of $717 million in 2020. The financial industry employed about 1,100 people, whereas trade, transportation, and utilities offered nearly four times as many jobs.

17.1.2 Impacts

The discussion of impacts on the demographics, economy, and employment in the Project area below uses the economic impact assessment, found in Appendix II-L1.

The assessment used Impact Analysis for Planning (IMPLAN), a predictive model that uses matrices to relate the performance of economic variables for 546 industries (as of completion of the modeling exercise for this Project) for national, state, and county geographies. The Project was modeled under two scenarios over a 7-year fabrication, construction and commissioning timeframe, Scenario 1 is based on using 114 WTGs of the 220 m rotor diameter platform (14.7 MW), and Scenario 2 is based on the PDE maximum with 121 WTGs of the 250 m rotor diameter platform (18 MW). In both scenarios the WTGs are on monopile foundations. The scenarios were modeled with a constant 2021 value, based on a "bill-of-goods" approach to expenditures and labor involved in procurement, installation, and administration during construction. The results of this modeling were in the form of direct, indirect, and induced economic impacts of the Project in the form of, respectively, jobs created due to local operations and spending, jobs created by suppliers, and jobs created due to increased local income and spending as part of construction of the Project.

17.1.2.1 Construction

It is not anticipated that construction will negatively impact the population of the Project area. The onshore components, the Barrier Beach Landfalls and Interconnection Facilities, are not proposed in residential areas and interference with the operations of existing business enterprises would be temporary. The Project is expected to bring new economic and employment opportunities to the Project area.

According to the IMPLAN modeling results, the direct economic impacts of the Project would be driven by expenditures on labor, materials, and equipment used for construction. Scenario 1 of the IMPLAN results tallies the total economic impact for Maryland during the construction phase of the Project. Over the course of the entire construction period, it is estimated that the Project will create the equivalent of 16,780 job years[17] (direct, indirect, and induced) associated with new business activity in Maryland with total sales effects valued at $3.44 billion for the state (see Table 17-2 and 17-3).

Table 17-2. Scenario 1 Construction Activities Impact on Maryland's Economy

Impact	All Years
Jobs (in job years)	**16,783**
Sales (Million 2021$)	**$3,440.1**
State and County (all counties) Tax Revenue (Million 2021$)	**$147.2**
Labor Income (Million 2021$)	**$1,246.9**
Value Added/Gross Regional Product (Million 2021$)	**$1,918.9**

Table 17-3. Scenario 2 Construction Activities Impact on Maryland's Economy

Impact	All Years
Jobs (in job years)	**18,717**
Sales (Million 2021$)	**$3861.5**
State and County Tax Revenue (Million 2021$)	**$162.8**
Labor Income (Million 2021$)	**$1,386.1**
Value Added/Gross Regional Product (Million 2021$)	**$2,127.5**

The Project presents an opportunity for the region, and Maryland in particular, to benefit from the economic activity related to the creation of a new industry. US Wind is focused on building out a local supply chain to benefit the Project and the broader U.S. offshore wind industry. US Wind believes that a diverse, well-compensated, and well-trained workforce delivers a higher-quality product and service, which is why US Wind is committed to creating full and equitable business opportunities for minority, women-owned, veteran-owned, and HUBZone businesses in the development of the Project. In November 2021, US Wind was awarded the "Best Practices Award" by the Maryland Minority Contractors Association for the company's work to maximize minority business enterprise (MBE) participation in the Project. Additionally, US Wind signed agreements

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[17] One job year is equivalent to one job for one year.

with organized labor such as United Steelworkers, Baltimore-DC Building and Construction Trades, and the International Brotherhood of Electrical Workers, to support union engagement with offshore wind in the region.

US Wind has engaged in good-faith consultations with the Maryland Governor's Office of Small, Minority & Women Business Affairs (GOSBA) and the Office of the Attorney General (AG's Office) for establishing a clear plan for MBE participation goals and procedures. These consultative efforts with GOSBA and the Maryland Attorney General's Office resulted in the establishment of US Wind's 2022 MBE Supplier Diversity Business Development and Local Content Policy, which will optimize US Wind's efforts to implement the MBE 15% goal.

US Wind continued educational engagement efforts, primarily focused towards ongoing partnerships with Baltimore City Public Schools. The successful completion of the KidWind Challenge – a national competition helping educators and students explore renewable energy – resulted in 1st, 2nd, and 3rd place winnings by Mergenthaler Vocational Technical High School during the state rounds. US Wind participated in recent Seagoing PAC meetings for Baltimore City Public Schools. Furthermore, connections were made with Coppin State University and Wor-Wic Community College representatives regarding the development of offshore wind manufacturing training.

US Wind continues to make visibility efforts by discussing projects and broadcasting upcoming opportunities within the MBE community to encourage diverse bidding. Recently efforts have included delivering company-sponsored presentations at the Baltimore President's Roundtable and at the Turner Station Conservation Team community meeting and exhibiting at the Maryland Washington Minority Companies Association 20th Annual 2023 Spring Breakfast Meeting/Business Showcase Expo.

US Wind also routinely participated in community outreach events with a variety of organizations including Prince George's County Legislative Wrap Up 2023; Capital Region Minority Supplier Development Council MBE Input Committee Annual Breakfast; Southern Maryland Minority Chamber of Commerce; Prince George Chamber of Commerce Coffee Connections; Lower Shore Workforce Alliance Offshore Wind Workforce Roundtable; Bi-County Business Roundtable Breakfast; and Prince George's Office of Central Services Supplier Development & Diversity Division Small Business meeting.

17.1.2.2 Operations

It is anticipated that the operations and maintenance of the Project will positively impact the population of the Project area. Analysis of potential jobs and spending during operations of the Project is included in Appendix II-L1 and shows this impact to the region and to Maryland once the Project is operational (see Tables 17-4 and 17-5).

Table 17-4. Scenario 1 O&M Impact on Maryland's Economy

Impact	All Years
Jobs (in job years)	**2,936**
Sales (Million 2021$)	**$2,163.0**
Labor Income (Million 2021$)	**$1,103.6**
Value Added/Gross Regional Product (Million 2021$)	**$1,371.3**

Table 17-5. Scenario 2 O&M Activities Impact on Maryland's Economy

Impact	All Years
Jobs (in job years)	**3,702**
Sales (Million 2021$)	**$2,721.7**
Labor Income (Million 2021$)	**$1,389.4**
Value Added/Gross Regional Product (Million 2021$)	**$1,725.6**

17.1.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Decommissioning impacts are expected to be similar to construction impacts. Decommissioning is expected to have a positive short-term impact on the economy and employment in the Project area, but a negative long-term impact, as decommissioning the Project constitutes the loss of economic and employment opportunities gained during Project operations.

17.2 Land Use and Coastal Transportation Infrastructure

17.2.1 Description of Affected Environment

Sussex County, Delaware

Land use in Sussex County is described in Table 17-6. Nearly half of Sussex County remains in its natural condition. Most of the county is open water (22%), with very little development (13%). Wetlands and forests comprise approximately 30% of the remaining land cover (19% and 12%, respectively). Nearly one third of the land cover within Sussex County is used for agricultural purposes (33%) (MRLC 2021), but this is changing as increasing amounts of historic farm land is being developed for housing. Between 2008 and 2015, over 10,000 building permits were issued for over 12,000 residential units. According to the County Planning and Zoning Department, the average density of new development has been approximately 1.9 dwelling units per acre in rural areas. As a result, land acreage is being consumed rapidly, particularly in rural areas since the average density is lower in these areas growth areas (Sussex County Planning and Zoning Commission 2018).

Table 17-6. Land Use in Sussex County, 2019

Sussex County Land Use Category (NLCD 2019)	Acres	%
Barren Land (Rock/Sand/Clay)	2,822	0.4%
Cultivated Crops	253,043	33.1%
Deciduous Forest	15,622	2.0%
Developed, High Intensity	5,050	0.7%
Developed, Low Intensity	31,328	4.1%
Developed, Medium Intensity	19,354	2.5%
Developed, Open Space	43,123	5.6%

Table 17-6. Land Use in Sussex County, 2019

Sussex County Land Use Category (NLCD 2019)	Acres	%
Emergent Herbaceous Wetlands	22,035	2.9%
Evergreen Forest	36,691	4.8%
Grassland/Herbaceous	1,626	0.2%
Mixed Forest	36,678	4.8%
Open Water	169,082	22.1%
Pasture/Hay	1,626	0.2%
Shrub/Scrub	3,136	0.4%
Woody Wetlands	124,019	16.2%
Grand Total	765,235	100.0%
Source: (MRLC 2021)		

The Delaware Inland Bays are framed by Interstate Route 9 to the north and Interstate Route 113 to the west. The barrier beach on either side of the Indian River Inlet is conserved as state parklands as part of Delaware Seashore State Park. State Route 1 (Coastal Highway) connects the north and south banks of the inlet via the Charles W. Cullen Bridge, a concrete bridge consisting of a 290 m (950 ft) cable-stayed center span flanked by 130 m (425 ft) approach units (E. Nelson 2012). It is the fifth bridge built to span the inlet in a 60-year period (E. Nelson 2012). Extreme tides and storm surge make the inlet vulnerable to erosion and scour. The banks of the inlet were armored in 1939 to defend against erosion (DNREC 2019).

A number of public transportation systems serve Sussex County. Nine public bus routes run throughout Sussex County, with four additional routes providing transit between counties (DART 2018). However, all of the bus routes are either inland or north of the Interconnection Facilities. The Jolly Trolley operates immediately north of the Interconnection Facilities, transporting passengers between Rehoboth Beach and Delaware Seashore State Park daily between Memorial Day and Labor Day (Jolly Trolley 2019). Further north, the Cape May-Lewes Ferry transports passengers between Delaware and New Jersey across Delaware Bay. Ferry service operates year-round and accommodates commuters, tourists, and special events (Cape May-Lewes Ferry 2019).

The installation of any upland onshore export cables to reach the Interconnection Facilities may impact public transportation systems in Sussex County. These impacts may result in the temporary cessation of services during construction and the rerouting of traffic to account for road closures. This may reduce access to local businesses in the area. Once the cables have been installed, public transportation services and traffic patterns will resume to the same operations as pre-construction.

Sussex County and local municipalities are undertaking projects to accommodate significant growth in the county, up 20.4 percent from 2010 to 2020[18]. New infrastructure and new traffic patterns, resulting from growth in the region, are planned during the potential period of

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[18] https://www.census.gov/quickfacts/fact/table/sussexcountydelaware/PST045222

construction, specifically outside of the peak recreation season, which is the same window of construction for US Wind. US Wind's construction activities have the potential to directly overlap with infrastructure construction and require overhaul or repair of recently installed projects. Announced planned projects along specific routes include:

- Onshore Export Cable Corridor 1a and 1b: sidewalk construction on Fred Hudson Road, sewer line and pump station installation on Vines Creek Road, and intersection improvement at State Route 26 and Falling Point Road.
- Onshore Export Cable Corridor 2: Pedestrian improvement projects in the Dewey Beach area in 2027-2028, intersection upgrades and road extension from Airport Road to State Route 24, and intersection improvements with turn lanes, bike paths, and pedestrian infrastructure at State Route 24 and Warrington Road.

Baltimore County, Maryland

Land use in Baltimore County is described in Table 17-7. The predominant land use in Baltimore County is forest (33%); however, developed land occupies nearly the same area (33%). Agriculture accounts for approximately 19% of land use in Baltimore County. Grasslands and shrublands, wetlands, and open water each represent approximately 3% of land in the County. Baltimore County also contains significant industrially-zoned land.

Table 17-7. Land Use in Baltimore County, 2019

Baltimore County Land Use Category (NLCD 2019)	Acres	%
Barren Land (Rock/Sand/Clay)	1,062	0.2%
Cultivated Crops	35,693	8.2%
Deciduous Forest	122,682	28.1%
Developed, High Intensity	11,053	2.5%
Developed, Low Intensity	41,530	9.5%
Developed, Medium Intensity	28,602	6.6%
Developed, Open Space	61,978	14.2%
Emergent Herbaceous Wetlands	2,432	0.6%
Evergreen Forest	1,984	0.5%
Grassland/Herbaceous	1,530	0.4%
Mixed Forest	17,613	4.0%
Open Water	52,890	12.1%
Pasture/Hay	48,870	11.2%

Table 17-7. Land Use in Baltimore County, 2019

Baltimore County Land Use Category (NLCD 2019)	Acres	%
Shrub/Scrub	1,670	0.4%
Woody Wetlands	6,893	1.6%
Grand Total	436,480	100.0%

Tradepoint Atlantic is a 3,300-acre property available for industrial development. Once the site of the world's largest iron and steel making facility, this parcel of land is currently available for industrial, marine, rail, and open land development. Since the emergence of Tradepoint Atlantic in 2014, over 10,000 new and permanent jobs have been created (Tradepoint Atlantic 2019).

The site is marketed as the largest, multi-modal industrial complex available for development on the east coast, as well as the largest on the Baltimore/Washington market. To date, 9.3 million square feet of distribution, warehousing and industrial facilities have been leased and developed at Tradepoint Atlantic, with potential to develop an additional 7 million square feet of Class A industrial development. The marine terminal within the Port of Baltimore has a 15-meter (50-foot) main channel, with four, 670-meter (2,200 linear feet) berths and an access channel ranging from 11 to 12 meters (36 to 41 feet). It is also directly accessible by major highways, such as I-695, I-95, and I-70, and by rail, with direct connections to CSX and Norfolk Southern (Tradepoint Atlantic 2019).

The proximity to 16 designated offshore lease areas, coupled with the multi-modal transportation resources at this site, allows Tradepoint Atlantic to be highly advantageous for offshore wind development, specifically the manufacture and assembly of foundation components. Basing staging, fabrication, and assembly activities at this location streamlines the construction phase and financially benefits Baltimore County.

Worcester County, Maryland

Worcester County is the easternmost county in Maryland and encompasses all of the state's oceanfront, from Delaware to the north to Virginia to the south. Land use in Worcester County is described in Table 17-8. The County's low elevation, coastal position, and restrictive zoning make forest, wetlands, and agriculture the predominant land use. Some 33% of the County is open water, while developed land accounts for nearly 7% of land use. On its entire oceanside flank, lie the barrier islands of Ocean City and Assateague, the county's main tourism drivers. Some 22 miles of the county's coast is Assateague Island and the northern 10 miles encompass Ocean City. The islands are separated by the Ocean City Inlet.

Table 17-8. Land Use in Worcester County, 2019

Worcester County Land Use Category (NLCD 2019)	Acres	%
Barren Land (Rock/Sand/Clay)	3,450	0.8%
Cultivated Crops	86,246	19.4%
Deciduous Forest	2,259	0.5%

Table 17-8. Land Use in Worcester County, 2019

Worcester County Land Use Category (NLCD 2019)	Acres	%
Developed, High Intensity	2,701	0.6%
Developed, Low Intensity	6,957	1.6%
Developed, Medium Intensity	4,518	1.0%
Developed, Open Space	14,675	3.3%
Emergent Herbaceous Wetlands	16,934	3.8%
Evergreen Forest	24,749	5.6%
Grassland/Herbaceous	563	0.1%
Mixed Forest	12,160	2.7%
Open Water	144,691	32.5%
Pasture/Hay	928	0.2%
Shrub/Scrub	1,190	0.3%
Woody Wetlands	122,630	27.6%
Grand Total	444,653	100.0%

U.S. Routes 13, 50, and 113 provide the primary land-based access in and out of Worcester County. More than 70 trucking establishments utilize these routes. The Bay Coast Railroad, Maryland & Delaware Railroad, and the Norfolk Southern Railway also serve Worcester County. The small Ocean City Municipal Airport and the larger Salisbury-Ocean City Wicomico Regional Airport offer air service a few miles outside of Ocean City and Snow Hill, respectively.

The Pocomoke River is navigable and offers inland access from the Chesapeake Bay, although the river is predominantly used by boaters and paddlers who access the water bodies via numerous up-river boat ramps. The Ocean City Inlet allows ocean-going vessels to access marinas in Ocean City and West Ocean City. Bayside marinas offer hundreds of boat slips with access to power hook-ups and fueling stations approximately 0.4 km (0.25 mi) from the Atlantic Ocean.

Berlin, Newark, Ocean City, Ocean Pines, Pocomoke City, Snow Hill, and West Ocean City have municipal water and sewer systems, although Ocean City, Berlin, Snow Hill, and Pocomoke City are the County's only incorporated towns. Nine utility providers supply either electricity, natural gas, or telecommunications services to communities in Worcester County (Worcester County Department of Economic Development 2019).

17.2.2 Impacts

17.2.2.1 Construction

Barrier Beach Landfall locations have been chosen to avoid impacts to sensitive coastal areas. Because the transition vaults at the Barrier Beach Landfalls will be buried underground in previously disturbed areas and landfalls will utilize HDD, this portion of the Project will have a negligible impact on land use. Upon completion of the HDD operations, the proposed landfall location at the 3 R's Beach or Tower Road parking lot in Delaware will be restored to pre-construction grade and conditions. No Barrier Beach Landfall locations are anticipated in Maryland.

Installation of up to four export cables in the optional land-based routes (Onshore Export Cable Corridors 1a, 1b, 1c, and 2) to reach the Interconnection Facilities would result in significant temporary disruption along roads and statewide bike routes in Sussex County, Delaware, and may affect ongoing infrastructure projects undertaken by the Delaware Department of Transportation and others. Road closures would be necessary during construction along any of the routes, resulting in rerouting and temporary access impacts to commercial, residential, and municipal properties such as schools, hospitals, recreation centers, and religious centers along all of the routes. Construction would be planned outside of the recreational season (mid-May through mid-September) and would therefore primarily affect residents and businesspeople in the area, as well as tourists and recreational traffic to a lesser extent.

Installation of land-based cables in existing ROWs also has the potential to interfere with recent and future infrastructure upgrades, such as new sewer lines, pumping stations, road and sidewalk improvements, by necessitating the rebuilding or potentially the delay of upgrade projects. The presence of export cables in existing ROWs would also preclude or limit future expansion projects due to the space required for US Wind's export cables in the ROWs.

Construction of the substations at the proposed Interconnection Facilities will convert open space into impervious surface but will have a minimal impact on land use. No new port or dock facilities are proposed to be constructed as part of the Project. If no alternative exists, US Wind may construct a new administrative building or quayside access.

It is not anticipated that any coastal transportation systems will be interrupted during construction due to a lack of geographic overlap between construction sites and transit locations. It is expected that construction barges will avoid conflicts with ferries because the ferries follow established schedules and routes and construction activities would be coordinated with the USCG and Notices to Mariners issued to inform the maritime interests of anticipated work activities and schedules. Construction activities would result in approximately 1,000 round trips by vessels (See Volume I, Section 3.1 for the proposed ports involved in construction). Onshore, US Wind will work with local officials to develop a traffic management plan to reduce impacts to local traffic during construction. Onshore cable routes, if pursued, would follow existing, previously disturbed utility or roadway Rights-of-Way.

17.2.2.2 Operations

It is anticipated that the O&M of the Project will have negligible impacts on land use and coastal infrastructure with location of export cables in Onshore Export Cable South Corridor.

If any of the land-based cable corridors are selected in existing ROWs, O&M of the cables has the potential to cause significant disruption to existing utility lines in the ROWs, and O&M of existing utilities in the ROW has the potential to negatively impact US Wind's export cables.

Project operations are projected to require approximately 2,500 round trips out of Ocean City over the estimated 25-year lifetime of the Project (Appendix II-C1). Existing port facilities and infrastructure are anticipated to be used; it is not expected that new infrastructure will be built

(See Volume I, Section 3.1 for the proposed ports involved in operations). Routine and non-routine maintenance will be addressed promptly, and only the portion of the Project area that pertains to the affected components would be impacted.

17.2.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Decommissioning impacts are expected to be similar to construction impacts.

17.3 Recreation and Tourism

17.3.1 Description of Affected Environment

This section describes the recreational resources and tourist activities that occur in the Project area. Recreational fishing is discussed in Volume II, Section 17.5.

Sussex County, Delaware

Delaware's Sussex County has 42 km (26 mi) of Atlantic Ocean coastline. Shorefronts in this area include 21 beaches, and a diversity of natural and developed landscapes that host substantial recreation, particularly in connection with marine fishing and beach-related activities (ICF Incorporated L.L.C. 2012). It is estimated that the population of the Inland Bays watershed more than doubles during the summer tourist season (DCIB 2016).

Delaware Seashore State Park follows the Atlantic coast for about 8 km (5 mi) north of the Indian River Inlet and more than 1.6 km (1 mi) south of the inlet. Cyclists may use the Charles W. Cullen Bridge to travel between parklands on either side of the inlet. There are campgrounds on either side of the inlet. The Burton Island Nature Preserve on the bay side of the barrier island features a walking path through coastal salt marsh. The Burton Island Nature Preserve is used for birding and for leading guided walks (DNREC 2019).

Delaware Seashore State Park has two ocean swimming beaches and a surfing area. A sand sculpting contest is held annually in July on the South Inlet beach (DNREC 2019). Swimming is allowed at the beach from May to September (Swim Guide 2019). Clamming and crabbing are only permitted in limited areas of the park, but fishermen pursuing finfish frequent the ocean beaches and the banks of the inlet. The Indian River Marina, located on the north side of the inlet, is open year-round and offers a boat ramp, dock space, and charter fishing trips. Canoes, kayaks, and sailboats use non-motorized boat launches north of the inlet on Rehoboth Bay (DNREC 2019).

As discussed above in Volume II, Section 17.1, tourism and recreation are critical to the economy of Sussex County. In 2018, tourism accounted for 95% of the GDP and provided 97% of the jobs in the County's ocean economy (NOEP 2020). The coastal towns, including Rehoboth Beach, Dewey Beach, Bethany Beach, South Bethany Beach, and Fenwick Island are all heavily dependent on revenues from tourism and real estate sale transfer taxes.

