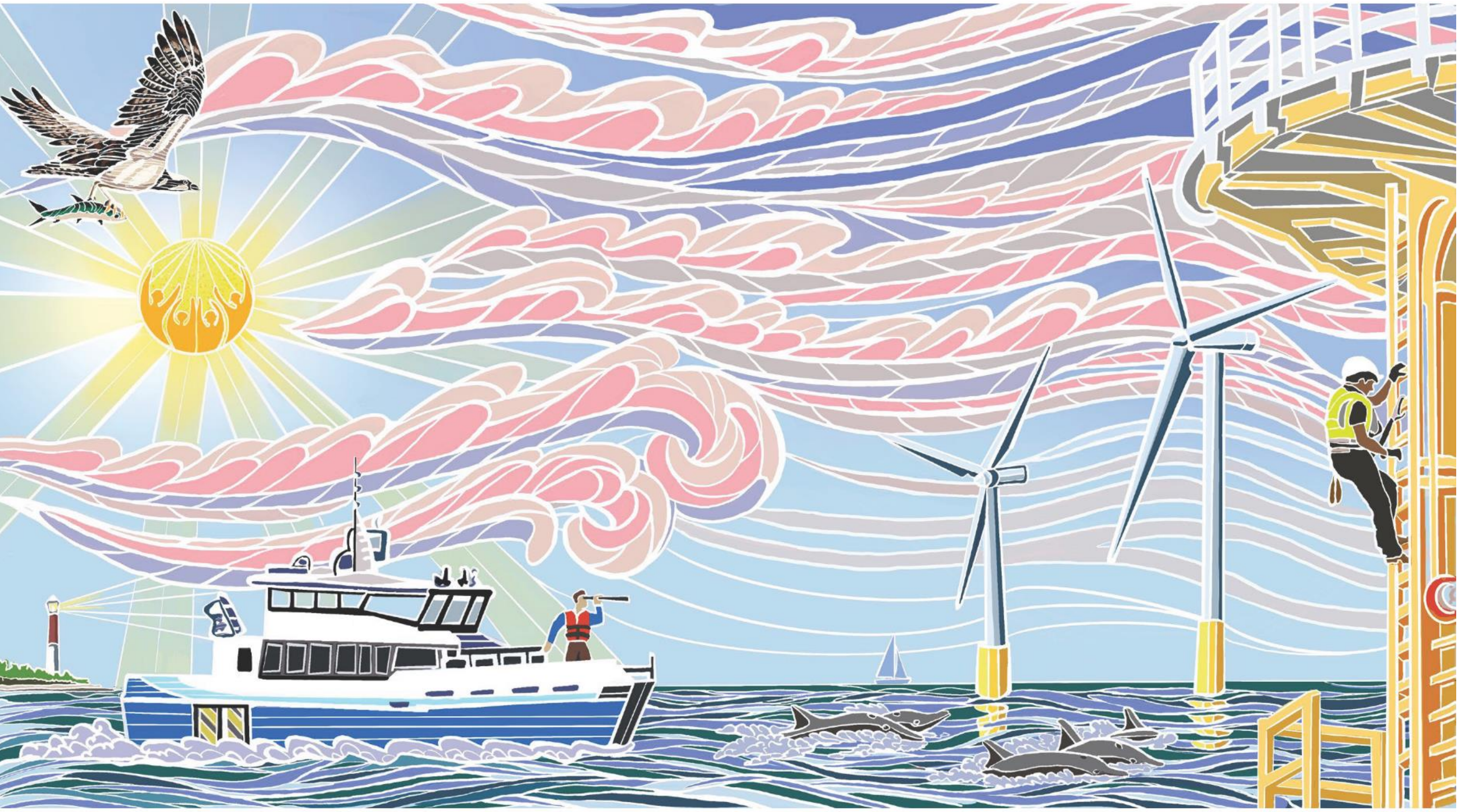
Atlantic Shores Offshore Wind

Construction and Operations Plan

Lease Area OCS-A 0549



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Volume I: Project Information

Submitted by:

ATLANTIC SHORES offshore wind

Submitted to:

BOEM Bureau of Ocean Energy Management

Prepared by:

EDR a better environment

Epsilon Associates Inc.