Baltimore County, Maryland

Both local residents and tourists frequent Maryland's coastline and beaches for swimming, boating, fishing, and sunbathing. Seven state parks in Baltimore County feature boat launches with access to Chesapeake Bay (Baltimore County Department of Recreation and Parks 2018).

Ramps are open daily year-round. Many of the state parks have areas for walking and picnicking, but the Marshy Point Nature Center is one of the more expansive facilities with its educational exhibits, hiking trails, and a canoe launch (Baltimore County Department of Recreation and Parks 2018). The Baltimore County Sailing Center also teaches students of all ages how to sail on the bay (Baltimore County Department of Recreation and Parks 2018).

As mentioned in the discussion of economy and employment in Volume II, Section 17.1, tourism and recreation play a large part in the ocean and coastal economies of Baltimore County. In 2018, tourism employed more than 5,000 people and generated a GDP exceeding $209 million for the County's ocean economy. In 2020, the leisure and hospitality industry provided nearly 27,000 jobs and a GDP of $2 billion in the County's coastal economy (NOEP 2020).

Worcester County, Maryland

As mentioned in the discussion of economy and employment in Volume II, Section 17.1, tourist and recreational activities in Worcester County have significant economic value. Ocean City and the County's ocean economy employed nearly 8,000 people in tourism in 2018, which generated a GDP of about $497 million. Similarly in 2020, the leisure and hospitality industry employed over 7,000 people and created a GDP of $471 million of the County's coastal economy (NOEP 2020).

Worcester County oversees 13 public parks that are open year-round. The County also enjoys over 70,000 acres of state and federal land which along with private enterprises boast thousands of campsites (MDDNR 2022b). There are fifteen public boat launches in the County, and some of the parks have piers that visitors can use for fishing or crabbing. Water trails, hiking paths, and boardwalks make parklands accessible to residents and visitors of all abilities and interests.

The County is particularly popular with birdwatchers because many migratory species pass through Worcester County enroute to their summer or winter grounds. Assateague Island, known for its highly-rated State Park and National Seashore, is also located in Worcester County (Worcester County 2018). Assateague State Park is the most visited state park in Maryland (MDDNR 2022a).

17.3.2 Impacts

17.3.2.1 Construction

Impacts to recreation in the Project area will be moderate during construction, but short-term in nature. The Barrier Beach Landfalls in Delaware at the proposed 3 R's Beach or Tower Road parking lots will be inaccessible while HDD operations for the landfalls are active. Off-season beachgoers who would typically drive to these locations in the Delaware Seashore State Park will have to temporarily find alternate parking, use alternate transportation, or, most likely, use an alternate beach. Potential beachgoers in this area range from surfers and swimmers to fishermen and beachcombers. No work will be conducted between Memorial Day and Labor Day.

Construction vessel traffic may also impact recreation and tourism in the Project area. Recreational boaters may experience limited access to parts of the near-shore Indian River Bay and minor travel delays due to conflicts with construction vessels. These are routine impacts that can occur between any two vessels while at sea and are generally nothing more than inconveniences. The visual and auditory effects of increased vessel traffic in the Project area can also impact the aesthetic value of the landscape for recreationalists and tourists. Visual impacts of the Project are discussed in greater detail in Appendix II-J1.

A joint study by the Delaware Sea Grant College Program and the Delaware Center for the Inland Bays determined that improvements in water quality within the Inland Bays (including Indian River Bay) have the potential to increase economic contributions (Hauser and Bason 2022). These include increased property values for waterfront homes and homes close to the water, increase in associated real estate economic contributions (including jobs), and an increase in outdoor recreation (Hauser and Bason 2022). US Wind would avoid impacts to water quality and therefore its potential economic contributions through the time of year restrictions outlined in Section 4.3.

Based on the proposed Project schedule, impacts to recreation will be short-term and have no long-term impacts. US Wind proposes concentrating construction activities for land-based onshore export cables and at Barrier Beach Landfalls outside of the summer recreation season (Memorial Day to Labor Day) to minimize negative impacts.

17.3.2.2 Operations

Routine Project operations will have a negligible impact on recreation and tourism. Maintenance activities are expected to occur on a routine basis. Any emergency maintenance that is required will be addressed promptly, and only the portion of the Project area that pertains to the affected infrastructure would be impacted. Few, if any, recreators are expected to forego a trip to a particular location due to occasional increases in boat traffic or similar potential indirect impacts associated with maintenance activities (USDOI and MMS 2007).

A review of current literature related to offshore wind’s impact on tourism along the East Coast of the United States indicated that it would likely be positive. A study of the only operating offshore wind project in the US found that Block Island, Rhode Island’s vacation rental market shows a significant increase in nightly reservations, occupancy rates and monthly revenue during peak-tourism months after construction of the Block Island Wind Farm. These results aligned with other indications of increased tourism activity for the Block Island Ferry, local for-hire fishing boats and helicopter charters (Carr-Harris and Lang 2019).

A survey was conducted of potential beachgoers along the East Coast to evaluate their reactions to potential wind power projects located at distances ranging from 4 to 32 km (2.5 to 20 mi) offshore. The majority of respondents indicated that their beach experience would not be affected by offshore wind projects. This stated preference survey suggests that for an offshore wind power project near shore (closer than 12 km (7.5 mi)) effects may be negative in economic terms while at further distances (20 – 30 km (12.5 – 20 mi)) there may be a net positive gain (G. Parsons and Firestone 2018).

In September 2017, The Sarah T. Hughes Field Politics Center at Goucher College conducted a poll of 671 Maryland residents. The residents were asked if seeing WTGs on the horizon from the beach of Ocean City, Maryland would make them more or less likely to vacation in Ocean City. The majority of respondents (75%) indicated that the visibility of WTGs would make no difference in vacation plans, 11% were less likely to vacation in Ocean City and 12% were more likely (Goucher Poll 2017).

Generally, the more recent relevant literature suggests that the majority of tourism activity in the area of the Project would be unaffected and that any negative impacts associated with the Project will be offset by positive increases in tourist activity by providing a new tourist attraction for people who would like to see the WTGs once they are operational.

17.3.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Decommissioning impacts are expected to be similar to construction impacts.

17.4 Environmental Justice

17.4.1 Description of Affected Environment

Executive Order 12898 instructs federal agencies to consider environmental justice issues in all agency decisions. It directs each federal agency to identify and address disproportionately high and adverse human health or environmental effects of the agency programs or actions on minority and low-income populations and populations that depend on fish and wildlife for subsistence. Low-income and minority communities are most vulnerable to environmental justice issues. Often these communities do not have an organized community group that can serve as a point of contact. Additionally, these communities may house a disproportionate amount of polluting facilities putting residents at a much higher risk for health problems from environmental exposures (MDE 2016b). The environmental justice characteristics of counties in the Project area are discussed below (Table 17-9).

Table 17-9. Environmental Justice Characteristics of the Project Area, 2021

Location	Location Type	Poverty Rate (%)	Minority Percentage (%)
Kent County	Visually Impacted	13.0%	35.7%
Sussex County	Visually Impacted, Port City, Landfall, Corridor, Substation	11.0%	16.8%
State of Delaware	**--**	**11.6%**	**31.6%**
Baltimore County	Port City	8.9%	41.2%
Wicomico County	Visually Impacted	14.2%	34.5%
Worcester County	Visually Impacted, Port City	11.7%	16.6%
State of Maryland	**--**	**10.3%**	**42.2%**
Cape May County	Visually Impacted	9.6%	8.3%
Cumberland County	Port City	13.1%	28.9%
State of New Jersey	--	10.2%	28.9%
Accomack County	Visually Impacted	17.6%	32.1%
Newport News City County	Port City (Hampton Roads)	14.5%	52.4
Norfolk City County	Port City (Hampton Roads)	17.6%	50.4%
Northampton County	Port City (Hampton Roads)	16.2%	35.9%
Portsmouth County	Port City	15.7%	61.1%
State of Virginia	**--**	**10.2%**	**31.2%**

Table 17-9. Environmental Justice Characteristics of the Project Area, 2021

Location	Location Type	Poverty Rate (%)	Minority Percentage (%)
United States	**--**	**11.6%**	**24.2%**

Kent County, Delaware

The poverty rate in Kent County, 13.0% in 2021, is more than the state poverty rate of 11.6% and the national poverty rate of 11.6%. The percentage of the population representing minority groups in Kent County in 2021, 35.7%, was also more than the percentage of the population representing minority groups in the state (31.6%) and the nation (24.2%) (USCB 2019b).

Sussex County, Delaware

The poverty rate in Sussex County was 11.0% in 2021, less than both the state and the national poverty rate. The percentage of the population representing minority groups in Sussex County in 2021, 16.8%, was also less than the percentage of the population representing minority groups in the state and the nation (USCB 2019a).

Baltimore County, Maryland

The poverty rate in Baltimore County, 8.9%, is less than the state poverty rate of 10.3% and the national poverty rate. The percentage of the population of Baltimore County that represented minority groups was 41.2% in 2021, which was less than the state-wide percentage of 42.2%, but greater than the nationwide percentage (USCB 2019a).

Wicomico County, Maryland

The poverty rate in Wicomico County was 14.2% in 2021, more than the state and national poverty rate. The percentage of the population representing minority groups in Wicomico County in 2021, 34.5%, was less than the percentage of the population representing minority groups in the state but greater than the nationwide percentage (USCB 2019b).

Worcester County, Maryland

At 11.7%, the poverty rate in Worcester County was more than both the statewide poverty rate and the national poverty rate. The percentage of the population of Worcester County representing minority groups is only 16.6%, lower than both the state-wide and nationwide percentages (USCB 2019a).

Cape May County, New Jersey

The poverty rate in Cape May County, 9.6%, is less than the state poverty rate of 10.2% and the national poverty rate. The percentage of the population of Cape May County that represented minority groups was 8.3% in 2021, which was less than the state-wide percentage of 28.9% and the nationwide percentage (USCB 2019b).

Cumberland County, New Jersey

The poverty rate in Cumberland County, 13.1%, is more than the state poverty rate of 10.2% and the national poverty rate. The percentage of the population of Cumberland County that represented minority groups was 28.9% in 2021, which was the state-wide percentage and more than the nationwide percentage (USCB 2019b).

Accomack County, Virginia

The poverty rate in Accomack County was 17.6% in 2021, more than both the state and national poverty rate. The percentage of the population of Accomack County representing minority groups was 32.2%, greater than the state and national percentage of minority groups (USCB 2019b).

Newport News City County, Virginia

The poverty rate in Newport News City County was 14.5% in 2021, more than both the state and national poverty rate. The percentage of the population of Newport News City County representing minority groups was 52.4%, greater than the state and national percentage of minority groups (USCB 2019b).

Norfolk City County, Virginia

The poverty rate in Norfolk City County was 17.6% in 2021, more than both the state and national poverty rate. The percentage of the population of Norfolk City County representing minority groups was 50.4%, greater than the state and national percentage of minority groups (USCB 2019b).

Northampton County, Virginia

The poverty rate in Northampton County was 16.2% in 2021, more than both the state and national poverty rate. The percentage of the population of Northampton County representing minority groups was 35.9%, greater than the state and national percentage of minority groups (USCB 2019b).

Portsmouth County, Virginia

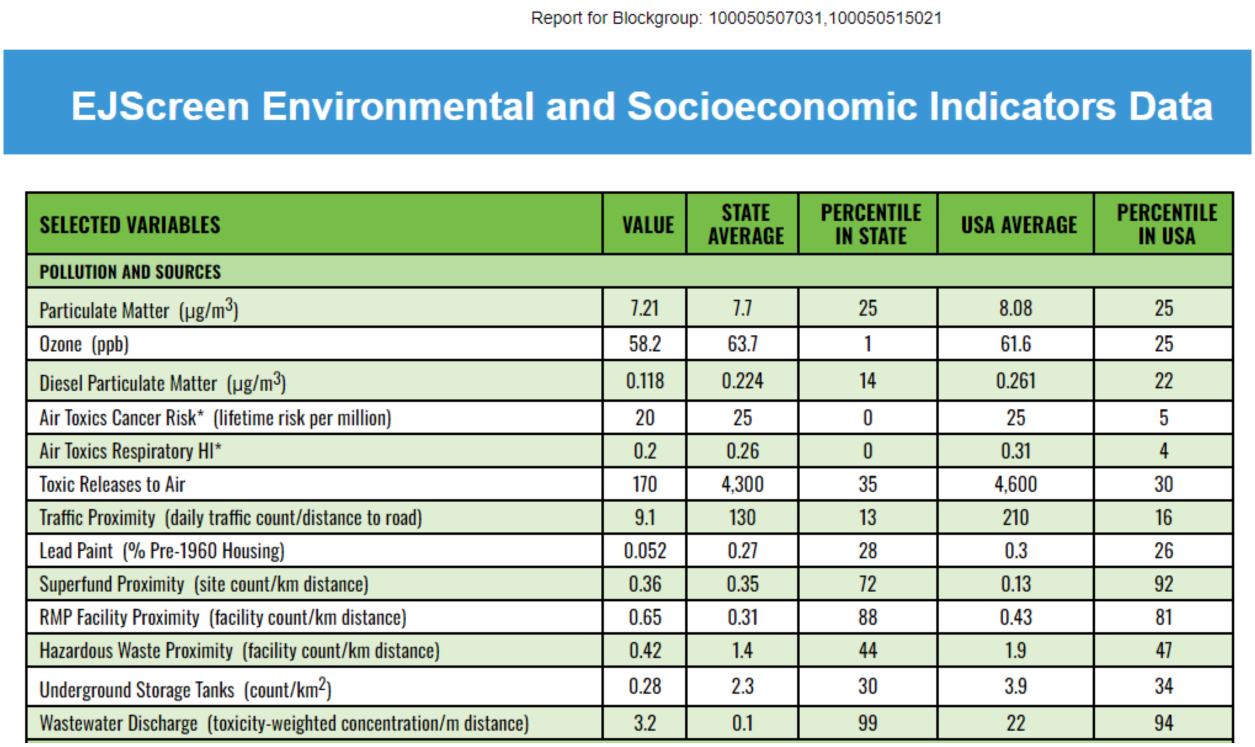
The poverty rate in Portsmouth County was 15.7% in 2021, more than both the state and national poverty rate. The percentage of the population of Portsmouth County representing minority groups was 61.1%, greater than the state and national percentage of minority groups (USCB 2019b).

17.4.1.1 Environmental Justice Screening

An environmental justice screening was conducted to determine potential environmental and demographic issues in the area using the Environmental Justice and Screening Tool (EJSCREEN). USEPA uses EJSCREEN to identify areas that may have higher environmental burdens and vulnerable populations as it develops programs, policies and activities that may affect communities. There are 12 environmental justice indexes in EJSCREEN reflecting environmental indicators. EJSCREEN also uses demographic factors as general indicators of a community's potential susceptibility to the types of environmental factors.

For the Project, EJSCREEN analyses were performed to identify communities impacted by activities in the vicinity of potential cable landfalls, onshore cable routes, onshore substations, point-of-interconnection, vessel staging ports, as well as visual impacts (see subsections for relevant figures).

An example of the EJSCREEN results are shown in Figure 17-2. The analysis compared the communities in the vicinity of the Project substations to the rest of the state and nation using percentiles. These percentiles are a way to see how local residents compare to everyone else in the United States. For example, the national percentile indicates what percent of the US population has an equal or lower potential for exposure, risk or proximity to certain facilities, or a lower percent minority exposure.



Report for Blockgroup: 100050507031,100050515021

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	7.21	7.7	25	8.08	25
Ozone (ppb)	58.2	63.7	1	61.6	25
Diesel Particulate Matter (µg/m^3)	0.118	0.224	14	0.261	22
Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	5
Air Toxics Respiratory HI*	0.2	0.26	0	0.31	4
Toxic Releases to Air	170	4,300	35	4,600	30
Traffic Proximity (daily traffic count/distance to road)	9.1	130	13	210	16
Lead Paint (% Pre-1960 Housing)	0.052	0.27	28	0.3	26
Superfund Proximity (site count/km distance)	0.36	0.35	72	0.13	92
RMP Facility Proximity (facility count/km distance)	0.65	0.31	88	0.43	81
Hazardous Waste Proximity (facility count/km distance)	0.42	1.4	44	1.9	47
Underground Storage Tanks (count/km^2)	0.28	2.3	30	3.9	34
Wastewater Discharge (toxicity-weighted concentration/m distance)	3.2	0.1	99	22	94

Source: United States Environmental Protection Agency. 2024. EJSCREEN. Retrieved: 4/23/2024, from https://ejscreen.epa.gov/mapper/.

Figure 17-2. Sample Environmental Justice Screening Report

Landfalls

Census block groups including and adjacent to landfall locations, 3R's Beach and Tower Road, were included in the EJSCREEN Reports and shown in Figure 17-3.

The EJSCREEN results shown in Tables 17-10, 17-11, and 17-12 indicate very low percentages of low income or minority populations compared to other communities in Delaware and the U.S. Based on these EJ Indexes and socioeconomic factors, any temporary Project impacts during construction at the landfall areas will not disproportionally impact environmental justice communities.

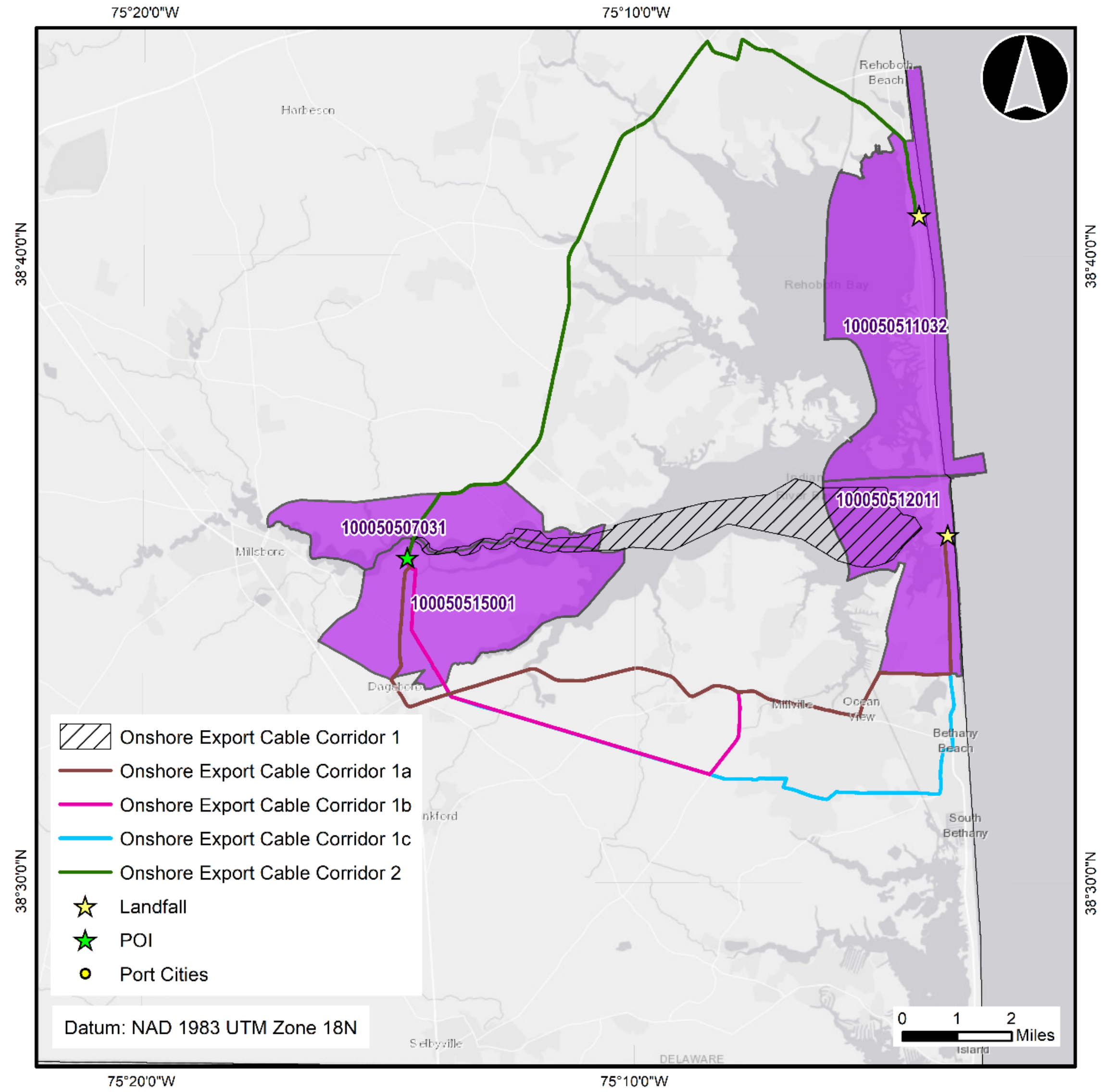


Figure 17-3. Census Block Groups Considered for EJSCREEN, for the Landfall and Onshore Substation Locations

Table 17-10. Landfall Environmental Justice Indexes at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Tower Road		EJScreen Report (Version 2.2) 3 R's Beach	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	4	9	3	11
EJ Index for Ozone	8	14	7	15
EJ Index for 2017 Diesel Particulate Matter*	13	14	12	13
EJ Index for 2017 Air Toxics Cancer Risk*	0	6	0	8
EJ Index for 2017 Air Toxics Respiratory HI*	0	4	0	5
EJ Index for Traffic Proximity	28	26	12	11
EJ Index for Lead Paint	18	19	11	0
EJ Index for Superfund Proximity	3	13	8	19
EJ Index for RMP Facility Proximity	0	5	6	9
EJ Index for Hazardous Waste Proximity	5	7	2	5
EJ Index for Underground Storage Tanks	23	24	24	25
EJ Index for Wastewater Discharge	14	17	27	27

Table 17-11. Tower Road Landfall Pollution and Sources and Socioeconomic Indicators at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Tower Road				
	Value	State	USA		
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.05	7.7	7	8.08	21
Ozone (ppb)	59.8	63.7	16	61.6	38
2017 Diesel Particulate Matter* (µg/m3)	0.171	0.224	35	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	210	130	80	210	75
Lead Paint (% Pre-1960 Housing)	0.14	0.27	47	0.3	40
Superfund Proximity (site count/km distance)	0.046	0.35	5	0.13	40
RMP Facility Proximity (facility count/km distance)	0.056	0.31	1	0.43	12

Table 17-11. Tower Road Landfall Pollution and Sources and Socioeconomic Indicators at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Tower Road				
	Value	State	USA		
		Avg.	%tile	Avg.	%tile
Hazardous Waste Proximity (facility count/km distance)	0.092	1.4	12	1.9	18
Underground Storage Tanks (count/km2)	0.28	2.3	30	3.9	34
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0012	0.1	47	22	50
Socioeconomic Indicators					
Demographic Index	6%	32%	5	65%	4
People of Color	2%	38%	3	39%	5
Low Income	11%	262%	23	31%	19
Unemployment Rate	0%	6%	0	6%	0
Limited English Speaking Households	0%	2%	0	5%	0
Less Than High School Education	2%	9%	22	12%	17
Under Age 5	0%	5%	0	6%	0
Over Age 64	48%	21%	93	17%	98

Table 17-12. 3 R's Beach Landfall Pollution and Sources and Socioeconomic Indicators at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) 3 R's Beach				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (μg/m3)	7.02	7.7	4	8.08	21
Ozone (ppb)	59.3	63.7	11	61.6	34
2017 Diesel Particulate Matter* (μg/m3)	0.134	0.224	24	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	15	130	18	210	20
Lead Paint (% Pre-1960 Housing)	0.0034	0.27	11	0.3	0
Superfund Proximity (site count/km distance)	0.054	0.35	12	0.13	46
RMP Facility Proximity (facility count/km distance)	0.071	0.31	9	0.43	18
Hazardous Waste Proximity (facility count/km distance)	0.055	1.4	2	1.9	10
Underground Storage Tanks (count/km2)	0.26	2.3	29	3.9	34

Table 17-12. 3 R’s Beach Landfall Pollution and Sources and Socioeconomic Indicators at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) 3 R's Beach				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.011	0.1	64	22	68
Socioeconomic Indicators					
Demographic Index	8%	32%	9	35%	6
People of Color	9%	38%	15	39%	20
Low Income	7%	26%	14	31%	11
Unemployment Rate	17%	6%	94	6%	93
Limited English Speaking Households	2%	2%	71	5%	65
Less Than High School Education	7%	9%	54	12%	45
Under Age 5	3%	5%	35	6%	32
Over Age 64	54%	21%	96	17%	98

Onshore Substations

Census block groups including and adjacent to the onshore substation, Indian River, shown in Figure 17-3, was included in the EJSCREEN Report.