April 2022
Revised March, September, and December 2023

CONSTRUCTION AND OPERATIONS PLAN

Lease Area OCS-A 0549

Atlantic Shores North

Volume I Project Information

Submitted to:

Bureau of Ocean Energy Management
45600 Woodland Rd
Sterling, VA 20166

Submitted by:

Atlantic Shores Offshore Wind

Prepared by:

Environmental Design & Research,
Landscape Architecture, Engineering & Environmental Services, D.P.C.

Epsilon Associates, Inc.

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List of Acronyms and Abbreviations

ACE	Atlantic City Electric
ACP	American Clean Power Association
ACPARS	Atlantic Coast Port Access Routing Study
AHTS	Anchor Handling Tug Supply
AIS	Automatic Identification System
ADLS	Aircraft Detection Lighting System
APE	Area of Potential Effect
API	American Petroleum Institute
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CO_2e	Carbon Dioxide Equivalent
COP	Construction and Operations Plan
CTV	Crew Transfer Vessel
CVA	Certified Verification Agent
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DAS	Distributed Acoustic Sensing
DCR	Discharge Cleanup and Removal
DLRP	Division of Land Resource Protection
DoD	Department of Defense
DOI	Department of Interior
DP	dynamic positioning
DPCC	Discharge Prevention, Containment, and Countermeasure
DTS	distributed temperature system
EA	Environmental Assessment
ECC	Export Cable Corridor
ECO	Educational and Community Outreach
eNGO	environmental non-governmental organization
EPA	Environmental Protection Agency
EPM	environmental protection measure
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FCP	Fisheries Communication Plan
FDR	Facility Design Report
FIR	Fabrication and Installation Report
FIR	Fishing Industry Representative
FLO	Fisheries Liaison Officer
FONSI	Finding of No Significant Impact
FR	Federal Register
FTE	full time equivalent
GBS	gravity-base structure

GHG	greenhouse gases
GIS	geographic information systems
HAT	Highest Astronomical Tide
HDD	horizontal directional drilling
HDPE	high-density polyethylene
HLV	heavy lift vessel
HPO	Historic Preservation Office
HSSE	health, safety, security, and environmental
HTV	heavy transport vessel
HVAC	high voltage alternating current
HVDC	high voltage direct current
IEC	International Electrotechnical Commission
IHA	Incidental Harassment Authorization
ISO	International Organization for Standardization
JCP&L	Jersey Central Power & Light
LED	light-emitting diode
LiDAR	light detection and ranging
LOA	Letter of Authorization (LOA)
MEC	munitions and explosives of concern
met	meteorological
metocean	meteorological and oceanographic
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MMPA	Marine Mammals Protection Act
MOTBY	Military Ocean Terminal Bayonne
MOU	memorandum of understanding
MRASS	Mariner Radio Activated Sound Signal
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NGTC	National Guard Training Center
NHPA	National Historic Preservation Act
NJWEA	New Jersey Wind Energy Area
NJBIA	New Jersey Business & Industry Association
NJBPU	New Jersey Board of Public Utilities
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NMFS	National Marine Fisheries Service
nm	Nautical Mile
NOx	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council, Inc.
NSRA	Navigation Safety Risk Assessment
NYSDEC	New York State Department of Environmental Conservation