The EJSCREEN results shown in Tables 17-13 and 17-14 indicate low percentages of minority populations and overall average low-income populations when compared to other communities in Delaware and the U.S. The area where the onshore substations is located is impacted by the operation of the nearby Indian River Power Plant and the related transmission infrastructure. Any temporary Project impacts during construction or during operation at the US Wind Substations would be insignificant compared to the impacts resulting from the operation of the power plant and related infrastructure and would not disproportionally impact environmental justice communities.

Table 17-13. Onshore Substation Environmental Justice Indexes at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Indian River Substation	
	Percentile in State	Percentile in USA
Environmental Justice Indexes		
EJ Index for Particulate Matter 2.5	29	32
EJ Index for Ozone	2	33
EJ Index for 2017 Diesel Particulate Matter*	23	31
EJ Index for 2017 Air Toxics Cancer Risk*	0	30
EJ Index for 2017 Air Toxics Respiratory HI*	0	20

Table 17-13. Onshore Substation Environmental Justice Indexes at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Indian River Substation	
	Percentile in State	Percentile in USA
EJ Index for Traffic Proximity	20	23
EJ Index for Lead Paint	36	34
EJ Index for Superfund Proximity	58	71
EJ Index for RMP Facility Proximity	67	66
EJ Index for Hazardous Waste Proximity	48	49
EJ Index for Underground Storage Tanks	41	44
EJ Index for Wastewater Discharge	79	72

Table 17-14. Onshore Substation Pollution and Sources and Socioeconomic Indicators at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Indian River Substation				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.21	7.7	25	8.08	25
Ozone (ppb)	58.2	63.7	1	61.6	25
2017 Diesel Particulate Matter* (µg/m3)	0.118	0.224	14	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	9.1	130	13	210	16
Lead Paint (% Pre-1960 Housing)	0.052	0.27	28	0.3	26
Superfund Proximity (site count/km distance)	0.36	0.35	72	0.13	92
RMP Facility Proximity (facility count/km distance)	0.65	0.31	88	0.43	81
Hazardous Waste Proximity (facility count/km distance)	0.42	1.4	44	1.9	47
Underground Storage Tanks (count/km2)	0.28	2.3	30	3.9	34
Wastewater Discharge (toxicity-weighted concentration/m distance)	3.2	0.1	99	22	94
Socioeconomic Indicators					
Demographic Index	26%	32%	45	35%	44
People of Color	23%	38%	37	39%	42
Low Income	29%	26%	61	31%	53

Table 17-14. Onshore Substation Pollution and Sources and Socioeconomic Indicators at Block Group Scale

Selected Variables	EJScreen Report (Version 2.2) Indian River Substation				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Unemployment Rate	7%	6%	67	6%	68
Limited English Speaking Households	0%	2%	60	5%	0
Less Than High School Education	7%	9%	56	12%	47
Under Age 5	2%	5%	29	6%	25
Over Age 64	32%	21%	81	17%	91

Onshore Export Cable Routes

Adjacent census block group data was included in the EJSCREEN Report by generating a 0.25 mi radius buffer along onshore export cable routes, shown in Figure 17-4. A 0.25 mi buffer along a cable route is a generally accepted corridor area to analyze when considering environmental justice impacts. Figure 17-4 shows the census blocks that fall along the onshore export cable routes.

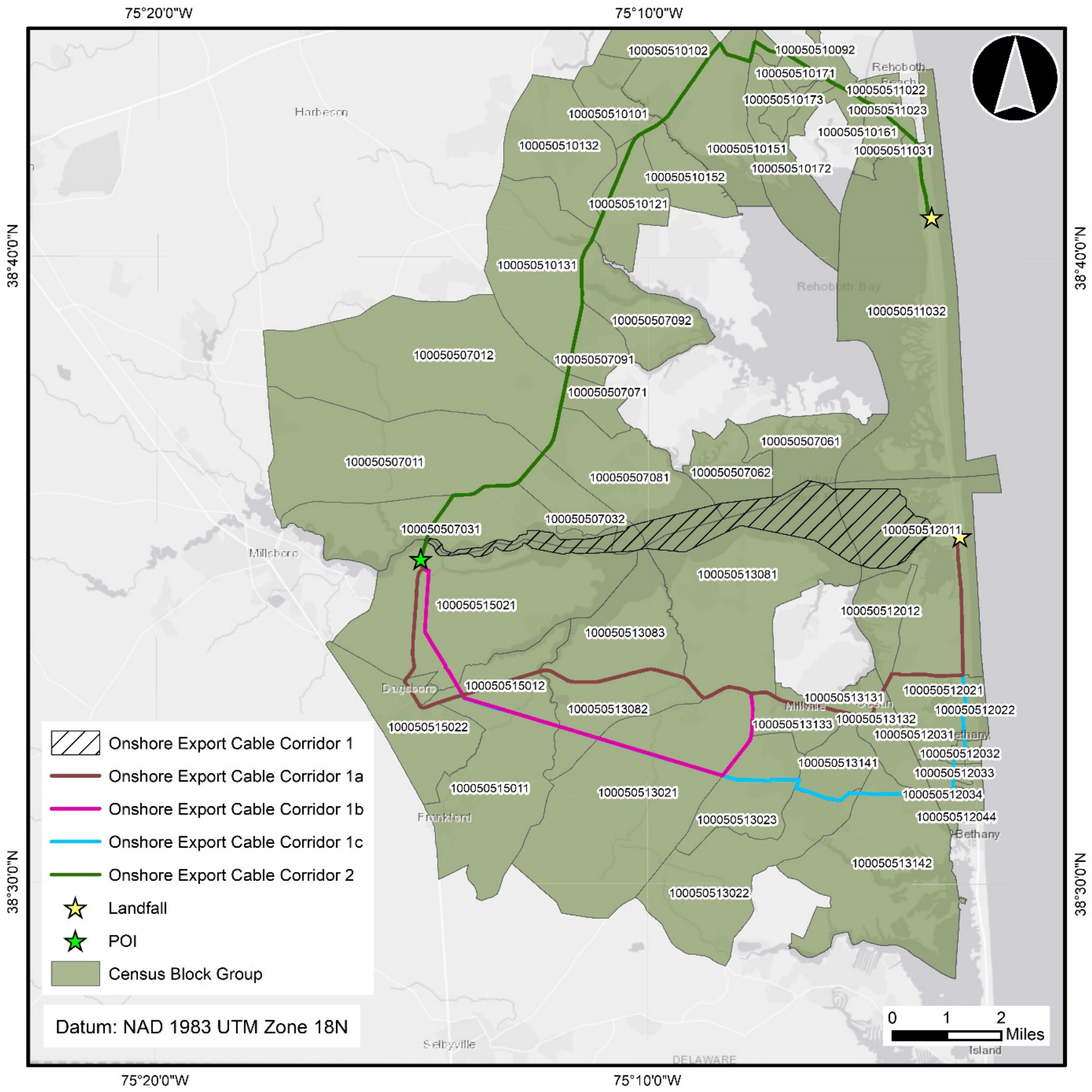


Figure 17-4. Census Blocks along the Onshore Export Cable Routes

The EJSCREEN results shown in Tables 17-15 through 17-20 indicate low percentages of low income or minority populations along the onshore cable corridors when compared to other communities in Delaware and the U.S. Based on these EJ Indexes and socioeconomic factors, any temporary Project impacts during construction along the onshore cable corridors will not disproportionally impact environmental justice communities.

Table 17-15a. Onshore Cable Route Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Corridor 1		EJScreen Report (Version 2.2) Corridor 1a	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	31	35	15	22
EJ Index for Ozone	8	39	4	25
EJ Index for 2017 Diesel Particulate Matter*	37	37	13	22
EJ Index for 2017 Air Toxics Cancer Risk*	0	33	0	21
EJ Index for 2017 Air Toxics Respiratory HI*	0	22	0	14
EJ Index for Traffic Proximity	12	18	29	29
EJ Index for Lead Paint	40	35	21	20
EJ Index for Superfund Proximity	53	70	36	52
EJ Index for RMP Facility Proximity	63	64	39	40
EJ Index for Hazardous Waste Proximity	40	42	22	26
EJ Index for Underground Storage Tanks	52	52	38	38
EJ Index for Wastewater Discharge	81	76	61	54

Table 17-15b. Onshore Cable Route Environmental Justice Indexes

Selected Variables	EJScreen Report (Version 2.2) Corridor 1b		EJScreen Report (Version 2.2) Corridor 1c	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	12	20	9	14
EJ Index for Ozone	6	24	3	16
EJ Index for 2017 Diesel Particulate Matter*	13	21	9	14
EJ Index for 2017 Air Toxics Cancer Risk*	0	19	0	11
EJ Index for 2017 Air Toxics Respiratory HI*	0	13	0	8
EJ Index for Traffic Proximity	27	27	17	17

Table 17-15b. Onshore Cable Route Environmental Justice Indexes

Selected Variables	EJScreen Report (Version 2.2) Corridor 1b		EJScreen Report (Version 2.2) Corridor 1c	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
EJ Index for Lead Paint	20	19	12	0
EJ Index for Superfund Proximity	26	44	19	32
EJ Index for RMP Facility Proximity	32	32	26	24
EJ Index for Hazardous Waste Proximity	11	18	8	12
EJ Index for Underground Storage Tanks	42	42	26	26
EJ Index for Wastewater Discharge	58	52	43	38

Table 17-15c. Onshore Cable Route Environmental Justice Indexes

Selected Variables	EJScreen Report (Version 2.2) Corridor 2	
	Percentile in State	Percentile in USA
Environmental Justice Indexes		
EJ Index for Particulate Matter 2.5	15	21
EJ Index for Ozone	14	30
EJ Index for 2017 Diesel Particulate Matter*	23	26
EJ Index for 2017 Air Toxics Cancer Risk*	0	19
EJ Index for 2017 Air Toxics Respiratory HI*	0	13
EJ Index for Traffic Proximity	35	33
EJ Index for Lead Paint	26	25
EJ Index for Superfund Proximity	19	40
EJ Index for RMP Facility Proximity	24	26
EJ Index for Hazardous Waste Proximity	22	24
EJ Index for Underground Storage Tanks	45	42
EJ Index for Wastewater Discharge	45	40

Table 17-16. Onshore Export Cable Corridor 1 Pollution and Sources and Socioeconomic Indicators

Selected Variables	EJScreen Report (Version 2.2) Corridor 1				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.18	7.7	20	8.08	24
Ozone (ppb)	58.6	63.7	4	61.6	29
2017 Diesel Particulate Matter* (µg/m3)	0.129	0.224	24	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	5.8	130	7	210	12
Lead Paint (% Pre-1960 Housing)	0.061	0.27	30	0.3	28
Superfund Proximity (site count/km distance)	0.18	0.35	47	0.13	83
RMP Facility Proximity (facility count/km distance)	0.41	0.31	78	0.43	73
Hazardous Waste Proximity (facility count/km distance)	0.21	1.4	33	1.9	36
Underground Storage Tanks (count/km2)	0.54	2.3	39	3.9	40
Wastewater Discharge (toxicity-weighted concentration/m distance)	4.5	0.1	99	22	95
Socioeconomic Indicators					
Demographic Index	29%	32%	51	35%	50
People of Color	27%	38%	43	39%	46
Low Income	32%	26%	67	31%	58
Unemployment Rate	9%	6%	79	6%	80
Limited English Speaking Households	2%	2%	72	5%	65
Less Than High School Education	15%	9%	79	12%	72
Under Age 5	5%	5%	53	6%	47
Over Age 64	39%	21%	87	17%	95

Table 17-17. Onshore Export Cable Corridor 1a Pollution and Sources and Socioeconomic Indicators

Selected Variables	EJScreen Report (Version 2.2) Corridor 1a				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.11	7.7	11	8.08	22
Ozone (ppb)	58.6	63.7	3	61.6	28
2017 Diesel Particulate Matter* (µg/m3)	0.118	0.224	14	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	38	130	33	210	35
Lead Paint (% Pre-1960 Housing)	0.047	0.27	25	0.3	25
Superfund Proximity (site count/km distance)	0.15	0.35	39	0.13	78
RMP Facility Proximity (facility count/km distance)	0.21	0.31	58	0.43	58
Hazardous Waste Proximity (facility count/km distance)	0.16	1.4	26	1.9	30
Underground Storage Tanks (count/km2)	1.7	2.3	58	3.9	55
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.48	0.1	93	22	89
Socioeconomic Indicators					
Demographic Index	17%	32%	27	35%	26
People of Color	15%	38%	25	39%	31
Low Income	20%	26%	44	31%	37
Unemployment Rate	4%	6%	54	6%	53
Limited English Speaking Households	1%	2%	65	5%	59
Less Than High School Education	6%	9%	46	12%	39
Under Age 5	4%	5%	47	6%	42
Over Age 64	34%	21%	83	17%	92

Table 17-18. Onshore Export Cable Corridor 1b Pollution and Sources and Socioeconomic Indicators

Selected Variables	EJScreen Report (Version 2.2) Corridor 1b				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.07	7.7	8	8.08	22
Ozone (ppb)	58.7	63.7	4	61.6	29
2017 Diesel Particulate Matter* (µg/m3)	0.12	0.224	15	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	35	130	31	210	33
Lead Paint (% Pre-1960 Housing)	0.04	0.27	23	0.3	24
Superfund Proximity (site count/km distance)	0.09	0.35	28	0.13	63
RMP Facility Proximity (facility count/km distance)	0.14	0.31	36	0.43	41
Hazardous Waste Proximity (facility count/km distance)	0.092	1.4	12	1.9	18
Underground Storage Tanks (count/km2)	2.3	2.3	65	3.9	61
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.35	0.1	93	22	88
Socioeconomic Indicators					
Demographic Index	16%	32%	24	35%	23
People of Color	15%	38%	25	39%	30
Low Income	18%	26%	41	31%	33
Unemployment Rate	5%	6%	59	6%	60
Limited English Speaking Households	1%	2%	67	5%	60
Less Than High School Education	5%	9%	42	12%	35
Under Age 5	2%	5%	29	6%	26
Over Age 64	39%	21%	87	17%	95

Table 17-19. Onshore Export Cable Corridor 1c Pollution and Sources and Socioeconomic Indicators

Selected Variables	EJScreen Report (Version 2.2) Corridor 1c				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.07	7.7	8	8.08	21
Ozone (ppb)	58.7	63.7	4	61.6	29
2017 Diesel Particulate Matter* (µg/m3)	0.121	0.224	15	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	45	130	38	210	38
Lead Paint (% Pre-1960 Housing)	0.029	0.27	19	0.3	21
Superfund Proximity (site count/km distance)	0.079	0.35	25	0.13	59
RMP Facility Proximity (facility count/km distance)	0.13	0.31	35	0.43	41
Hazardous Waste Proximity (facility count/km distance)	0.081	1.4	9	1.9	16
Underground Storage Tanks (count/km2)	0.61	2.3	40	3.9	41
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.24	0.1	90	22	86
Socioeconomic Indicators					
Demographic Index	10%	32%	15	35%	11
People of Color	8%	38%	14	39%	20
Low Income	12%	26%	27	31%	22
Unemployment Rate	5%	6%	56	6%	55
Limited English Speaking Households	0%	2%	61	5%	57
Less Than High School Education	5%	9%	43	12%	36
Under Age 5	2%	5%	26	6%	23
Over Age 64	48%	21%	92	17%	98

Table 17-20. Onshore Export Cable Corridor 2 Pollution and Sources and Socioeconomic Indicators

Selected Variables	EJScreen Report (Version 2.2) Corridor 2				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.14	7.7	15	8.08	23
Ozone (ppb)	59.5	63.7	13	61.6	36
2017 Diesel Particulate Matter* (µg/m3)	0.142	0.224	27	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	130	130	69	210	64
Lead Paint (% Pre-1960 Housing)	0.091	0.27	39	0.3	34
Superfund Proximity (site count/km distance)	0.069	0.35	21	0.13	54
RMP Facility Proximity (facility count/km distance)	0.11	0.31	25	0.43	31
Hazardous Waste Proximity (facility count/km distance)	0.13	1.4	20	1.9	24
Underground Storage Tanks (count/km2)	1.6	2.3	57	3.9	55
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.41	0.1	93	22	88
Socioeconomic Indicators					
Demographic Index	16%	32%	25	35%	24
People of Color	14%	38%	23	39%	29
Low Income	19%	26%	43	31%	35
Unemployment Rate	4%	6%	53	6%	52
Limited English Speaking Households	0%	2%	0	5%	0
Less Than High School Education	5%	9%	42	12%	35
Under Age 5	2%	5%	26	6%	24
Over Age 64	40%	21%	88	17%	96

Ports

The potential Project vessel staging port cities, shown in Figure 17-5, were included in the EJSCREEN Report. Since the Port of New York & New Jersey is not a city, four adjacent census blocks in Bayonne, New Jersey, were used for this analysis.

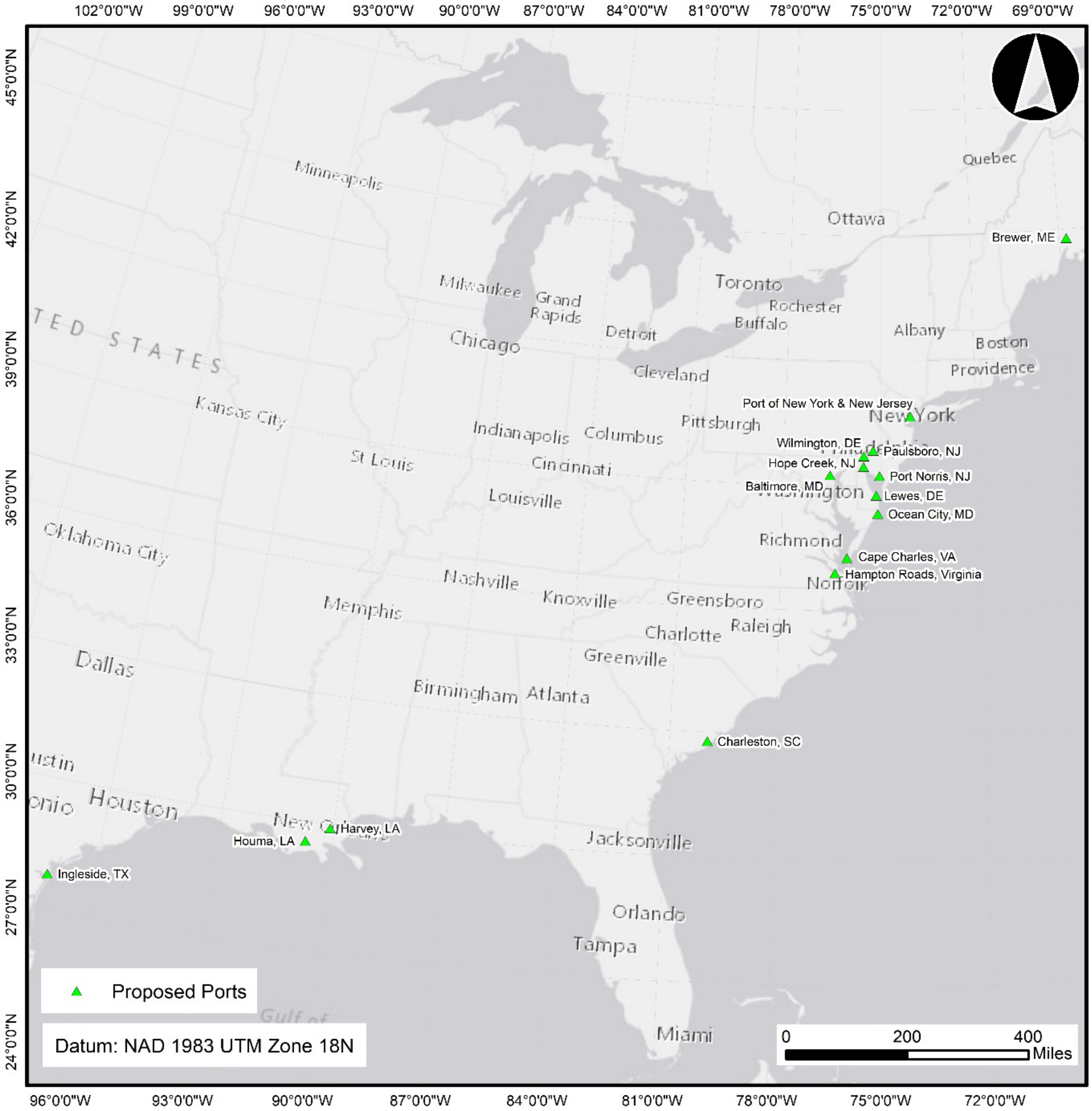


Figure 17-5. Proposed Vessel Staging Ports for the Project

The EJSCREEN results shown in Tables 17-21 through 17-36 indicate varying percentages of low income or minority populations around the potential Project ports when compared to other communities in Delaware, Maryland, New Jersey, Virginia and the U.S. However, the additional Project port vessel activity and any associated impacts will be insignificant compared to the vessel activity and impacts associated with operations at these ports every day. Because the potential Project impacts in the areas surrounding the potential vessel staging ports do not represent a significant increase from current impacts, the Project impacts during construction and operation around the potential Project vessel staging ports will not disproportionally impact environmental justice communities.