NYSDPS	New York State Department of Public Services
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy and Research Development Authority
NYSOGS	New York State Office of General Service
NYSOPRHP	New York State Office of Parks, Recreation and Historic Preservation
O&M	Operations and Maintenance
OCS	Outer Continental Shelf
OEM	original equipment manufacturer
OLPD	online partial discharge
OREC	Offshore Renewable Energy Certificate
OSHA	Occupational Safety and Health Administration
OSRP	Oil Spill Response Plan
OSS	offshore substation
OWPEBS	Ocean/Wind Power Ecological Baseline Studies
PANYNJ	Port Authority of New York and New Jersey
PATON	Private Aid to Navigation
PDE	Project Design Envelope
PLGR	pre-lay grapnel run
$PM_{2.5}$	fine particulate matter (2.5 microns or smaller)
PNCT	Port Newark Container Terminal
POI	point of interconnection
PPTN	Public Policy Transmission Need
PVC	polyvinyl chloride
RNA	rotor nacelle assembly
ROD	Record of Decision
RODA	Responsible Offshore Development Alliance
ROSA	Responsible Offshore Science Alliance
ROV	remotely operated vehicle
ROW	right-of-way
RUCOOL	Rutgers University Center for Ocean Observing Leadership
SAP	Site Assessment Plan
SAR	search and rescue
SATV	service accommodation and transfer vessel
SBMT	South Brooklyn Marine Terminal
SCADA	supervisory control and data acquisition
SF_6	sulfur hexafluoride
SMS	Safety Management System
SO_2	sulfur dioxide
SOV	service operation vessel
SPCC	Spill Prevention, Control, and Countermeasure
SPMT	self-propelled modular transporters
STATCOM	static synchronous compensator
TBD	to be determined
Call	Call for Information and Nominations

TMP	Traffic Management Plan
TSHD	trailing suction hopper dredge
UPS	uninterruptible power supply
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VHF	very high frequency
VMS	Vessel Monitoring System
WTG	wind turbine generator
XLPE	cross-linked polyethylene

Glossary

Term	Definition
The Project	Atlantic Shores' proposal to develop an offshore wind energy generation project within Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0549 comprised of up to 157 total wind turbine generators (WTGs) and up to 8 offshore substations (OSSs).
Atlantic Shores Offshore Wind, LLC (Atlantic Shores)	Atlantic Shores Offshore Wind, LLC is the owner and operator of the Project.
Atlantic Shores Project Area (Project Area) Offshore Project Area Onshore Project Area	The combined onshore and offshore area where Atlantic Shores' facilities are physically located. The offshore area where the Project facilities are physically located. This includes the Lease Area and the Monmouth and Northern Export Cable Corridors (ECCs). The onshore area where the Project facilities are physically located.
Atlantic Shores Project Region (Project Region) Offshore Project Region Onshore Project Region	The larger region surrounding the Atlantic Shores Project Area. The extent of the Project Region varies by resource. The broader offshore geographic region that could be affected by Project-related activities. The Offshore Project Region includes the Lease Area. The broader onshore geographic region that could be affected by Project-related activities, which could include entire towns, communities, counties, etc.
Area of Potential Effect (APE)	The APE is defined in 36 CFR §800.16 as "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."
Cable protection	Material (e.g., rock, concrete mattresses, etc.) placed over an offshore cable to prevent damage to the cable.
Construction staging activities	Activities conducted in port such as component fabrication and assembly; offloading and loading shipments of Project components; storing Project components; preparing Project components for installation; and/or preparing vessels to tow floating components to the Lease Area.
Crew transfer vessel (CTV)	A relatively small vessel used to transfer crew and supplies from port to the Offshore Project Area.
Duct bank	The underground structure that houses onshore interconnection cables and consists of high-density polyethylene (HDPE) or polyvinyl chloride (PVC) conduits encased in concrete.
Export cable	A submarine transmission cable that is buried beneath the seafloor and connects an OSS to a landfall site.
Export Cable Corridor (ECC) Monmouth ECC Northern ECC	The area identified for routing the export cables between a landfall site and the Lease Area. The ECC that extends north from Lease Area OCS-A 0499 along the eastern edge of Lease Area OCS-A 0549 to the Monmouth Landfall Site. The ECC that extends north from Lease Area OCS-A 0549 to the New York Landfall Sites and northern New Jersey Landfall Sites, including the Asbury Branch of the Northern ECC.
Fisheries Communication Plan (FCP)	A plan that defines outreach and engagement with fishing interests throughout the Project lifecycle.
Foundation	A steel and/or concrete structure that supports a WTG, OSS, or meteorological (met) tower and is affixed to the seabed using piles, suction buckets, or gravity.

Term	Definition
Gravity-base structure (GBS)	A type of foundation consisting of a heavy steel-reinforced concrete and/or steel structure that sits on the seabed.
Gravity-pad tetrahedron base	A type of foundation that is comprised of a tetrahedral-shaped (i.e., three-legged pyramidal) frame that rests on the seabed and is secured in place using high weight pads (i.e., gravity pads) below each leg.
Horizontal directional drilling (HDD)	A trenchless cable installation methodology that avoids surface disturbance by drilling a pilot hole, enlarging the pilot hole, then inserting a conduit for future installation of cables.
Inter-array cables	Submarine transmission cables that connect groups of WTGs to an OSS.
Inter-link cable	A submarine transmission cable that may be used to connect OSSs together.
Jacket	A type of foundation with three to eight legs that are secured to the seafloor using piles or suction buckets at the base of each leg.
Landfall site New Jersey Landfall Sites Monmouth Landfall Site Asbury Landfall Sites New York Landfall Sites Narrows Landfall Sites Raritan Landfall Sites	A shoreline site where the export cables transition from offshore to onshore. The shoreline site in Sea Girt, New Jersey (Monmouth County) where export cables are proposed to be installed in the Monmouth ECC transition onshore. The shoreline site in the Asbury Park, New Jersey area where export cables are proposed to be installed in the Asbury Branch of the Northern ECC transition onshore. The shoreline sites in the New York City area where export cables installed in the Northern ECC transition onshore. These landfall locations include Staten Island and Brooklyn.
Lease Area OCS-A 0549 (Lease Area)	Lease Area OCS-A 0549 was originally located within the northern half of Lease Area OCS-A 0499. Atlantic Shores applied for segregation of this portion of the lease area which was approved by BOEM in April 2022 and is designated as Lease Area OCS-A 0549.
New Jersey Wind Energy Area (NJWEA)	The area offshore New Jersey was identified as suitable for offshore renewable energy development by BOEM through a multi-year, public environmental review process.
Marshalling port	Ports where Project components will be offloaded, stored, pre-assembled, and prepared for load-out.
Meteorological and oceanographic (metocean) buoy	Buoys temporarily installed in the Lease Area to monitor weather and sea state conditions during construction.
Meteorological (met) tower	A tower permanently installed in the Lease Area to measure meteorological conditions during construction and operations.
Monopile	A type of foundation consisting of a single steel tube that is driven into the seabed.
Mono-bucket	A type of foundation comprised of a single suction bucket supporting a single steel or concrete tubular structure (similar to a monopile).
Offshore cable system	All offshore transmission cables (inter-array cables, inter-link cables, and export cables).
Offshore facilities	All of the Project-related offshore infrastructure (WTGs, OSSs, offshore cables, etc.).
Offshore substation (OSS)	An OSS located in the Lease Area containing transformers and other electrical gear, which will serve as a common collection point for power from the WTGs and also serve as the origin for the export cables that deliver power to shore.
Onshore interconnection cable	An onshore transmission cable installed within a buried duct bank that connects a landfall site to an onshore substation and/or converter station and subsequently to a POI.
Onshore interconnection cable route	The onshore routes within which the onshore interconnection cables will be installed.