Table 17-21a. Port City Environmental Justice Indexes

Selected Variables	EJScreen Report (Version 2.2) Baltimore, MD		EJScreen Report (Version 2.2) Hampton Roads, VA	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	86	76	44	44
EJ Index for Ozone	89	92	80	62
EJ Index for 2017 Diesel Particulate Matter*	81	86	66	62
EJ Index for 2017 Air Toxics Cancer Risk*	78	84	33	59
EJ Index for 2017 Air Toxics Respiratory HI*	76	87	56	65
EJ Index for Traffic Proximity	83	85	77	71
EJ Index for Lead Paint	88	90	79	69
EJ Index for Superfund Proximity	82	87	90	85
EJ Index for RMP Facility Proximity	88	89	83	69
EJ Index for Hazardous Waste Proximity	88	88	85	71
EJ Index for Underground Storage Tanks	78	77	80	74
EJ Index for Wastewater Discharge	75	58	72	54

Table 17-21b. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Ocean City, MD		EJScreen Report (Version 2.2) Port Norris, NJ	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	4	18	33	44
EJ Index for Ozone	8	30	81	76
EJ Index for 2017 Diesel Particulate Matter*	12	26	5	42
EJ Index for 2017 Air Toxics Cancer Risk*	0	21	29	39
EJ Index for 2017 Air Toxics Respiratory HI*	0	14	0	25

Table 17-21b. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Ocean City, MD		EJScreen Report (Version 2.2) Port Norris, NJ	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
EJ Index for Traffic Proximity	45	49	0	9
EJ Index for Lead Paint	18	20	73	80
EJ Index for Superfund Proximity	9	30	5	62
EJ Index for RMP Facility Proximity	55	58	12	12
EJ Index for Hazardous Waste Proximity	0	6	8	27
EJ Index for Underground Storage Tanks	48	49	26	51
EJ Index for Wastewater Discharge	30	21	43	46

Table 17-21c. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Lewes, DE		EJScreen Report (Version 2.2) Cape Charles, VA	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	10	15	0	18
EJ Index for Ozone	15	26	79	70
EJ Index for 2017 Diesel Particulate Matter*	22	22	38	38
EJ Index for 2017 Air Toxics Cancer Risk*	0	12	0	32
EJ Index for 2017 Air Toxics Respiratory HI*	0	8	0	22
EJ Index for Traffic Proximity	20	20	22	19
EJ Index for Lead Paint	26	23	77	70
EJ Index for Superfund Proximity	5	23	29	35
EJ Index for RMP Facility Proximity	9	14	0	5
EJ Index for Hazardous Waste Proximity	35	35	3	5
EJ Index for Underground Storage Tanks	36	36	50	50
EJ Index for Wastewater Discharge	24	25	N/A	N/A

Table 17-21d. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Port of New York & New Jersey		EJScreen Report (Version 2.2) Charleston, SC	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	78	76	16	35
EJ Index for Ozone	43	76	42	56
EJ Index for 2017 Diesel Particulate Matter*	81	86	66	59
EJ Index for 2017 Air Toxics Cancer Risk*	73	78	90	67
EJ Index for 2017 Air Toxics Respiratory HI*	79	84	91	76
EJ Index for Traffic Proximity	69	73	65	56
EJ Index for Lead Paint	33	51	49	48
EJ Index for Superfund Proximity	61	83	70	67
EJ Index for RMP Facility Proximity	86	84	56	55
EJ Index for Hazardous Waste Proximity	75	82	56	47
EJ Index for Underground Storage Tanks	72	85	56	59
EJ Index for Wastewater Discharge	81	80	39	43

Table 17-21e. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Paulsboro, NJ		EJScreen Report (Version 2.2) Hope Creek, NJ	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	16	35	13	16
EJ Index for Ozone	42	56	29	34
EJ Index for 2017 Diesel Particulate Matter*	66	59	7	20
EJ Index for 2017 Air Toxics Cancer Risk*	90	67	8	10
EJ Index for 2017 Air Toxics Respiratory HI*	91	76	0	7
EJ Index for Traffic Proximity	65	56	0	3
EJ Index for Lead Paint	49	48	35	36
EJ Index for Superfund Proximity	70	67	2	21

Table 17-21e. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Paulsboro, NJ		EJScreen Report (Version 2.2) Hope Creek, NJ	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
EJ Index for RMP Facility Proximity	56	55	8	9
EJ Index for Hazardous Waste Proximity	56	47	7	13
EJ Index for Underground Storage Tanks	56	59	0	25
EJ Index for Wastewater Discharge	39	43	10	11

Table 17-21f. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Wilmington, DE		EJScreen Report (Version 2.2) Ingleside, TX	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	92	78	33	78
EJ Index for Ozone	93	89	12	56
EJ Index for 2017 Diesel Particulate Matter*	91	85	21	30
EJ Index for 2017 Air Toxics Cancer Risk*	89	84	24	43
EJ Index for 2017 Air Toxics Respiratory HI*	88	69	14	27
EJ Index for Traffic Proximity	90	86	32	48
EJ Index for Lead Paint	91	89	62	58
EJ Index for Superfund Proximity	83	91	81	87
EJ Index for RMP Facility Proximity	87	84	64	81
EJ Index for Hazardous Waste Proximity	92	89	61	66
EJ Index for Underground Storage Tanks	91	85	46	65
EJ Index for Wastewater Discharge	91	88	76	83

Table 17-21g. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Houma, LA		EJScreen Report (Version 2.2) Harvey, LA	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	6	57	44	78
EJ Index for Ozone	76	63	84	71
EJ Index for 2017 Diesel Particulate Matter*	66	71	83	87
EJ Index for 2017 Air Toxics Cancer Risk*	38	71	58	85
EJ Index for 2017 Air Toxics Respiratory HI*	24	59	33	70
EJ Index for Traffic Proximity	67	62	80	75
EJ Index for Lead Paint	65	69	70	74
EJ Index for Superfund Proximity	81	82	86	82
EJ Index for RMP Facility Proximity	54	67	81	89
EJ Index for Hazardous Waste Proximity	70	74	86	88
EJ Index for Underground Storage Tanks	68	72	82	85
EJ Index for Wastewater Discharge	74	78	60	68

Table 17-21h. Port City Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Brewer, ME	
	Percentile in State	Percentile in USA
Environmental Justice Indexes		
EJ Index for Particulate Matter 2.5	25	2
EJ Index for Ozone	67	5
EJ Index for 2017 Diesel Particulate Matter*	84	18
EJ Index for 2017 Air Toxics Cancer Risk*	78	25
EJ Index for 2017 Air Toxics Respiratory HI*	74	17
EJ Index for Traffic Proximity	82	48
EJ Index for Lead Paint	74	59
EJ Index for Superfund Proximity	44	29
EJ Index for RMP Facility Proximity	84	48
EJ Index for Hazardous Waste Proximity	84	56
EJ Index for Underground Storage Tanks	83	50
EJ Index for Wastewater Discharge	85	45

Table 17-22. Baltimore, MD, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Baltimore, MD				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	8.19	7.84	89	8.08	49
Ozone (ppb)	70.1	66	82	61.6	94
2017 Diesel Particulate Matter* (µg/m3)	0.368	0.288	73	0.261	70-80th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	28	18	25	50-60th
2017 Air Toxics Respiratory HI*	0.38	0.34	7	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	370	180	86	210	86
Lead Paint (% Pre-1960 Housing)	0.7	0.32	82	0.3	86

Table 17-22. Baltimore, MD, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Baltimore, MD				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Superfund Proximity (site count/km distance)	0.2	0.13	85	0.13	85
RMP Facility Proximity (facility count/km distance)	1.3	0.42	88	0.43	92
Hazardous Waste Proximity (facility count/km distance)	6.2	2.1	90	1.9	91
Underground Storage Tanks (count/km2)	3.1	1.9	77	3.9	68
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.11	1.2	93	22	82
Socioeconomic Indicators					
Demographic Index	55%	36%	78	35%	79
People of Color	73%	49%	69	39%	79
Low Income	39%	22%	82	31%	67
Unemployment Rate	7%	6%	74	6%	72
Limited English Speaking Households	2%	3%	65	5%	63
Less Than High School Education	14%	10%	76	12%	69
Under Age 5	6%	6%	61	6%	62
Over Age 64	14%	16%	47	17%	44

Table 17-23. Hampton, VA, Roads Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Hampton Roads, VA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.03	7.53	21	8.08	21
Ozone (ppb)	59.7	59.1	63	61.6	37
2017 Diesel Particulate Matter* (µg/m3)	0.176	0.209	42	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	23	29	0	25	<50th
2017 Air Toxics Respiratory HI*	0.3	0.33	9	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	150	150	73	210	67

Table 17-23. Hampton, VA, Roads Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Hampton Roads, VA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Lead Paint (% Pre-1960 Housing)	0.25	0.22	65	0.3	53
Superfund Proximity (site count/km distance)	0.24	0.11	92	0.13	88
RMP Facility Proximity (facility count/km distance)	0.19	0.21	74	0.43	55
Hazardous Waste Proximity (facility count/km distance)	0.82	0.61	80	1.9	58
Underground Storage Tanks (count/km2)	2.3	1.9	70	3.9	61
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00045	7.2	65	22	42
Socioeconomic Indicators					
Demographic Index	47%	31%	80	35%	72
People of Color	63%	38%	80	39%	74
Low Income	31%	25%	66	31%	56
Unemployment Rate	6%	5%	71	6%	64
Limited English Speaking Households	1%	2%	64	5%	58
Less Than High School Education	7%	10%	51	12%	48
Under Age 5	6%	6%	62	6%	61
Over Age 64	15%	17%	50	17%	49

Table 17-24. Ocean City, MD, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Ocean City, MD				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	6.86	7.84	3	8.08	18
Ozone (ppb)	59.2	66	7	61.6	33
2017 Diesel Particulate Matter* (µg/m3)	0.13	0.288	6	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	28	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.34	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	210	180	71	210	75

Table 17-24. Ocean City, MD, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Ocean City, MD				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Lead Paint (% Pre-1960 Housing)	0.039	0.32	20	0.3	23
Superfund Proximity (site count/km distance)	0.037	0.13	8	0.13	34
RMP Facility Proximity (facility count/km distance)	1.5	0.42	90	0.43	93
Hazardous Waste Proximity (facility count/km distance)	0.037	2.1	0	1.9	6
Underground Storage Tanks (count/km2)	2.1	1.9	67	3.9	59
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00014	1.2	54	22	32
Socioeconomic Indicators					
Demographic Index	18%	36%	26	35%	27
People of Color	10%	49%	13	39%	22
Low Income	25%	22%	64	31%	47
Unemployment Rate	4%	6%	49	6%	50
Limited English Speaking Households	1%	3%	58	5%	57
Less Than High School Education	6%	10%	43	12%	39
Under Age 5	3%	6%	26	6%	27
Over Age 64	37%	16%	95	17%	94

Table 17-25. Port Norris, NJ, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Port Norris, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.24	8.05	15	8.08	26
Ozone (ppb)	64.7	63.9	71	61.6	73
2017 Diesel Particulate Matter* (µg/m3)	0.124	0.414	1	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	27	1	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.33	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	1.1	210	0	210	4

Table 17-25. Port Norris, NJ, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Port Norris, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Lead Paint (% Pre-1960 Housing)	0.63	0.44	70	0.3	82
Superfund Proximity (site count/km distance)	0.053	0.45	1	0.13	45
RMP Facility Proximity (facility count/km distance)	0.034	0.3	4	0.43	5
Hazardous Waste Proximity (facility count/km distance)	0.066	2.8	2	1.9	13
Underground Storage Tanks (count/km2)	0.16	15	10	3.9	30
Wastewater Discharge (toxicity-weighted concentration/m distance)	7.3E-05	0.045	23	22	28
Socioeconomic Indicators					
Demographic Index	39%	33%	64	35%	63
People of Color	33%	45%	44	39%	52
Low Income	44%	22%	85	31%	74
Unemployment Rate	7%	6%	64	6%	68
Limited English Speaking Households	0%	7%	0	5%	0
Less Than High School Education	10%	10%	66	12%	58
Under Age 5	6%	5%	60	6%	58
Over Age 64	14%	17%	45	17%	42

Table 17-26. Lewes, DE, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Lewes, DE				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.15	7.7	17	8.08	23
Ozone (ppb)	60.4	63.7	22	61.6	44
2017 Diesel Particulate Matter* (µg/m3)	0.157	0.224	30	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	21	130	22	210	25
Lead Paint (% Pre-1960 Housing)	0.2	0.27	57	0.3	47

Table 17-26. Lewes, DE, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Lewes, DE				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Superfund Proximity (site count/km distance)	0.045	0.35	4	0.13	39
RMP Facility Proximity (facility count/km distance)	0.075	0.31	11	0.43	20
Hazardous Waste Proximity (facility count/km distance)	1.2	1.4	62	1.9	64
Underground Storage Tanks (count/km2)	1.3	2.3	52	3.9	51
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00089	0.1	43	22	47
Socioeconomic Indicators					
Demographic Index	11%	32%	16	35%	11
People of Color	6%	38%	9	39%	14
Low Income	16%	26%	39	31%	29
Unemployment Rate	1%	6%	27	6%	27
Limited English Speaking Households	0%	2%	61	5%	57
Less Than High School Education	10%	9%	64	12%	57
Under Age 5	1%	5%	21	6%	18
Over Age 64	49%	21%	94	17%	98

Table 17-27. Cape Charles, VA, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Cape Charles, VA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	6.41	7.53	0	8.08	11
Ozone (ppb)	66.3	59.1	99	61.6	82
2017 Diesel Particulate Matter* (µg/m3)	0.136	0.209	28	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	29	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.33	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	5.7	150	14	210	12
Lead Paint (% Pre-1960 Housing)	0.55	0.22	87	0.3	76
Superfund Proximity (site count/km distance)	0.026	0.11	20	0.13	24
RMP Facility Proximity (facility count/km distance)	0.025	0.21	0	0.43	2

Table 17-27. Cape Charles, VA, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Cape Charles, VA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Hazardous Waste Proximity (facility count/km distance)	0.026	0.61	2	1.9	3
Underground Storage Tanks (count/km2)	0.55	1.9	42	3.9	40
Wastewater Discharge (toxicity-weighted concentration/m distance)	N/A	7.2	N/A	22	N/A
Socioeconomic Indicators					
Demographic Index	28%	31%	50	35%	48
People of Color	22%	38%	35	39%	41
Low Income	34%	25%	70	31%	61
Unemployment Rate	9%	5%	82	6%	77
Limited English Speaking Households	1%	2%	64	5%	57
Less Than High School Education	3%	10%	26	12%	23
Under Age 5	3%	6%	31	6%	77
Over Age 64	33%	17%	93	17%	92

Table 17-28. Port of New York & New Jersey Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Port of New York & New Jersey				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	8.65	8.05	78	8.08	63
Ozone (ppb)	63	63.9	25	61.6	63
2017 Diesel Particulate Matter* (µg/m3)	0.758	0.414	93	0.261	95-100th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	27	33	25	50-60th
2017 Air Toxics Respiratory HI*	0.4	0.33	61	0.31	70-80th
Traffic Proximity (daily traffic count/distance to road)	200	210	68	210	74
Lead Paint (% Pre-1960 Housing)	0.082	0.44	15	0.3	32
Superfund Proximity (site count/km distance)	0.17	0.45	15	0.3	32

Table 17-28. Port of New York & New Jersey Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Port of New York & New Jersey				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
RMP Facility Proximity (facility count/km distance)	1.1	0.3	93	0.43	89
Hazardous Waste Proximity (facility count/km distance)	4.2	2.8	73	1.9	86
Underground Storage Tanks (count/km2)	14	15	64	3.9	92
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.023	0.045	82	22	73
Socioeconomic Indicators					
Demographic Index	44%	33%	70	35%	69
People of Color	67%	45%	71	39%	76
Low Income	22%	22%	61	31%	40
Unemployment Rate	2%	6%	30	6%	37
Limited English Speaking Household	10%	7%	77	5%	85
Less Than High School Education	4%	10%	40	12%	32
Under Age 5	7%	5%	69	6%	37
Over Age 64	9%	17%	21	17%	21

Table 17-29. Charleston, SC, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Charleston, SC				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.33	8.07	14	8.08	28
Ozone (ppb)	61.9	62.6	44	61.6	56
2017 Diesel Particulate Matter* (µg/m3)	0.277	0.188	81	0.261	60-70th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	31	30	9	25	50-60th
2017 Air Toxics Respiratory HI*	0.52	0.41	90	0.31	90-95th
Traffic Proximity (daily traffic count/distance to road)	190	63	93	210	73
Lead Paint (% Pre-1960 Housing)	0.22	0.091	93	0.13	87

Table 17-29. Charleston, SC, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Charleston, SC				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Superfund Proximity (site count/km distance)	0.23	0.091	93	0.13	87
RMP Facility Proximity (facility count/km distance)	0.26	0.3	71	0.43	65
Hazardous Waste Proximity (facility count/km distance)	0.5	0.42	76	1.9	49
Underground Storage Tanks (count/km2)	3.5	2.9	74	3.9	70
Wastewater Discharge (toxicity-weighted concentration/m distance)	8.5	1	98	22	96
Socioeconomic Indicators					
Demographic Index	26%	37%	35	35%	44
People of Color	29%	38%	43	39%	48
Low Income	23%	36%	30	31%	44
Unemployment Rate	4%	6%	47	6%	47
Limited English Speaking Households	1%	1%	77	5%	58
Less Than High School Education	4%	13%	25	12%	32
Under Age 5	6%	5%	60	6%	57
Over Age 64	15%	19%	41	17%	49

Table 17-30. Paulsboro, NJ, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Paulsboro, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.33	8.07	14	8.08	28
Ozone (ppb)	61.9	62.6	44	61.6	56
2017 Diesel Particulate Matter* (µg/m3)	0.277	0.188	81	0.261	60-70th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	31	30	9	25	50-60th
2017 Air Toxics Respiratory HI*	0.52	0.41	90	0.31	90-95th
Traffic Proximity (daily traffic count/distance to road)	190	63	93	210	73

Table 17-30. Paulsboro, NJ, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Paulsboro, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Lead Paint (% Pre-1960 Housing)	0.22	0.16	74	0.3	50
Superfund Proximity (site count/km distance)	0.23	0.091	93	0.13	87
RMP Facility Proximity (facility count/km distance)	0.26	0.3	71	0.43	65
Hazardous Waste Proximity (facility count/km distance)	0.5	0.42	76	1.9	49
Underground Storage Tanks (count/km2)	3.5	2.9	74	3.9	70
Wastewater Discharge (toxicity-weighted concentration/m distance)	8.5	1	98	22	96
Socioeconomic Indicators					
Demographic Index	26%	37%	35	35%	44
People of Color	29%	38%	43	39%	48
Low Income	23%	36%	30	31%	44
Unemployment Rate	4%	6%	47	6%	47
Limited English Speaking Household	1%	1%	77	5%	58
Less Than High School Education	4%	13%	25	12%	32
Under Age 5	6%	5%	60	6%	57
Over Age 64	15%	19%	41	17%	49

Table 17-31. Hope Creek, NJ, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Hope Creek, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.4	8.05	18	8.08	29
Ozone (ppb)	64.6	63.9	69	61.6	73
2017 Diesel Particulate Matter* (µg/m3)	0.164	0.414	8	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	27	1	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.33	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	1.1	210	0	210	4

Table 17-31. Hope Creek, NJ, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Hope Creek, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Lead Paint (% Pre-1960 Housing)	0.63	0.44	69	0.3	81
Superfund Proximity (site count/km distance)	0.05	0.45	1	0.13	43
RMP Facility Proximity (facility count/km distance)	0.064	0.3	10	0.43	15
Hazardous Waste Proximity (facility count/km distance)	0.11	2.8	7	1.9	22
Underground Storage Tanks (count/km2)	0.066	15	0	3.9	26
Wastewater Discharge (toxicity-weighted concentration/m distance)	2E-05	0.045	16	22	21
Socioeconomic Indicators					
Demographic Index	9%	33%	11	35%	9
People of Color	9%	45%	13	39%	22
Low Income	9%	22%	33	31%	16
Unemployment Rate	5%	6%	53	6%	58
Limited English Speaking Households	0%	7%	0	5%	0
Less Than High School Education	9%	10%	61	12%	52
Under Age 5	8%	5%	79	6%	78
Over Age 64	9%	17%	24	17%	23

Table 17-32. Wilmington, DE, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Wilmington, DE				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	8.32	7.7	83	8.08	53
Ozone (ppb)	66.2	63.7	91	61.6	81
2017 Diesel Particulate Matter* (µg/m3)	0.334	0.224	85	0.261	70-80th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	25	51	25	50-60th
2017 Air Toxics Respiratory HI*	0.3	0.26	37	0.31	<50th

Table 17-32. Wilmington, DE, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Wilmington, DE				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Traffic Proximity (daily traffic count/distance to road)	390	130	93	210	87
Lead Paint (% Pre-1960 Housing)	0.68	0.27	86	0.3	84
Superfund Proximity (site count/km distance)	0.3	0.35	67	0.13	91
RMP Facility Proximity (facility count/km distance)	0.37	0.31	77	0.43	71
Hazardous Waste Proximity (facility count/km distance)	4.6	1.4	92	1.9	88
Underground Storage Tanks (count/km2)	6.4	2.3	91	3.9	82
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.16	0.1	85	22	84
Socioeconomic Indicators					
Demographic Index	55%	32%	86	35%	79
People of Color	71%	38%	86	39%	78
Low Income	40%	26%	78	31%	69
Unemployment Rate	9%	6%	76	6%	77
Limited English Speaking Household	2%	2%	70	5%	64
Less Than High School Education	11%	9%	68	12%	61
Under Age 5	6%	5%	64	6%	60
Over Age 64	14%	21%	36	17%	42

Table 17-33. Ingleside, TX, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Ingleside, TX				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	8.67	9.11	21	8.08	64
Ozone (ppb)	58.9	64.6	7	61.6	31
2017 Diesel Particulate Matter* (µg/m3)	0.0863	0.218	12	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	28	1	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.3	1	0.31	<50th

Table 17-33. Ingleside, TX, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Ingleside, TX				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Traffic Proximity (daily traffic count/distance to road)	31	150	26	210	31
Lead Paint (% Pre-1960 Housing)	0.1	0.17	58	0.3	35
Superfund Proximity (site count/km distance)	0.33	0.085	96	0.13	92
RMP Facility Proximity (facility count/km distance)	0.54	0.63	65	0.43	78
Hazardous Waste Proximity (facility count/km distance)	0.44	0.75	58	1.9	47
Underground Storage Tanks (count/km2)	1.6	2.3	51	3.9	54
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.63	0.91	96	22	90
Socioeconomic Indicators					
Demographic Index	47%	46%	53	35%	71
People of Color	56%	58%	47	39%	70
Low Income	38%	34%	59	31%	66
Unemployment Rate	2%	5%	33	6%	29
Limited English Speaking Households	3%	8%	50	5%	67
Less Than High School Education	15%	16%	58	12%	72
Under Age 5	6%	6%	52	6%	60
Over Age 64	12%	14%	49	17%	36

Table 17-34. Houma, LA, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Houma, LA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.74	8.62	2	8.08	38
Ozone (ppb)	60.8	59.8	78	61.6	47
2017 Diesel Particulate Matter* (µg/m3)	0.257	0.247	63	0.261	50-60th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	27	32	0	25	<50th

Table 17-34. Houma, LA, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Houma, LA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
2017 Air Toxics Respiratory HI*	0.3	0.38	1	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	79	86	72	210	50
Lead Paint (% Pre-1960 Housing)	0.29	0.22	72	0.3	57
Superfund Proximity (site count/km distance)	0.31	0.076	96	0.13	91
RMP Facility Proximity (facility count/km distance)	0.21	0.62	48	0.43	59
Hazardous Waste Proximity (facility count/km distance)	2.4	1.1	83	1.9	77
Underground Storage Tanks (count/km2)	3.4	2.2	77	3.9	69
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.17	49	90	22	84
Socioeconomic Indicators					
Demographic Index	38%	41%	51	35%	62
People of Color	36%	43%	48	39%	55
Low Income	40%	40%	51	31%	69
Unemployment Rate	6%	7%	60	6%	65
Limited English Speaking Households	2%	2%	82	5%	65
Less Than High School Education	17%	15%	63	12%	75
Under Age 5	9%	6%	75	6%	80
Over Age 64	15%	17%	51	17%	50

Table 17-35. Harvey, LA, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Harvey, LA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	8.24	8.62	22	8.08	51
Ozone (ppb)	60.1	59.8	65	61.6	41
2017 Diesel Particulate Matter* (µg/m3)	0.349	0.247	78	0.261	70-80th

Table 17-35. Harvey, LA, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Harvey, LA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	32	10	25	50-60th
2017 Air Toxics Respiratory HI*	0.3	0.38	1	0.31	70-80th
Traffic Proximity (daily traffic count/distance to road)	110	86	79	210	58
Lead Paint (% Pre-1960 Housing)	0.24	0.22	66	0.3	52
Superfund Proximity (site count/km distance)	0.087	0.076	76	0.13	62
RMP Facility Proximity (facility count/km distance)	1.1	0.62	82	0.43	90
Hazardous Waste Proximity (facility count/km distance)	3.3	1.1	90	1.9	82
Underground Storage Tanks (count/km2)	5.1	2.2	86	3.9	77
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0028	49	53	22	57
Socioeconomic Indicators					
Demographic Index	57%	41%	71	35%	81
People of Color	67%	43%	73	39%	76
Low Income	47%	40%	61	31%	78
Unemployment Rate	9%	7%	70	6%	77
Limited English Speaking Households	6%	2%	90	5%	77
Less Than High School Education	16%	15%	60	12%	73
Under Age 5	7%	6%	63	6%	66
Over Age 64	15%	17%	47	17%	47

Table 17-36. Brewer ME, Pollution Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Brewer ME				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	4.52	5.59	17	8.08	1
Ozone (ppb)	52.1	52.8	48	61.6	4

Table 17-36. Brewer ME, Pollution Sources and Socioeconomic Indicators.

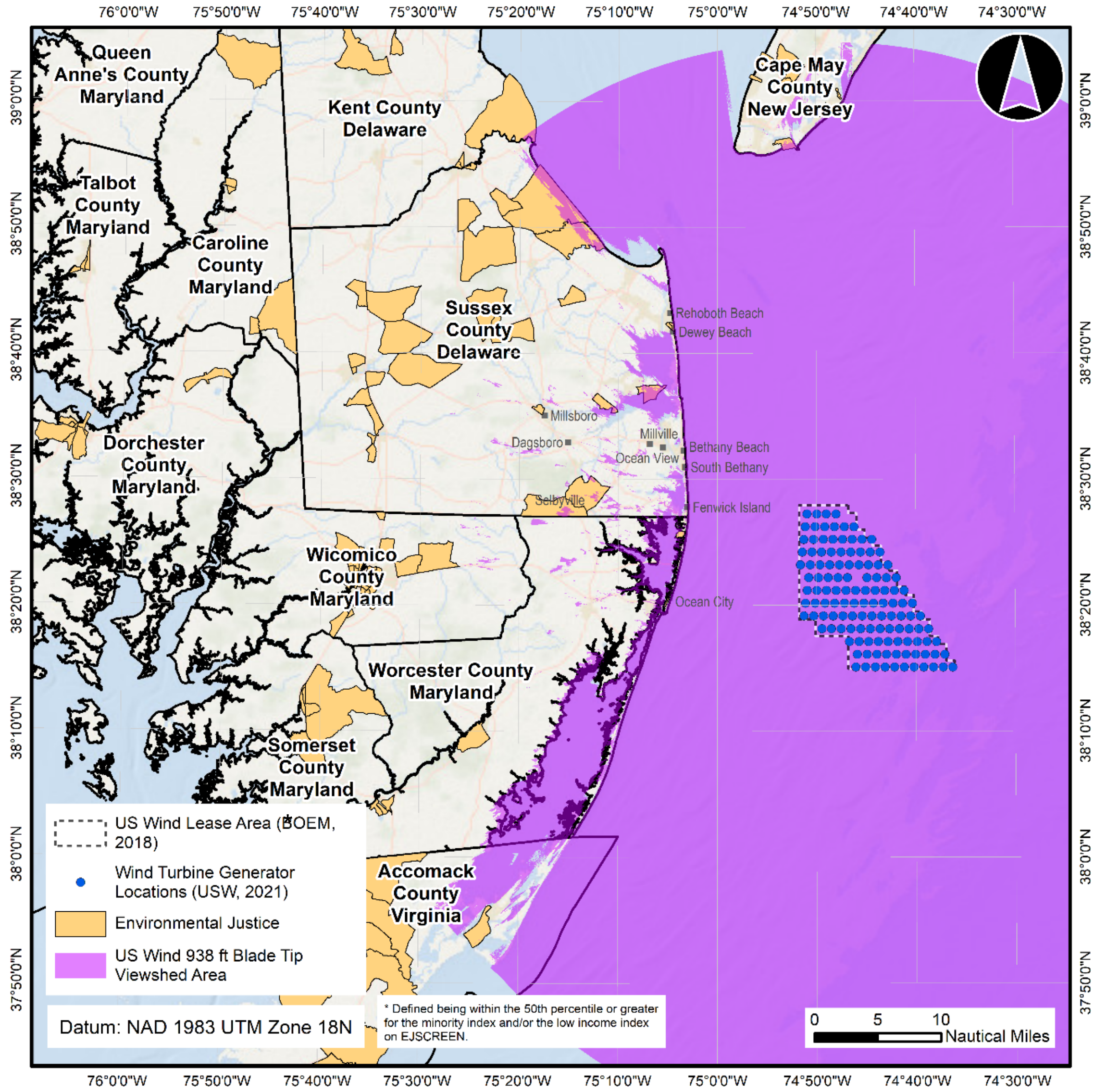
Selected Variables	EJScreen Report (Version 2.2) Brewer ME				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
2017 Diesel Particulate Matter* (µg/m3)	0.0872	0.0745	73	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	17	31	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.18	23	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	160	66	88	210	69
Lead Paint (% Pre-1960 Housing)	0.48	0.37	74	0.3	72
Superfund Proximity (site count/km distance)	0.029	0.071	28	0.13	27
RMP Facility Proximity (facility count/km distance)	0.23	0.21	79	0.43	61
Hazardous Waste Proximity (facility count/km distance)	2.2	1.1	83	1.9	75
Underground Storage Tanks (count/km2)	1.9	0.68	87	3.9	57
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0014	0.002	85	22	51
Socioeconomic Indicators					
Demographic Index	21%	18%	65	35%	33
People of Color	5%	8%	46	39%	12
Low Income	37%	28%	71	31%	65
Unemployment Rate	3%	5%	53	6%	45
Limited English Speaking Households	0%	1%	0	5%	0
Less Than High School Education	5%	6%	50	12%	38
Under Age 5	6%	4%	68	6%	57
Over Age 64	17%	22%	36	17%	55

Visually Impacted Areas

The counties within the 43-mile Project viewshed analysis were included in the EJSCREEN Report shown in Figure 17-6 and were identified as potentially impacted visually by the turbines in the Lease area.

The EJSCREEN results shown in Tables 17-37 through 17-41 indicate low percentages of low income or minority populations within the counties potentially exposed to visual impacts to the Project when compared to other communities in Delaware, Maryland, New Jersey, Virginia and the U.S. However, most of the visual impacts from the Project would be on coastal communities, which typically have lower percentages of low income and minority populations than inland areas.

As a result, any visual impacts from the Project would not disproportionally impact environmental justice communities.



Datum: NAD 1983 UTM Zone 18N

* Defined being within the 50th percentile or greater for the minority index and/or the low income index on EJSCREEN.

Figure 17-6. Viewshed Area Considered for EJSCREEN

Table 17-37a. Visually Impacted Areas Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Kent and Sussex County, DE		EJScreen Report (Version 2.2) Wicomico and Worcester County, MD	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	35	36	16	33
EJ Index for Ozone	34	58	10	40
EJ Index for 2017 Diesel Particulate Matter*	40	42	21	41
EJ Index for 2017 Air Toxics Cancer Risk*	0	34	29	58
EJ Index for 2017 Air Toxics Respiratory HI*	39	33	24	43
EJ Index for Traffic Proximity	48	45	66	60
EJ Index for Lead Paint	48	43	41	49
EJ Index for Superfund Proximity	51	68	46	47
EJ Index for RMP Facility Proximity	53	55	14	44
EJ Index for Hazardous Waste Proximity	44	46	60	61
EJ Index for Underground Storage Tanks	54	53	46	56
EJ Index for Wastewater Discharge	60	57	52	55

Table 17-37b. Visually Impacted Areas Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Cape May, NJ		EJScreen Report (Version 2.2) Accomack County, VA	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
Environmental Justice Indexes				
EJ Index for Particulate Matter 2.5	12	20	4	26
EJ Index for Ozone	49	56	82	65
EJ Index for 2017 Diesel Particulate Matter*	9	31	23	28
EJ Index for 2017 Air Toxics Cancer Risk*	19	23	0	40
EJ Index for 2017 Air Toxics Respiratory HI*	0	16	0	26
EJ Index for Traffic Proximity	32	36	46	40
EJ Index for Lead Paint	35	42	77	67

Table 17-37b. Visually Impacted Areas Environmental Justice Indexes.

Selected Variables	EJScreen Report (Version 2.2) Cape May, NJ		EJScreen Report (Version 2.2) Accomack County, VA	
	Percentile in State	Percentile in USA	Percentile in State	Percentile in USA
EJ Index for Superfund Proximity	15	48	6	14
EJ Index for RMP Facility Proximity	35	30	72	60
EJ Index for Hazardous Waste Proximity	8	14	37	32
EJ Index for Underground Storage Tanks	32	47	46	50
EJ Index for Wastewater Discharge	5	6	82	67

Table 17-38. Kent and Sussex Counties, DE, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Kent and Sussex County, DE				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.2	7.7	23	8.08	25
Ozone (ppb)	61.2	63.7	27	61.6	50
2017 Diesel Particulate Matter* (µg/m3)	0.139	0.224	26	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	25	0	25	<50th
2017 Air Toxics Respiratory HI*	0.22	0.26	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	50	130	40	210	40
Lead Paint (% Pre-1960 Housing)	0.13	0.27	45	0.3	39
Superfund Proximity (site count/km distance)	0.23	0.35	58	0.13	87
RMP Facility Proximity (facility count/km distance)	0.25	0.31	65	0.43	63
Hazardous Waste Proximity (facility count/km distance)	0.33	1.4	40	1.9	44
Underground Storage Tanks (count/km2)	1.1	2.3	50	3.9	49
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.12	0.1	83	22	83
Socioeconomic Indicators					
Demographic Index	30%	32%	53	35%	51

Table 17-38. Kent and Sussex Counties, DE, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Kent and Sussex County, DE				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
People of Color	32%	38%	49	39%	51
Low Income	29%	26%	61	31%	52
Unemployment Rate	5%	6%	59	6%	60
Limited English Speaking Households	2%	2%	73	5%	65
Less Than High School Education	11%	9%	67	12%	60
Under Age 5	5%	5%	60	6%	55
Over Age 64	23%	21%	68	17%	77

Table 17-39. Wicomico and Worcester Counties, MD, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Wicomico and Worcester County, MD				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	7.06	7.84	7	8.08	21
Ozone (ppb)	58.5	66	5	61.6	27
2017 Diesel Particulate Matter* (µg/m3)	0.127	0.288	6	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	23	28	0	25	<50th
2017 Air Toxics Respiratory HI*	0.25	0.34	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	59	180	36	210	43
Lead Paint (% Pre-1960 Housing)	0.16	0.32	42	0.3	43
Superfund Proximity (site count/km distance)	0.035	0.13	7	0.13	32
RMP Facility Proximity (facility count/km distance)	0.32	0.42	73	0.43	69
Hazardous Waste Proximity (facility count/km distance)	0.95	2.1	50	1.9	60
Underground Storage Tanks (count/km2)	1.2	1.9	52	3.9	50
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00051	1.2	63	22	43

Table 17-39. Wicomico and Worcester Counties, MD, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Wicomico and Worcester County, MD				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Socioeconomic Indicators					
Demographic Index	31%	36%	48	35%	52
People of Color	32%	49%	39	39%	52
Low Income	29%	22%	70	31%	54
Unemployment Rate	8%	6%	74	6%	73
Limited English Speaking Households	2%	3%	69	5%	66
Less Than High School Education	10%	10%	66	12%	59
Under Age 5	5%	6%	53	6%	54
Over Age 64	20%	16%	69	17%	66

Table 17-40. Cape May County, NJ, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Cape May County, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	6.95	8.05	8	8.08	19
Ozone (ppb)	64.9	63.9	72	61.6	74
2017 Diesel Particulate Matter* (µg/m3)	0.144	0.414	4	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	27	1	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.33	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	62	210	31	210	44
Lead Paint (% Pre-1960 Housing)	0.29	0.44	34	0.3	57
Superfund Proximity (site count/km distance)	0.1	0.45	16	0.13	67
RMP Facility Proximity (facility count/km distance)	0.1	0.3	30	0.43	30
Hazardous Waste Proximity (facility count/km distance)	0.15	2.8	12	1.9	28

Table 17-40. Cape May County, NJ, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Cape May County, NJ				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Underground Storage Tanks (count/km2)	3.5	15	34	3.9	70
Wastewater Discharge (toxicity-weighted concentration/m distance)	4.2E-06	0.045	7	22	13
Socioeconomic Indicators					
Demographic Index	19%	33%	34	35%	30
People of Color	15%	45%	21	39%	31
Low Income	23%	22%	64	31%	43
Unemployment Rate	7%	6%	66	6%	70
Limited English Speaking Households	1%	7%	44	5%	61
Less Than High School Education	6%	10%	49	12%	41
Under Age 5	4%	5%	48	6%	46
Over Age 64	27%	17%	85	17%	84

Table 17-41. Accomack County, VA, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Accomack County, VA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Pollution and Sources					
Particulate Matter 2.5 (µg/m3)	6.51	7.53	1	8.08	12
Ozone (ppb)	60.9	59.1	77	61.6	49
2017 Diesel Particulate Matter* (µg/m3)	0.0868	0.209	9	0.261	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	29	0	25	<50th
2017 Air Toxics Respiratory HI*	0.2	0.33	0	0.31	<50th
Traffic Proximity (daily traffic count/distance to road)	17	150	27	210	22
Lead Paint (% Pre-1960 Housing)	0.3	0.22	70	0.3	58
Superfund Proximity (site count/km distance)	0.013	0.11	3	0.13	7
RMP Facility Proximity (facility count/km distance)	0.16	0.21	69	0.43	48
Hazardous Waste Proximity (facility count/km distance)	0.14	0.61	34	1.9	27

Table 17-41. Accomack County, VA, Visually Impacted Areas Pollution and Sources and Socioeconomic Indicators.

Selected Variables	EJScreen Report (Version 2.2) Accomack County, VA				
	Value	State		USA	
		Avg.	%tile	Avg.	%tile
Underground Storage Tanks (count/km2)	0.24	1.9	31	3.9	33
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.058	7.2	91	22	79
Socioeconomic Indicators					
Demographic Index	41%	31%	73	35%	65
People of Color	40%	38%	58	39%	59
Low Income	41%	25%	79	31%	70
Unemployment Rate	4%	5%	57	6%	50
Linguistically Isolated	2%	2%	72	5%	64
Less Than High School Education	18%	10%	83	12%	77
Under Age 5	5%	6%	56	6%	55
Over Age 64	24%	17%	79	17%	79

Subsistence and Harvest Practices

No published data has been found related to subsistence and harvest practices in the Project area.

As part of its ongoing stakeholder engagement, US Wind is actively working with the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Lenape Tribe of Delaware as well as thirteen additional Tribes with potential cultural linkage to the Project area in order to better understand how the Project may impact the natural and physical environmental resources, as well as the social and cultural resources, used by these communities. As stated in Executive Order 13175, “The United States continues to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, tribal trust resources, and Indian tribal treaty and other rights.”

In addition to the coordination between BOEM and the tribes, US Wind has communicated and will continue to communicate with the Tribes directly throughout the Project. On September 9, 2021, US Wind requested information from the 16 Tribes BOEM and US Wind have identified that may have a cultural link to areas that may be affected by the Project. US Wind offered to discuss the Project in detail and invited the Tribes, at their discretion, to share pertinent information about traditions, practices, beliefs, and other cultural resources that may be affected by Project activities. Through on-going outreach efforts, US Wind will work directly with the Tribes to develop measures to avoid negative impacts to the resources, traditions, and cultural practices of these communities.

17.4.2 Impacts

17.4.2.1 Construction

Due to the primarily offshore nature of Project activities and limited need for upland resources, it is anticipated that the Project will not have disproportionately high or adverse environmental or health effects on minority or low-income populations. Upland/coastal activities, which could have the potential to impact minority or low-income populations, are expected to be conducted at existing fabrication sites, staging areas, substations and ports without the need for expansion or significant changes in use relative to existing operations. If upland onshore export cables are installed, the cables would be predominantly located in previously disturbed land. As described in Volume II, Section 17.1, the Project is expected to create new jobs and economic growth in Maryland, which could benefit low-income populations. The Project is not anticipated to have any impacts that would add exposure risk, risk of release, or increase proximity risk to environmental justice communities in the Project area.

17.4.2.2 Operations

Routine Project operations will have a negligible impact on environmental justice. Maintenance activities are expected to occur on a routine basis. Any emergency maintenance that is required will be addressed promptly, and only the portion of the Project area that pertains to the affected infrastructure would be impacted.

17.4.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Decommissioning impacts are expected to be similar to construction impacts.