Term	Definition
Onshore Interconnection Cable Route	The onshore interconnection cable route options that extend from the landfall locations to the Points of Interconnection.
Onshore facilities	All of the onshore infrastructure (onshore substations and/or converter stations, onshore interconnection cables, etc.) associated with the Project.
Onshore substation	A landside substation constructed for Atlantic Shores containing transformers and other electrical gear where the onshore interconnection cable voltage will be increased or decreased in preparation for grid interconnection.
Onshore substation and/or converter station site	A parcel of land where an onshore substation and/or converter station may be located.
Piled jacket	A type of foundation consisting of a steel lattice structure that is fixed to the seabed using piles connected to each leg of the jacket.
Point of interconnection (POI)	An existing substation where the Project's onshore interconnection cables will interconnect into the electrical grid.
Port facilities	Facilities and infrastructure located within/adjacent to a port that will be used by Atlantic Shores during construction and operations.
Project Design Envelope (PDE)	The PDE identifies a reasonable range of designs for proposed components and installation techniques for the Project.
Scour protection	Material (e.g., rock, concrete mattresses, etc.) placed around the base of a foundation to protect it from sediment transport/erosion caused by water currents.
Suction bucket jacket	A type of foundation consisting of a steel lattice structure that is fixed to the seabed by suction buckets installed below each leg of the jacket.
Suction bucket tetrahedron base	A type of foundation that is comprised of a tetrahedral-shaped (i.e., three-legged pyramidal) frame that rests on the seabed and is secured to the seafloor using suction buckets.
Service operation vessel (SOV)	A relatively large vessel that offers considerable capacity for personnel and spare parts, allowing for service trips that are several weeks in duration. An SOV includes sleeping quarters for technicians and may include workshop space.
Splice vault	An underground concrete "box" where segments of the onshore interconnection cable are joined together.
Transition piece	A part of the foundation structure that contains a flange for connection to the WTG tower and may include secondary structures such as a boat landing, ladders, a work platform, a crane, and other ancillary components. A transition piece may be installed on top of a monopile, mono-bucket, or GBS foundation.
Transition vault	A type of splice vault located at a landfall site where the export cables are connected to the onshore interconnection cables.
Utility right-of-way (ROW)	Previously disturbed corridor that contain existing electric transmission lines or other utilities.
Wind turbine generator (WTG)	An offshore wind turbine that will generate electricity.

Executive Summary

Introduction

Atlantic Shores Offshore Wind, LLC (Atlantic Shores) is a 50/50 joint venture between EDF-RE Offshore Development, LLC (an indirect, wholly owned subsidiary of EDF Renewables, Inc. [EDF Renewables]) and Shell New Energies US LLC (Shell). Atlantic Shores is submitting this Construction and Operations Plan (COP) to the Bureau of Ocean Energy Management (BOEM) for the development of offshore wind energy generation known as the Atlantic Shores North Project (the Project) within the Lease Area OCS-A 0549 (Lease Area).

The purpose of the Project is to develop offshore wind energy generation facilities within BOEM Lease Area OCS-A 0549 to provide clean, renewable energy to the Northeastern U.S. by the mid-to-late 2020s. Specifically, the Atlantic Shores Lease Area is capable of providing clean, renewable energy to the New Jersey and/or New York electrical grids. The Project will help the U.S., New Jersey, and New York achieve their renewable energy goals, diversify each State's electricity supply, increase electricity reliability, and reduce greenhouse gas (GHG) emissions. The Project will also provide numerous environmental, health, community, and economic benefits, such as the creation of substantial new employment opportunities, including within disadvantaged communities.

In accordance with the New Jersey Offshore Wind Economic Development Act (OWEDA), the State of New Jersey will be awarding Offshore Wind Renewable Energy Certificate (OREC) allowances to offshore wind energy projects through a competitive solicitation process every two years through 2026. Similarly, the New York State Energy and Research Development Authority (NYSERDA) is supporting the development of 9,000 megawatts (MW) of offshore wind energy by 2030. The Project is being developed to possibly support one or both of the above-referenced solicitations.

Project Overview

Atlantic Shores' Lease Area is located on the Outer Continental Shelf (OCS) within the New Jersey Wind Energy Area (NJWEA), which was identified by BOEM as suitable for offshore renewable energy development through a multi-year, public environmental review process. Atlantic Shores' proposed offshore wind energy generation facilities will be located in Lease Area OCS-A 0549, which is 81,129 acres (328.3 square kilometers [km^2]) in area (see Figure E-1). Lease Area OCS-A 0549 is located north of and is adjacent to Atlantic Shores' Lease Area OCS-A 0499. At its closest point, the Lease Area is approximately 8.4 miles (mi) (13.5 kilometers [km]) from the New Jersey coast and approximately 60 mi (96.6 km) from the New York State coast. The facilities to be installed within the Lease Area will include:

- a maximum of up to 157 wind turbine generators (WTGs)
- up to 8 small, 4 medium, or 3 large offshore substations (OSSs)

- inter-array and/or inter-link cables connecting the WTGs and OSSs
- up to one permanent meteorological (met) tower.