17.5 Commercial and Recreational Fisheries

17.5.1 Description of Affected Environment

Fisheries Management

Commercial and recreational fishing is common throughout the mid-Atlantic region. Commercial fishing within the Project area is managed by the Mid-Atlantic Fishery Management Council, NOAA’s Highly Migratory Species Office, and the Atlantic States Marine Fisheries Commission. There are a number of fishery management plans in place for regulating and managing fisheries in the region. These include plans for summer flounder, scup, black sea bass, spiny dogfish, Atlantic mackerel, squid, butterfish, bluefish, surfclam, ocean quahog, and tilefish. See Volume II, Section 8.0 for additional information on fishery management plans.

Sea Risk Solutions prepared a Fisheries Assessment Report (FAR) for the Project (Appendix II-F2). According to the FAR, commercial fishing vessels will head to selected fishing grounds west to east after departing Ocean City. Commercial fishing vessels transiting from points north and south to access regional fishing grounds offshore of the Lease area will transit in a direction that is generally north/south and may choose to avoid the Lease area once it is built out.

Fishing occurs both offshore in the Atlantic Ocean as well as in the Delaware Inland Bays. However, there are a number of regulations in place in the Inland Bays due to degraded water quality. There are fish consumption advisories for striped bass and bluefish, as a result of elevated concentrations of polychlorinated biphenyls and mercury. Additionally, as of 2016, shellfish harvesting was prohibited in 32 percent of the Inland Bays and approved only seasonally in an additional 7 percent. Hard clam is the primary shellfish species of recreational and commercial concern in Indian River Bay (see Section 7.0) and is harvested using hand-rakes. Oyster reefs were also common in the Inland Bays until the 1950s, when the population was devastated by disease (DCIB 2016). Although natural oyster reefs are no longer present in Indian River Bay (Ewart 2013), the state of Delaware has designated portions of Indian River Bay as shellfish aquaculture development areas (SADA). Volunteer oyster gardeners have found that oysters can grow successfully throughout the Inland Bays, which led to the approval of oyster and clam farming.

Commercial and recreational fishing activities in the Project area are detailed in the sections below.

Commercial Fishing Resources

Commercial fishing in the Project area occurs primarily offshore in both Maryland and Delaware. AIS data for fishing vessels (vessels type classified as “Fishing”, traveling at 5 knots or less) in the vicinity of the Project area in 2019 indicate that activity was primarily located outside of the Lease area (Figure 17-7). Within the Project area, vessel tracks were largely consolidated along a route between Ocean City and offshore fishing grounds to the east of the Lease area (Figure 17-7). U.S. fisheries landings data from 2017 to 2020 indicate that the following species were the top valued commercial fisheries (by revenue) in Delaware: blue crab, eastern oyster, knobbed whelk, black sea bass, and horseshoe crab ((NOAA Fisheries 2021f), Table 17-42). These five species accounted for 88.4% of the commercial fishing revenue in Delaware from 2017 to 2020 (NOAA Fisheries 2021f). Collectively, species for which data was withheld for confidentiality reasons accounted for 8.0% of fisheries landings in Delaware between 2017 to 2020 (NOAA Fisheries 2021f). Top fisheries in Maryland between 2017 to 2020 were similar to Delaware, with the most valuable being blue crab, eastern oyster, striped bass, sea scallop, and black sea bass ((NOAA Fisheries 2021f), Table 17-43). Together, these species accounted for 85.4% of the commercial fishing revenue in Maryland from 2017 to 2020 (NOAA Fisheries 2021f). Collectively, species for which data was withheld for confidentiality reasons accounted for 5.8% of fisheries landings in Delaware between 2017 to 2020 (NOAA Fisheries 2021f). In both Delaware and Maryland, blue crab accounted for at least 60% of fisheries revenues from 2017 to 2020 (NOAA Fisheries 2021f).

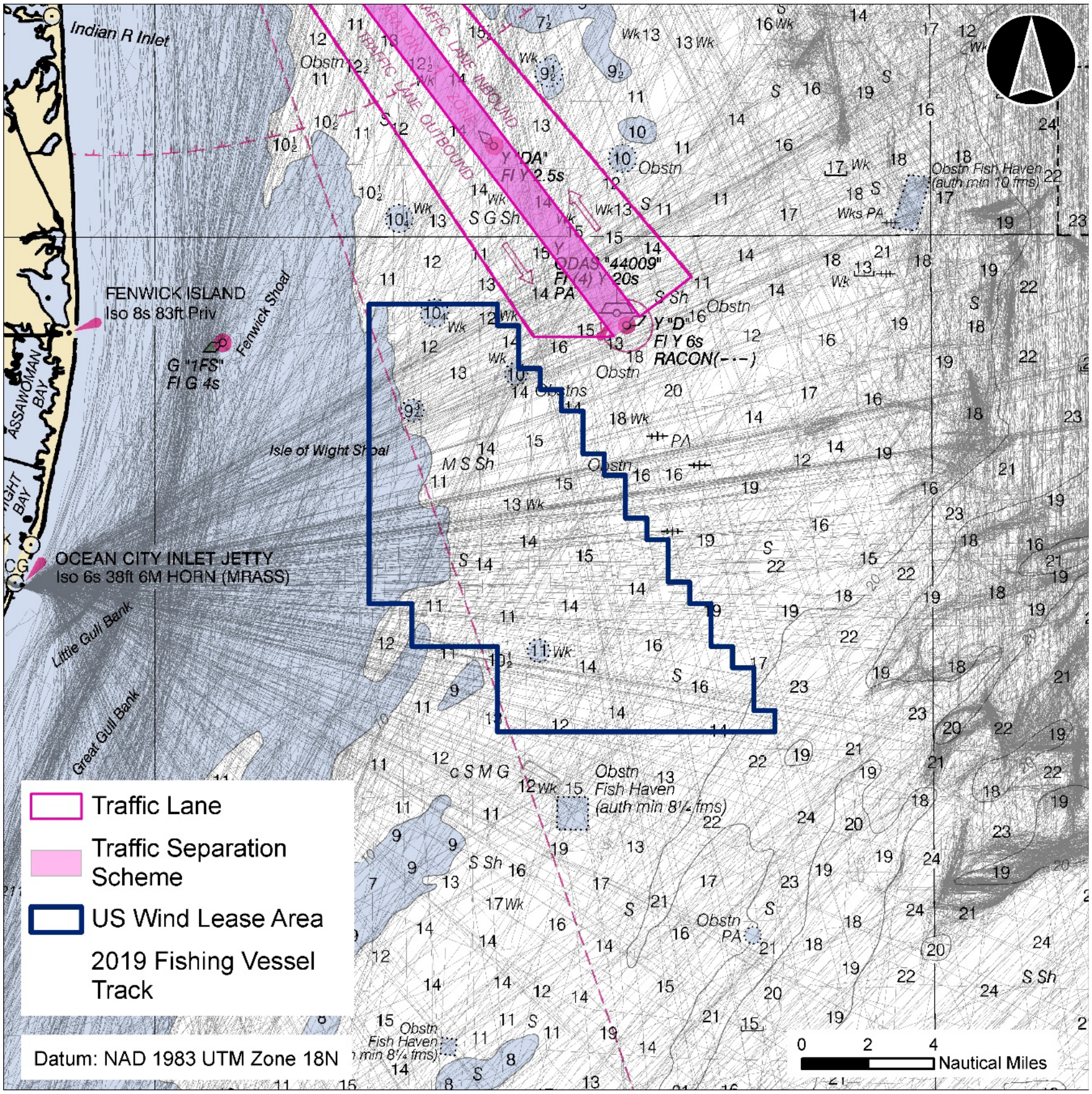


Figure 17-7. **Lease Area and 2019 Fishing Vessel Tracks. Includes AIS data for vessels classified as "Fishing" and traveling less than 5 knots (to exclude transiting vessels)**

Table 17-42. Delaware Commercial Landings Revenue, 2017 to 2020

Species	2017	2018	2019	2020	2017 - 2020 Total	Percent
Crab, blue	$7,318,230	$7,574,143	$8,479,459	$7,195,054	$30,566,886	73.3%
Oyster, Eastern	$701,035	$644,134	$994,059	$456,833	$2,796,061	6.7%
Withheld for confidentiality	$946,144	$960,824	$446,575	$329,388	$2,682,931	6.4%

Table 17-42. Delaware Commercial Landings Revenue, 2017 to 2020

Species	2017	2018	2019	2020	2017 - 2020 Total	Percent
Bass, Black Sea	$277,610	$512,794	$493,616	$429,426	$1,713,446	4.1%
Whelk, Knobbed	$237,230	$639,987	$518,137	$260,753	$1,656,107	4.0%
Bass, Striped	ND	ND	$470,237	$477,684	$947,921	2.3%
Crab, Horseshoe	ND	ND	$287,394	$218,405	$505,799	1.2%
Clam, Quahog, Northern	$101,178	$73,050	$72,566	$41,900	$288,694	0.7%
Lobster, American	$194,902	ND	ND	$85,450	$280,352	0.7%
Eel, American	ND	$96,777	$42,614	$5,722	$145,113	0.3%
Menhaden, Atlantic	$8,938	$17,082	$8,369	$15,985	$50,374	0.1%
All other species	$14,381	$25,274	$14,677	$6,348	$60,680	0.1%
Total	**$9,799,648**	**$10,544,065**	**$11,827,703**	**$9,522,948**	**$41,694,364**	**100%**

Source: NOAA Fisheries 2021
ND = no data available

Table 17-43. Maryland Commercial Landings Revenue, 2017 to 2020

Species	2017	2018	2019	2020	2017 - 2020 Total	Percent
Crab, Blue	$48,535,248	$45,307,942	$48,058,247	$33,174,255	$175,075,692	60.0%
Oyster, Eastern	$10,473,078	$6,741,398	$9,949,103	$9,209,648	$36,373,227	12.5%
Bass, Striped	$7,060,881	$6,021,992	$6,014,945	$4,535,955	$23,633,773	8.1%
Withheld for confidentiality	$5,559,224	$6,402,021	$3,970,662	$6,000,027	$21,931,934	7.5%
Scallop, Sea	$944,785	$1,208,629	$2,403,227	$1,710,241	$6,266,882	2.1%
Bass, Black Sea	$1,235,518	$1,253,816	$1,192,217	$960,083	$4,641,634	1.6%
Catfish, Blue	$920,308	$1,082,032	$1,134,435	$876,953	$4,013,728	1.4%

Table 17-43. Maryland Commercial Landings Revenue, 2017 to 2020

Species	2017	2018	2019	2020	2017 - 2020 Total	Percent
Menhadens	$648,149	$732,878	$627,099	$964,225	$2,972,351	1.0%
Clam, Soft	$1,662,770	$911,325	$212,798	$29,350	$2,816,243	1.0%
Eel, American	$1,399,552	ND	$842,812	ND	$2,242,364	0.8%
Flounder, Summer	$563,964	$608,333	$402,484	$484,708	$2,059,489	0.7%
Swordfish	$157,185	ND	$194,935	$683,600	$1,035,720	0.4%
Shad, Gizzard	ND	$555,233	$248,245	$141,590	$945,068	0.3%
Perch, White	ND	ND	$936,549	ND	$936,549	0.3%
Tuna, Bigeye	ND	ND	$570,570	$352,607	$923,177	0.3%
Tuna, Yellowfin	$394,043	$173,904	$254,642	$100,581	$923,170	0.3%
Whelk, Channeled	$12,167	$68,732	$288,222	$312,395	$681,516	0.2%
Lobster, American	$208,084	$175,993	$82,436	$80,793	$547,306	0.2%
Shark, Dogfish, Spiny	$295,487	$97,349	ND	$64,646	$457,482	0.2%
Spot	$167,147	$113,323	$44,852	$131,232	$456,554	0.2%
Crab, Horseshoe	$320,887	$46,142	ND	$65,287	$432,316	0.1%
Perch, Yellow	$93,841	$74,018	$105,487	$51,561	$324,907	0.1%
Conchs	$161,774	$14,925	$64,242	ND	$240,941	0.1%
Crab, Jonah	$73,596	$60,399	$50,866	$39,390	$224,251	0.1%
Croaker, Atlantic	$137,953	$76,944	$5,355	$2,817	$223,069	0.1%
All other species	$486,071	$258,051	$331,679	$277,141	$1,352,942	0.5%
Total	$81,511,712	$71,985,379	$77,986,109	$60,249,085	$291,732,285	100%

Source: NOAA Fisheries 2021
ND = no data available

As shown in Figure 17-8, commercial fishing revenue is relatively low in the Project area compared to areas further offshore.

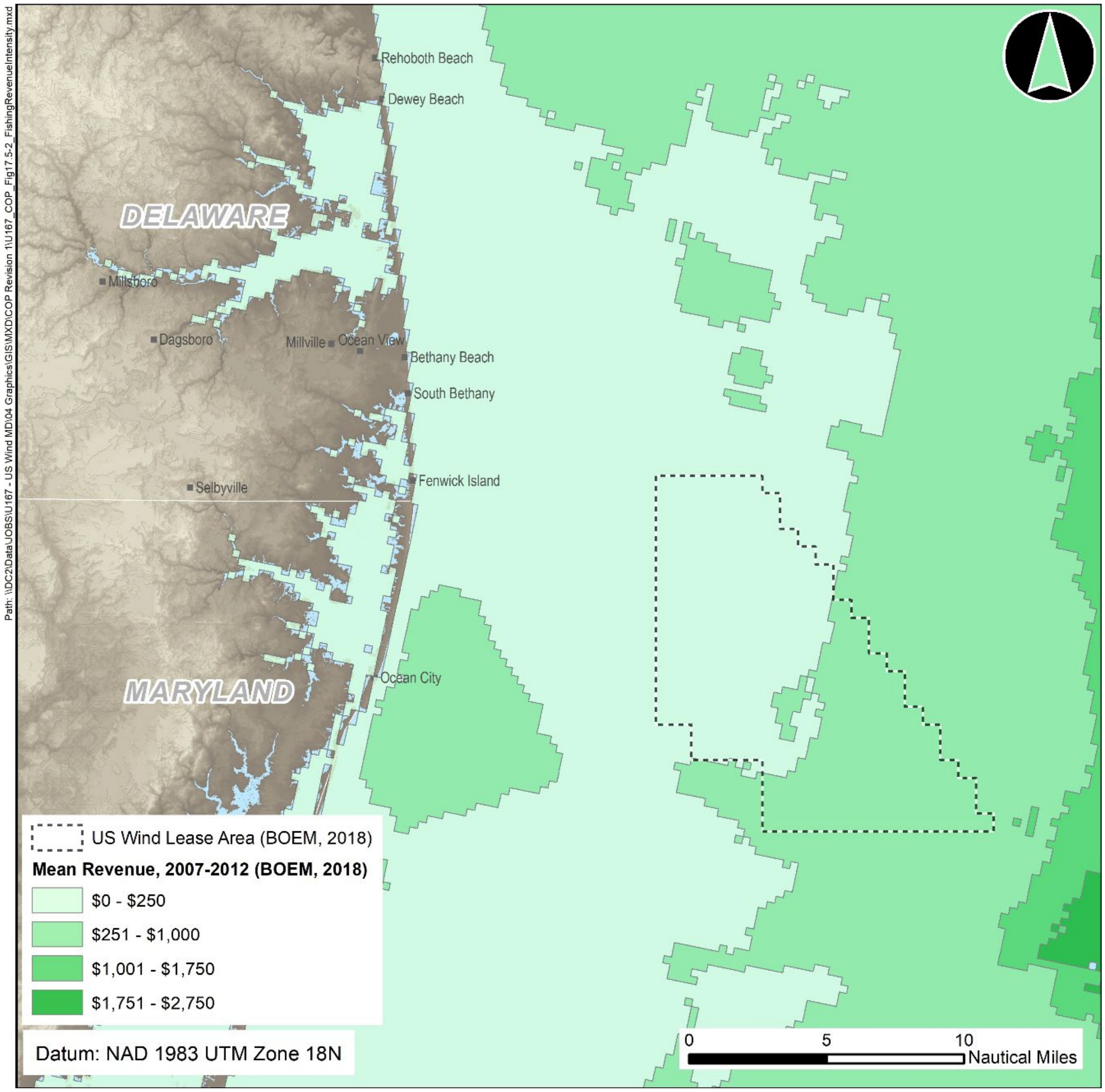


Figure 17-8. Lease Area and Revenue-Intensity Raster from Commercial Fishing Activity

As discussed in the FAR, of the ports in the region, Ocean City receives the most landings from commercial fishing within the Lease area. See Section 3 of Appendix II-F2. Vessels from Ocean City accounted for the greatest percentage of commercial fishing vessel trips to the Project area of any port from 2008 through 2019 (NOAA Fisheries 2021c, 2021e) The small commercial fishing fleet out of Ocean City is dominated by trawlers, gill netters, dredgers, and potters (MDDNR 2021a). The majority (68%) of vessels served by Ocean City are small, with a length of less than 15 m (50 ft) (NOAA NEFSC 2014). Fish packing facilities have not been active in Delaware since the 1980's, so vessels that depart from Delaware typically land their catch in Ocean City to take advantage of one of the three packing facilities as well (NOAA Fisheries n.d.). The Worcester

County Commission zoned the Ocean City harbor as a commercial marine district and oversees a commercial dock in West Ocean City (NOAA Fisheries n.d.).

Fisheries and Gear Types

US Wind contracted Sea Risk Solutions to conduct a study of fisheries and fishing activities in the Lease area (Sea Risk Solutions 2021). See section 2 of Appendix II-F2 for a detailed discussion of fisheries gear types utilized in the Lease area.

Potential Commercial Fishery Activity Exposure to Lease Area Activities

Fisheries landings data from 2008 to 2019 in the Lease area were compiled and summarized by NOAA Fisheries ((NOAA Fisheries 2021c, 2021e), Appendix II-F2). The Lease area was subdivided into two portions (western and eastern, US Wind 1 and US Wind 2, respectively) by NOAA Fisheries for the 2021 fisheries assessments ((NOAA Fisheries 2021c, 2021e), Appendix II-F2). This data informed the 2021 Sea Risk Solutions Fisheries Assessment Report.

Between 2008 and 2019, total annual fisheries revenue within the Lease area averaged $217,583, and total annual landings averaged 315,917 pounds (Table 17-44 and Appendix II-F2). While the Lease area is lightly fished and the fisheries revenue in the area is low in the context of the region, this revenue is critical to those few fishermen who derive important portions of their incomes from the Lease area (Appendix II-F2).

Table 17-44. Revenue and Landings from within the Lease Area 2008 – 2019

Year	Total Lease Area	
	Revenue	Landings (lbs)
2008	$279,000	452,000
2009	$393,000	180,000
2010	$256,000	664,000
2011	$200,000	254,000
2012	$163,000	304,000
2013	$148,000	439,000
2014	$173,000	298,000
2015	$271,000	202,000
2016	$256,000	264,000
2017	$145,000	280,000
2018	$209,000	361,000
2019	$118,000	93,000
Annual Average	**$217,583**	**315,917**

Source: Appendix II-F2
US Wind 1 and US Wind 2 combined, rounded to the nearest 1,000.

Within the Lease area, the Fishery Management Plans (FMPs) that derived the most revenue between 2008 to 2019, and were therefore the most exposed to potential impacts from development, were the sea scallop, and summer flounder, scup, and black sea bass FMPs (NOAA Fisheries 2021c, 2021e). Harvest of species for which there is no federal FMP also accounted for a significant portion of twelve-year revenue in Lease area (NOAA Fisheries 2021c, 2021e). Landings and revenue data for the most impacted FMPs, and other impacted FMPs, in each portion of the Lease area are presented in Table 17-45 (NOAA Fisheries 2021c, 2021e).

Table 17-45. Total Revenue for Most Impacted FMPs within the Lease Area, 2008 – 2019

FMP	Twelve Year Revenue	Percentage of 12-Year Revenue
Sea Scallop	$865,000	33.1%
No Federal FMP	$666,000	25.5%
Summer Flounder, Scup, Black Sea Bass	$381,000	14.6%
Surfclam, Ocean Quahog	$176,000	6.7%
Spiny Dogfish	$145,000	5.6%
Mackerel, Squid, and Butterfish	$127,000	4.9%
All Others[1]	$250,000	9.6%

Source: NOAA Fisheries 2021a and 2021b

[1] All Others indicates all FMPs not listed, including those with less than three permits or dealers impacted which were not identified in NOAA Fisheries 2021a and 2021b to protect confidentiality.

In the Lease area, sea scallops, whelk, summer flounder, surf clams, and black sea bass accounted for over 65% of 12-year revenue (Table 17-46, Appendix II-F2). Landings data for additional species, and 12-year and average annual revenue by species, are presented in Appendix II-F2.

Table 17-46. Total Revenue by Species within the Lease Area, 2008 – 2019

Species	Twelve Year Revenue	Percentage of 12-Year Revenue
Sea Scallop	$869,501	33.6%
Whelk	$284,119	11.0%
Summer Flounder	$211,209	8.2%
Surf Clam	$175,246	6.8%
Black Sea Bass	$169,040	6.5%
All Others	$880,369	34.0%

Source: Appendix II-F2

A variety of different gear types are utilized within the Lease area ((NOAA Fisheries 2021c, 2021e), Table 17-47). Though sea scallop dredging accounts for the greatest percentage of revenue of any gear type in the Lease area, revenue has declined in recent years (Appendix II-F2). Other gear types that account for significant percentages of revenue with the Lease area include bottom trawling, pot fishing (other non-lobster), and sink gillnetting (NOAA Fisheries 2021c, 2021e). The “All Others” category includes species with less than three permits or dealers impacted to protect data confidentiality. Landings data by gear type in each portion of the Lease area are presented in NOAA Fisheries (NOAA Fisheries 2021c, 2021e).

Table 17-47. Total Revenue by Gear Type within the Lease Area, 2008 – 2019

Gear Type[1]	Twelve Year Revenue	Percentage of 12-Year Revenue
Dredge-Scallop	$854,000	32.7%
Trawl-Bottom	$531,000	20.4%
Pot-Other	$462,000	17.7%
Gillnet-Sink	$226,000	8.7%
Dredge-Clam	$219,000	8.4%
All Others	$209,000	8.0%
Pot-Lobster	$60,000	2.3%
Seine-Purse	$27,000	1.0%
Longline-Bottom	$9,000	0.3%
Gillnet-Other	$11,000	0.4%
Handline	<$500	<0.01%

Source: NOAA Fisheries 2021a and 2021b

[1] "All Others" includes species with less than three permits or dealers impacted to protect confidentiality.

Nearly three quarters of fisheries revenue derived from the Lease area is landed at three ports; Ocean City, Maryland, Cape May, New Jersey, and New Bedford, Massachusetts (Appendix II-F2). A majority of all revenue from the Lease area between 2008 and 2019 was landed at the ports of Ocean City and Cape May, which are located within 25 km (16 mi) and 53 km (33 mi) of the Lease area, respectively (NOAA Fisheries 2021c, 2021e). Revenue data for the most impacted ports for each portion of the Lease area (eastern and western) are presented in Appendix II-F2.

Recreational Fishing Resources

The majority of recreational fishing in Delaware occurs in inland waters. Total catch for recreational fishing in Delaware from 2018 to 2021, including observed harvest, reported harvest, and released fish is included in Table 17-48. Top species by catch include summer flounder, bluefish, black sea bass, and white perch. For each of the top twelve species by catch, over 60% of the catch occurred in inland waters for all species except black sea bass, striped mullet, and smooth dogfish (NOAA Fisheries 2021e).

US Wind contracted Sea Risk Solutions to conduct a study of fisheries and fishing activities in the Lease area (Sea Risk Solutions 2021). See section 4.1 of Appendix II-F2 for a discussion of recreational fishing in the Lease area include sport fishing opportunities such as world-famous fishing tournaments for billfishes and tunas. Tournaments include the White Marlin Open, the Big Fish Classic, the Ocean City Tuna Tournament, the Ocean City Marlin Club Canyon Kickoff and the Heels and Reels Tournament.

The most important offshore fishing ground in the vicinity of the Project area is located offshore of Delaware. This area, known for its rocky bottom and corals, is referred to as the “Old Grounds.” The Old Grounds is heavily used for recreational and for-hire charter fishing, primarily targeting winter flounder, summer flounder, black sea bass, tautog, and red hake.

Artificial reefs have been established offshore to provide substrate that encourages growth of marine invertebrates and provides protection for crustaceans and fish. They also provide recreational fishing opportunities. The reef locations are shown in Figure 17-9. None are located within the Lease area. Offshore Export Cable Corridor 2 could potentially intersect with a currently unused portion on an artificial reef and fish haven location. US Wind enlarged Offshore Export Cable Corridor 2 to avoid this area, in case future efforts are undertaken to expand the area of structure within the artificial reef. Charted wreck sites that may also create artificial habitat are shown in Figure 17-9.

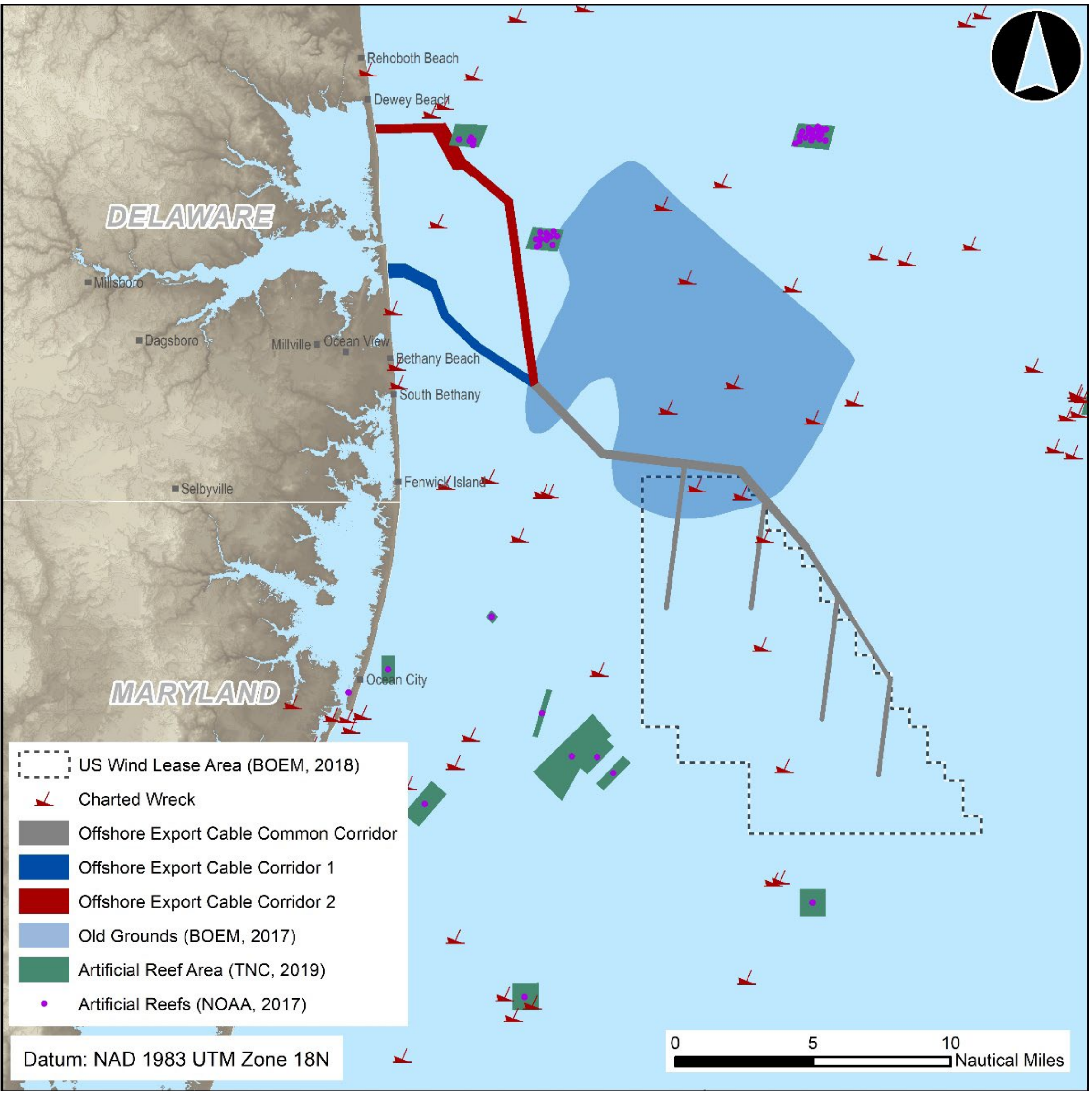


Figure 17-9. Location of Old Grounds Fishing Area and Artificial Reefs

Table 17-48. Delaware Recreational Fishing Total Catch, 2018 to 2021

Species	Ocean > 3 mi		Ocean <= 3 mi		Inland		Total	
	Catch (# individuals)	Percent of species catch	Catch (# individuals)	Percent of species catch	Catch (# individuals)	Percent of species catch	Catch (# individuals)	Percent of Grand Total
Atlantic Croaker	50,742	6%	56,337	6%	807,986	88%	915,065	3.08%
Summer Flounder	769,211	33%	56,411	2%	1,499,017	64%	2,324,639	7.81%
Bluefish	52,042	4%	524,269	35%	903,569	61%	1,479,880	4.97%
Black Sea Bass	1,717,529	65%	25,342	1%	902,526	34%	2,645,397	8.89%
White Perch	NP	0%	3,725	0%	2,113,592	100%	2,117,317	7.12%
Spot	NP	0%	161,218	15%	898,274	85%	1,059,492	3.56%
Striped Bass	45,651	4%	84,624	6%	1,173,652	90%	1,303,927	4.38%
Tautog	149,181	11%	38,025	3%	1,222,324	87%	1,409,530	4.74%
Oyster Toadfish	24,738	3%	9,169	1%	893,856	96%	927,763	3.12%
Channel Catfish	NP	0%	NP	0%	496,277	100%	496,277	1.67%
Smooth Dogfish	76,994	14%	172,114	32%	288,431	54%	537,539	1.81%
Striped Mullet	NP	0%	44,404	81%	10,439	19%	54,843	0.18%

Table 17-48. Delaware Recreational Fishing Total Catch, 2018 to 2021

Species	Ocean > 3 mi		Ocean <= 3 mi		Inland		Total	
	Catch (# individuals)	Percent of species catch	Catch (# individuals)	Percent of species catch	Catch (# individuals)	Percent of species catch	Catch (# individuals)	Percent of Grand Total
All other Species	3,033,421	21%	1,136,800	8%	10,307,174	71%	14,477,395	48.67%
Grand Total	**4,311,822**	**13%**	**5,001,251**	**15%**	**24,674,898**	**73%**	**29,749,064**	**100.00%**

Source: NOAA Fisheries 2021
NP= Species is not present/not taken from the area

In the Delaware Inland Bays, over 200,000 recreational fishing trips are made per year (DCIB 2016). In Indian River Bay, fishing access areas include Rosedale's Beach, Massey Landing, Holts Landing, Indian River Marina, and Indian River Inlet. Rosedale's Beach is located at the base of Indian River; Massey Landing and Holts Landing are located near the center of the Bay, on the north and south shores, respectively; and Indian River Marina is located to the east of Indian River Inlet (DNREC 2017a).

The vast majority of recreational fishing in Maryland also occurs in inland waters such as lakes, rivers and inland bays. Total catch for recreational fishing in Maryland from 2018 to 2021 is included in Table 17-49. Top species by catch include white perch, striped bass, and spot. For each of the top twelve species by catch, over 80% of the catch occurred in inland waters for all species except bluefish and black sea bass (NOAA Fisheries 2021e). The density of recreational fishing vessels that included federally permitted party boats and charter boat trips is illustrated in Figure 17-10.

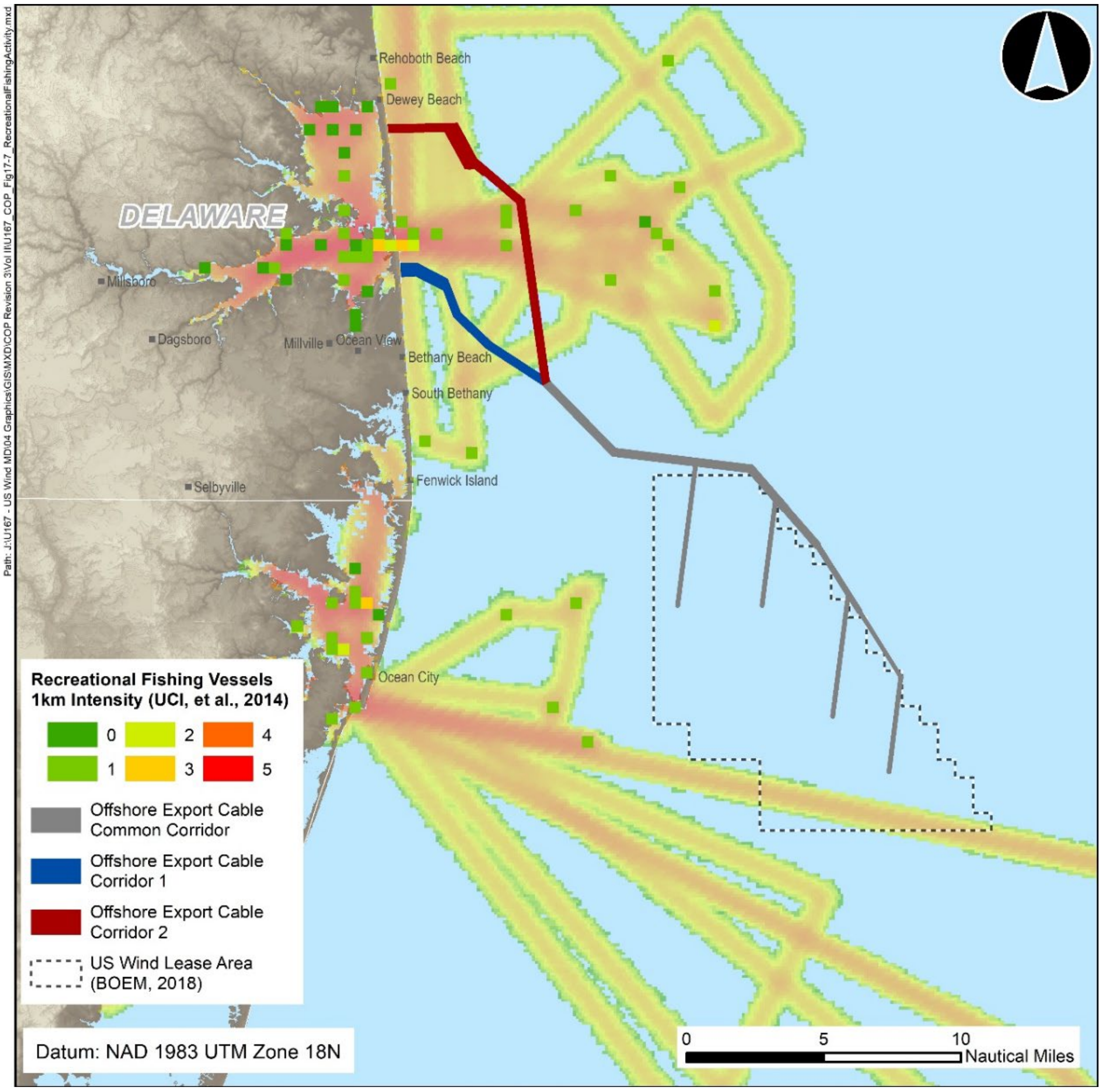


Figure 17-10. Recreational fishing vessel activity in the Project Area

Table 17-49. Maryland Recreational Fishing Total Catch, 2018 to 2021

Species	**Ocean > 3 mi**		**Ocean <= 3 mi**		**Inland**		**Total**	
	Catch (# individuals)	**Percent of species catch**	**Catch (# individuals)**	**Percent of species catch**	**Catch (# individuals)**	**Percent of species catch**	**Catch (# individuals)**	**Percent of Grand Total**
White Perch	NP	0%	NP	0%	39,872,049	100%	39,872,049	15.68%
Striped Bass	17581	0%	46,233	0%	26,223,121	100%	26,286,935	10.34%
Spot	66	0%	121,085	0%	24,172,004	100%	24,293,155	9.56%
Atlantic Croaker	16,792	0%	36,755	1%	6,592,912	99%	6,646,459	2.61%
Channel Catfish	NP	0%	NP	0%	9,236,335	100%	9,236,335	3.63%
Largemouth Bass	NP	0%	NP	0%	2,368,920	100%	2,368,920	0.93%
Summer Flounder	417,826	13%	67,049	2%	2,628,975	84%	3,113,850	1.22%
Black Sea Bass	1,449,363	28%	42,557	1%	3,601,666	71%	5,093,586	2.00%
Bluefish	50,334	3%	336,188	20%	1,327,997	77%	1,714,519	0.67%
Yellow Perch	NP	0%	NP	0%	1,786,285	100%	1,786,285	0.70%
Hickory Shad	NP	0%	NP	0%	168,650	100%	168,650	0.07%
Tautog	82,462	6%	107,034	8%	1,130,785	86%	1,320,281	0.52%
All other species	3,007,663	2%	885,265	1%	128,448,645	97%	132,341,573	52.05%
Grand Total	**5,042,087**	**2%**	**1,642,166**	**1%**	**247,558,344**	**97%**	**254,242,597**	**100.00%**

Source: NOAA Fisheries 2021
NP= Species is not present/not taken from the area

Potential Recreational Fishery Activity Exposure to Lease Area Activities

As referenced in the above discussion of potential commercial fishery exposure to Lease area activities, a BOEM study (Kirkpatrick et al. 2017) assessed existing recreational fisheries-related activities in the Lease area for exposure to wind energy development. It also assessed exposure of shoreside dependents, which include businesses that directly support (e.g. gas stations, bait and ice dealers, transportation, etc.) and/or use the landings of commercial and recreational fisheries (e.g. first point of sale dealers, etc.). Data in the study specific to recreational fisheries activities conducted and/or related to recreational fishing within the Lease area are summarized below.

Table 17-50 summarizes recreational fishery activity exposure by state in terms of for-hire boat trips, for-hire angler trips, private angler trips, and total expenditures. Recreational fishing activity was considered exposed if it occurs on or near the Lease area. Shore-based fishing is not included as these anglers will not, most likely, be exposed to Lease area development activities. Recreational fishing activity exposure, attributable to the Lease area, range from less than one percent to less than seven percent of activity totals in each category. Overall, expenditures for recreational fishing trips are most exposed in New Jersey, at 6.8 percent of total expenditures (Kirkpatrick et al. 2017).

Table 17-50. State-Level Average Annual Exposure of Recreational Fishery to Lease Area, 2007-2012

State	Total For-Hire Boat Trips	Percent Total For-Hire Boat Trips Exposed	Total For-Hire Angler Trips	Percent Total For-Hire Angler-Trips Exposed	Total Private Boat Angler-Trips	Percent Total Private-Boat Angler-Trips Exposed	Total Expenditures (private boat and for-hire)	Percent Total Expendi-tures Exposed
MD	696	6.3	12,422	6.6	1,704,515	0.36	$16,122,478	2.9
DE	1,093	1.7	12,512	2.6	522,766	4.53	$19,771,177	5.0
NJ	8,177	0	153,989	0	3,028,511	1.56	$44,135,406	6.8

Source: Kirkpatrick et al. 2017

Table 17-51 shows that Ocean City, Maryland and Indian River, Delaware, the ports closest to the Project area, had the highest number of for-hire boat trips exposed to the Lease area per year during the BOEM report study period. For both ports, these exposed trips were a small percentage of total for-hire trips. Cape May, New Jersey had the highest total exposure for angler trips (both for-hire and private) and angler expenditures (Kirkpatrick et al. 2017).

Table 17-51. Lease Area Average Annual Private Boat and For-Hire Recreational Exposure by Port Group, 2007-2012

Port Group	Exposed For-Hire Boat Trips	Percent For-Hire Boat Trips Exposed	Exposed For-Hire Angler-Trips	Exposed Private Boat Angler-Trips	Percent Total Angler-Trips Exposed	Total Expenditures (Private Boat and For-Hire)	Percent Total Expenditures Exposed
Maryland							
Ocean City	44	6.3	823	4,364	2.3	$12,328,325	3.1
Pocomoke City	0	0	0	1,767	2.0	$3,794,153	2.0
Delaware							
Indian River	18	5.2	316	5,512	6.0	$4,473,090	6.1
Lewes	~0	~0	2	8,424	5.7	$6,813,618	4.9
Milford	~0	7.7	1	0	~0	$2,092,891	~0
Other Sussex	~0	1.0	~0	9,726	6.0	$6,391,579	6.0
New Jersey							
Cape May	1	~0	7	47,348	9.7	$32,011,401	9.4
Ocean City	~0	0.1	2	0	~0	$1,646,222	~0
Sea Isle City	~0	0.1	10	0	~0	$2,373,273	~0
Wildwood	~0	0.1	8	0	~0	$8,104,510	~0
Total	**63**	**0.4**	**1,168**	**77,141**	**5.4**	**$80,029,061**	**5.6**

Source: Kirkpatrick et al. 2017

The study concluded that generally neither recreational fisheries, nor their shoreside dependents, are highly exposed to development of the Lease area (Kirkpatrick et al. 2017).

17.5.2 Impacts

17.5.2.1 Construction

Activities associated with Project construction have the potential to impact commercial and recreational fisheries, though these impacts are expected to be minor and temporary.

US Wind has partnered with the University of Maryland Center for Environmental Science (UMCES) on a study of commercial and recreational fisheries. The primary goal of the 8-year UMCES Fishery Resource Monitoring program is to evaluate how Ocean City Maryland commercial and recreational fisheries for black sea bass will adapt and be impacted by the Project. Wind turbine foundations will add three-dimensional structure where very little currently exists. Under these new conditions, highly aggregated distributions of black sea bass centered on turbines are expected to result in increased catches by commercial and recreational fisheries. Additionally, black sea bass sensitivity to the percussive and vessel noises associated with turbine construction could cause dispersal from turbine and project regions resulting in short-term disruptions in catch. Commercial and recreational fishers are working with the UMCES team to evaluate changed black sea bass catch rates between 2-year periods: before, during, and after turbine construction within the project area, beginning in 2023. Monitoring designs utilize Before-After-Gradient and Before-After-Control-Impact procedures testing hypothesized changes in catch amplitude and variance. The commercial pot survey consists of rigs of 15 commercial pots each, with pots spaced proximate and distant to turbine structures to capture both turbine- and project-scaled changes in black sea bass catch rates. Monthly pot surveys (Mar-Nov) of six rigs, four in the project area and two in an adjacent control area, deploy ropeless EdgeTech devices to avoid whale and turtle entanglements. Statistical power analysis during an initial trial year (2022) showed that the sampling design supports detecting a >4-fold increase in catch rates. The recreational survey compares two existing well-fished artificial reef sites (control) to two turbine sites during monthly surveys (May-Oct) through standardized bottom drift and jig angling techniques. Both commercial and recreational surveys examine patterns of black sea bass colonization to new foundations as well as size, sex and diet metrics during all phases of the study.

Habitat Alteration

Construction activities, including cable burial, cofferdam installation, and contact of anchors and jack-up vessels with the seafloor, will temporarily alter habitat in the area. Benthic organisms located in the path of the jet plow, beneath jack-up vessel legs, in areas of anchor chain sweep, and within cofferdam footprints, will likely experience mortality. However, these impacts will be temporary and localized, as seafloor habitats are expected to undergo rapid physical and biological recovery following disturbance (Refer to Volume II, Section 7.0).

The installation of WTGs, OSSs, Met Tower, scour protection, and cable protection (in areas where cable burial depth is insufficient) will result in direct mortality to organisms located in the footprint of these structures, as well as long-term impacts to the benthic community resulting from conversion of soft sediment habitat to hard substrate (Refer to Volume II, Section 7.0). The area impacted by these activities will be limited and commercial and recreational fisheries are not expected to be impacted.

The offshore export cables and up to four WTGs with associated inter-array cables may be located within the Old Grounds recreational fishing area. As all of the primary species of interest in this area are demersal, Project construction may have temporary minor impacts on recreational fishing in this area. It is expected that demersal fish will temporarily move out of the Project area during active construction and return after construction noise and sediment disturbance have stopped (See Volume II, Section 8.0).

Noise and Suspended Sediment/Deposition

Exposure to elevated sound levels associated with construction activities, including vessel and pile driving noise, is expected to have negligible to minor impacts on fish, and therefore commercial and recreational fisheries, within the Project area. Fish are likely to respond to this activity by temporarily avoiding the area of the sound source (Refer to Volume II, Section 8.0).

Similarly, Project activities, including the installation of onshore export cables in Indian River Bay, have the potential to result in temporary and localized increases in suspended sediment concentrations. These water quality changes could impact finfish, and individuals are likely to vacate the area immediately surrounding Project activities (Refer to Volume II, Section 8.0). As avoidance behavior in response to noise and water quality changes will be temporally limited, impacts on commercial and recreational fishing will be negligible.

Space-Use Conflicts

US Wind does not propose any long-term vessel exclusions during construction of the Project. Temporary exclusion areas, including fishing restrictions, will occur in the area of offshore construction activities for safety reasons. Restrictions would be temporary and are anticipated to have negligible impact on commercial and recreational fisheries.

Modest increases in vessel traffic will occur in and around ports used for Project mobilization. However, these temporary changes are unlikely to impact either commercial or recreational fisheries activity. Where feasible, space-use conflicts will be mitigated through the implementation of best management practices (BMPs) as described in BOEM’s 2014 report on this topic (Ecology and Environment Inc. 2014).

One of the BMPs for commercial wind energy development identified by BOEM is that a lessee designate a Fisheries Liaison and develop a fisheries communication plan (BOEM 2015). The plan, which is implemented with the assistance of the liaison, allows Lessees to acquire information from representatives of the fishing community and to fully consider the impacts of construction and operation of proposed facilities throughout the life of the Project. US Wind contracted Sea Risk Solutions as the Fishing Liaison Officer. Sea Risk Solutions developed a Fisheries Communication Plan for US Wind to address installation, operation, and decommissioning of the Project as well as activities prior to Project construction such as surveys and deployment of the Metocean Buoy (Appendix II-F1). The Fisheries Communication Plan identifies the Fisheries Liaison who serves as US Wind’s outreach representative to the fishing industry and two Fisheries Representatives who represent the local fishing community. A summary of meetings that US Wind has conducted with the fishing community will be included in the stakeholder engagement summary (Appendix II-L2).

17.5.2.2 Operations

Habitat Alteration

The addition of man-made structures to the marine environment, in the form of WTG, OSS and Met Tower foundations and scour protection, will have long term impacts on finfish and shellfish. These structures will provide new habitat, of a type previously absent from the Project area, for the duration of operation. WTG foundations are likely to act as vertical artificial reef systems and fish aggregation devices (see Volume II, Section 8.0). The addition of submerged infrastructure may also result in the organic enrichment of sediments surrounding WTGs, OSSs and Met Tower, which could result in changes to the benthic community (See Volume II, Section 7.0). These impacts will likely be highly localized and are likely to have only minor impacts on commercial fishing activities in the region and is expected to attract recreational fishing.

EMF

While in operation, export and inter-array cables will produce electromagnetic fields (EMFs). Some marine fishes are able to detect EMFs. However, exposure to EMF will be limited by cable shielding and burial, and any impacts to commercial and recreational fisheries from EMFs are expected to be minor and short-term (See Volume II, Section 8.2.2). A site-specific study of potential impacts of EMF found electric fields produced by the operation of project cables to be below the reported detection thresholds for electrosensitive marine organisms (Exponent 2023).

Space-Use Conflicts and Noise

US Wind does not plan to establish any long-term vessel exclusion areas around WTGs, OSSs, Met Tower or other structures during operation of the Project. Temporary and localized fishing and navigation restrictions may be necessary in the immediate area of Project maintenance activities. Noise resulting from maintenance activities has the potential to elicit avoidance responses from fish. However, as fish are expected to rapidly return to these areas following completion of maintenance actions, these activities are not anticipated to impact commercial or recreational fisheries.

The addition of Project components (WTGs, OSSs and Met Tower) will introduce new structures within the Lease area and will result in increased vessel allision risk (see Appendix II-K1). However, these structures will be widely spaced, lit, and marked per USCG guidelines. These factors, coupled with sound boat handling practices, will minimize potential risks to navigation.

The use of mobile gear within the Lease area and along the offshore export cables is unlikely to be restricted during Project operations, as cables will be buried 1 to 4 m (3 to 13 ft) below the seafloor. In areas where sufficient burial depth is not attainable, cable protection in the form of concrete mattresses or rock will be installed. These materials may present a risk for gear entanglement. However, burial is the preferred cable protection approach, and cable protection will be minimized to the greatest extent practicable.

17.5.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Removal of Project structures would alter the benthic environment and fish habitat in the Lease area by removing hard substrates. This change would result in mortality to organisms attached to Project structures, and displacement of organisms utilizing Project structures for habitat, but would reestablish baseline pre-construction conditions. Fish are also likely to temporarily avoid the area immediately surrounding removal activities in response to vessel and equipment noise. Impacts from these activities would be similar to those described above for construction.

17.6 Other Uses

17.6.1 Description of Affected Environment

Marine Minerals

Following the 1994 amendments to the OCSLA, BOEM may offer and enter into a noncompetitive, negotiated lease to mine sand, shell, or gravel located in marine environments for certain types of projects that receive funding or authorization from the Federal Government. The primary function of BOEM's marine minerals program as such is identifying and mining sand on the OCS to be used for beach nourishment and coastal restoration projects (USDOI and BOEM 2012). Most of the area between the Lease area and the Submerged Lands Act boundary is considered to contain sand resources. The Isle of Wight Shoal; Fenwick Shoal; Weaver Shoal; and Shoals

A, B, C, D are located in this area, and the Delaware Sand Resource Area is located further north, offshore from the location of the Barrier Beach Landfalls (USDOI and BOEM 2014).

Sediment in these areas ranges from poorly to very well sorted sands, and the mean grain size of sediment in these areas is medium sand or greater. Weaver Shoal and Isle of Wight Shoal are suitable sources for replenishing sand on beaches in Ocean City and Assateague Island. It is estimated that there are more than 253 million cubic m (8,934 million cubic ft) of sand with high resource potential and more than 100 million cubic m (3,521 million cubic ft) of sand with moderate resource potential in the Maryland sand borrow areas and 35 million cubic m (1,236 million cubic ft) of usable sand resources in the Delaware Sand Resource Area (Louis Berger Group Inc. 1999). A small portion of Offshore Export Cable Corridor 1 overlaps with the northeast corner of Borrow Area C, as well as the southwest corner of Borrow Area G before making landfall (Figure 17-11). Borrow areas C and G are currently inactive. Fenwick Shoal is currently a proposed sand resource area and is a concern of both USACE and BOEM (Figure 17-12). The portion of the shoal that falls offshore of Delaware is approximately 44.3 km^2 (10,940 acres), of which Offshore Export Cable Common Corridor occupies approximately 3.0 km^2 (753 acres), or 6.9%.

During the drafting of the offshore export cable corridors, great care was taken to avoid sand borrow areas and sand resource areas. However, due to the proximity of these areas to each other and the location of the USCG anchorage area (to the north of the Lease area), avoiding sand borrow and resource areas entirely is not feasible. Communication with BOEM’s marine minerals program and the USACE indicated that encroachment on the inactive sand borrow areas would be acceptable given that no active areas are impacted. In correspondence with USACE in the initial stages of the 408 Request, USACE requested that Offshore Export Cable Common Corridor be moved north to avoid the Fenwick Shoal, a move that is not practicable or feasible due to the newly established USCG anchorage area to the north (see Figure 17-12).

Utilities

There are no known or documented submerged cables, pipelines or military seabed assets in the vicinity of the Project area. Two offshore wind energy lease areas are located to the north of US Wind’s Lease area: OCS-A 0519, under Skipjack Offshore Energy, LLC, and OCS-A 0482 under GSOE I, LLC.

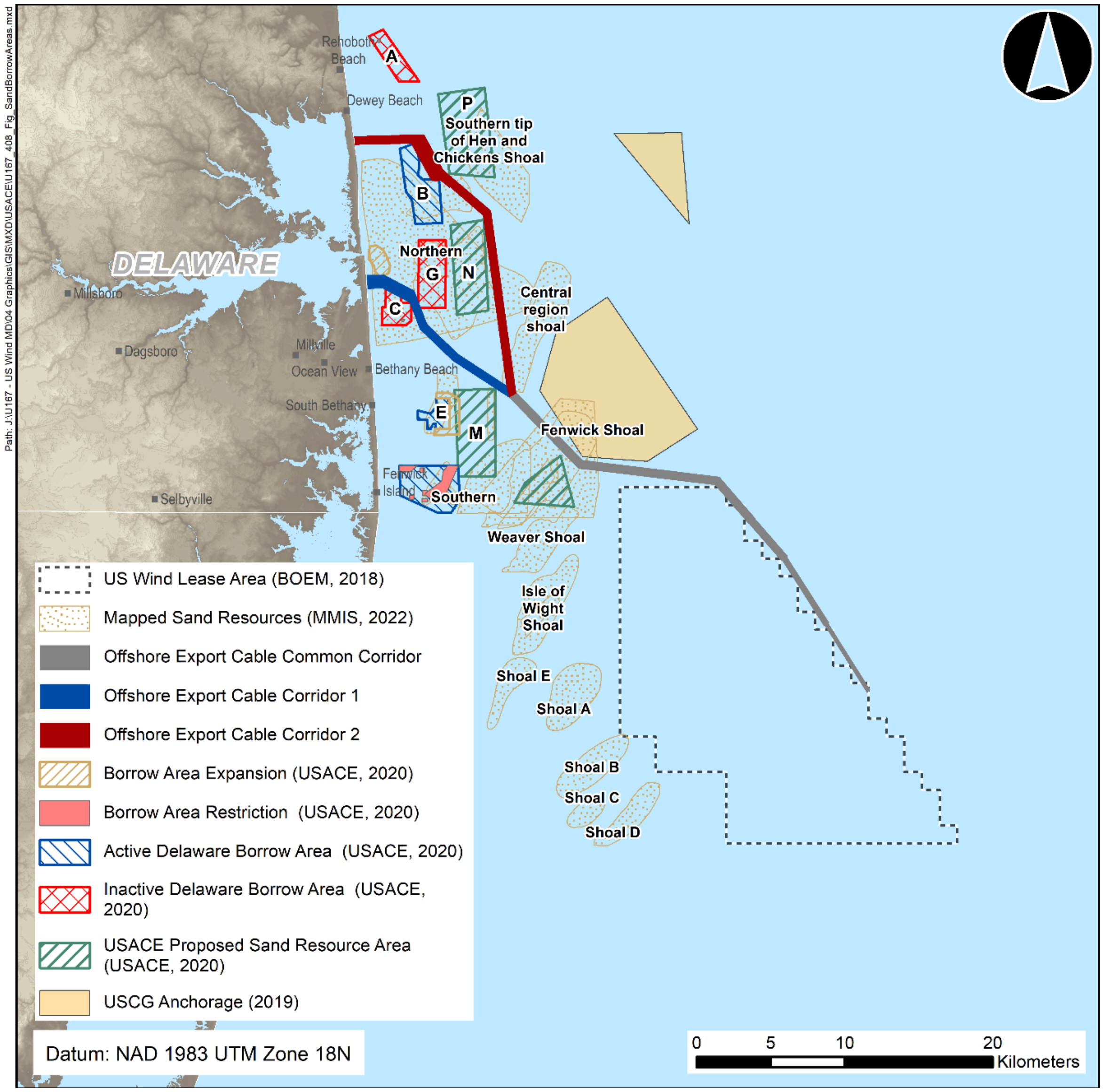


Figure 17-11. Sand Borrow Areas

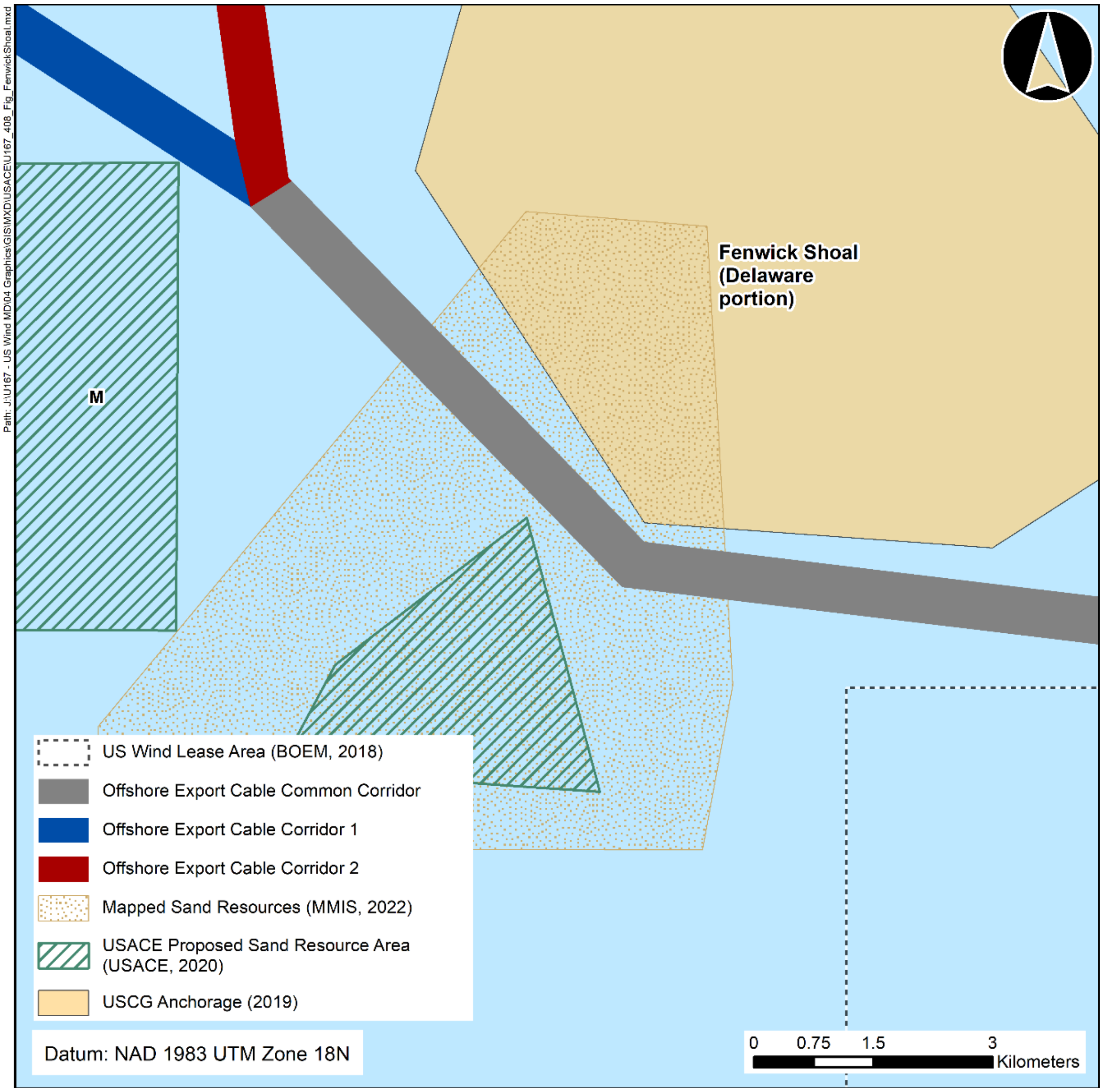


Figure 17-12. Offshore Export Cable Corridors through Fenwick Shoal

17.6.2 Impacts

17.6.2.1 Construction

Marine Minerals

It is not anticipated that construction will interfere with marine minerals operations. Active mineral resources are not present in the Lease area, and construction barges will be part of routine traffic passing by the borrow areas offshore Ocean City. No sand resource (borrow) areas have been identified in the vicinity of the Lease area (USDOI and BOEM 2012). Offshore Export Cable Corridor 1 overlaps a small portion of two inactive sand borrow areas (Borrow Areas C and G) (Figure 17-10). US Wind will coordinate with the United States Army Corps of Engineers (USACE) and others to address as necessary. USACE Proposed sand resource areas have been identified to the west of the Lease area.

Utilities

It is not anticipated that construction will interfere with offshore utilities. No submerged cables or pipelines have been identified in the Project area. The proposed Offshore Export Cable Corridors and vessel routes avoid crossing any neighboring wind energy lease areas. US Wind is willing to coordinate with appropriate parties about future submarine cable crossings as needed.

17.6.2.2 Operations

The Offshore Export Cable Corridors have been designed to avoid active and inactive sand borrow areas to the extent practicable. Due to other constraints in locating the Offshore Export Cable Corridors (See Volume I, Figure 2-1), there are several sections that would be in close proximity to and potentially overlap with existing active and inactive sand borrow areas. US Wind will coordinate with the United States Army Corps of Engineers (USACE) and others to address as necessary.

17.6.2.3 Decommissioning

Decommissioning involves the removal of WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system. Decommissioning impacts are expected to be similar to construction impacts. It is not anticipated that decommissioning will impact marine mineral resources or offshore utilities.

17.7 Mitigation and Monitoring

US Wind will implement the following mitigation measures to reduce Project impacts on socioeconomic resources.

- US Wind will work with local officials to develop a traffic management plan to reduce impacts to local traffic during construction.
- US Wind will concentrate onshore construction activities outside of the summer recreation season to the greatest extent practicable and will coordinate with DNREC Parks and Recreation to minimize interference with beach activities.
- US Wind will coordinate with local stakeholders to develop opportunities for eco-tourism related to the Project.
- US Wind has sited and developed Project elements to minimize disturbance to resources, to the extent practicable, enjoyed by residents of and visitors to the region.
- Onshore cables and facilities at the Barrier Beach Landfalls will be buried.
- US Wind developed a Fisheries Communication Plan, in conjunction with the designated Fisheries Liaison Officer and will work with fisheries stakeholders to update it as appropriate.
- US Wind established a process for gear loss compensation for commercial fishermen.

- US Wind will work cooperatively with commercial/recreational fishing entities and interests to review planned activities and ensure that the construction and operation activities will minimize potential conflicts.
- US Wind will conduct pre- and post-construction monitoring for regionally important species, in a partnership with the University of Maryland Center for Environmental Science to study black sea bass, to identify commercial and recreational fishing impact.
- US Wind will implement practices and operating procedures to reduce the likelihood of vessel accidents and fuel spills. An Oil Spill Response Plan has been prepared and will be implemented for construction and for operations activities.
- WTGs, OSSs, and the Met Tower will be marked per USCG guidelines in consultation with USCG, BOEM and other regulatory agencies as appropriate.
- Submarine cables will be buried and regularly inspected to maintain cable burial.
- Conduct a site-specific study of potential EMF impacts on electrosensitive marine organisms.
- Route Offshore Export Cable Corridors to avoid marine mineral resources areas to the extent practicable.
- US Wind is committed to creating full and equitable business opportunities for minority, women-owned, veteran-owned, and HUBZone businesses in the development of the Project.
- US Wind has hired a team of MBE participation and compliance experts to lead the company’s outreach efforts to minority businesses and community organizations.
- US Wind is coordinating with area organized labor organizations to develop a skilled local workforce for the Project.
- US Wind has a strong interest in the welfare of workers employed by the construction managers, contractors and subcontractors on all components of the Project.
- US Wind is committed to achieving substantial involvement of Maryland-based small businesses in all phases of the Project.
- US Wind is committed to creating opportunities for Delaware-based companies able to deliver supply chain components and/or perform on-site work in Delaware.
- US Wind has a particular focus on creating meaningful economic opportunities for environmental justice communities in the Baltimore, Maryland area.
- US Wind will support workforce initiatives that are focused on providing support to minority and low-income populations, women, veterans, and underserved communities.

18.0 Coastal Zone Management Consistency

The Coastal Zone Management Act authorizes states to manage the development and use of coastal waters and adjacent lands. The Act authorizes the state to conduct a consistency review of federal actions that may affect a state's coastal uses and/or resources. In accordance with the Coastal Zone Management Act, US Wind has sought to avoid or minimize impacts to environmental and coastal resources throughout the siting, design, and development of the Project. Accordingly, US Wind provides consistency certifications pertaining to Subparts D and E herein. 16 USC 1451; 15 CFR Part 930.

The Project has been sited and designed, and will be constructed and operated, in a manner that is consistent with the applicable Maryland Department of Natural Resources (DNR) Coastal Management Program (CMP) Enforceable Coastal Policies. The policies were approved by the NOAA on October 19, 2020 (Effective July 6, 2020). The policies that are relevant to the Project are provided in Appendix II-M1 and are accompanied by a brief description of the Project consistency with the policies. This is a voluntary submission as the Project is outside of the Maryland coastal zone (7 Del. C. c: 5104 § 1.3).

The entire state of Delaware has been designated as the Coastal Zone Management Area. The Act authorizes the state to conduct a consistency review of federal actions that may affect Delaware's coastal uses and/or resources. In addition, portions of the Project are within the Delaware Coastal Zone, which generally runs the length of the state along the Delaware River, the Delaware Bay, the Inland Bays and the Atlantic Ocean. US Wind is therefore required to submit a coastal zone management consistency certification for the Project for the state of Delaware. The US Wind Project has been sited and designed, and will be constructed and operated, in a manner that is consistent with the applicable DNREC Coastal Management Program (CMP) policies (updated November 2018). The policies that are relevant to the Project are provided in Appendix II-M2 and are accompanied by a brief description of the Project consistency with the policies.

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