The Lease Area layout is designed to maximize offshore renewable wind energy production while minimizing effects on existing marine uses. The structures will be aligned in a uniform grid with multiple lines of orientation allowing straight transit through the Lease Area. Given the proximity to and shared border between the two Atlantic Shores lease areas, the layouts of both lease areas form a continuous regular grid. In developing the layout, existing vessel traffic patterns and feedback from agencies and stakeholders (including the U.S. Coast Guard and commercial and recreational fishermen) were considered.

Within the Lease Area, the WTGs and OSSs will be connected by inter-array cables and/or inter-link cables. Energy from the OSSs will be delivered to shore by buried export cables that will be located within designated Export Cable Corridors (ECCs) from the Lease Area through Federal as well as New Jersey and/or New York State waters to landfall sites on the New Jersey and/or New York coastlines.

The Monmouth ECC extends from south to north along the eastern side of the Lease Area. The Monmouth ECC then continues north prior to turning west to a terminus at a landfall site in southern Monmouth County, New Jersey (Monmouth Landfall Sites). The total length of the Monmouth ECC associated with the Project from the Lease Area to the landfall location is approximately 66.9 mi (107.6 km). This ECC will also be used to convey export cables associated with the Atlantic Shores South Project (Lease Area OCS-A 0499).

The maximum length of the Northern ECC from the Lease Area to the furthest potential landfall location is approximately 90.4 mi (145.5 km). The Northern ECC extends north from the Lease Area toa point where it branches off into New Jersey waters (the Asbury Branch of the Northern ECC) and continues further north to a point where it branches to three possible landfall locations in New York. The Asbury Branch of the Northern ECC extends westward from the Northern ECC approximately 8.6 mi (13.9 km) to the potential Asbury Landfall Sites in northern Monmouth County, New Jersey. In New York State waters, the Northern ECC branches to the Lemon Creek and Wolfe's Pond Landfall Sites on southwest Staten Island in Richmond County, New York and the Fort Hamilton Landfall Site in Brooklyn in Kings County, New York. Section 4.7 provides additional information regarding proposed landfall locations associated with the Project.

Atlantic Shores will use horizontal directional drilling (HDD) technology to install the export cables from the end of the ECCs to the Landfall Sites to minimize impacts to the intertidal and nearshore habitats and ensure stable burial of the cables. From each landfall site, the onshore interconnection cables will travel underground primarily along existing roadways and utility rights-of-way (ROWs) to new or existing onshore substation and/or converter station sites. Potential Points of Interconnection (POIs) with existing substations are located in both New Jersey (Atlantic Substation and Larrabee Substation) and New York (Fresh Kills Substation, Goethals Substation and Gowanus Substation). The Project requires the ability to interconnect at the identified POIs to not only accommodate the maximum amount of electricity that could be generated by the Project but also to enable the reliable delivery of renewable offshore wind energy into both the New Jersey and New York markets (see

Section 1.2 for additional information regarding Project purpose and need). Atlantic Shores has formally filed requests for a queue position at each of the POIs under consideration.

Organization of the COP

This COP has been developed in accordance with 30 Code of Federal Regulations (CFR) Part 585, applicable BOEM and other regulatory guidance, and the stipulations in Atlantic Shores' Lease Agreement OCS-A 0549. This COP is organized into two volumes:

- Volume I provides detailed descriptions of the Project's offshore and onshore facilities and how Atlantic Shores plans to construct, operate, and decommission those facilities.

- Volume II characterizes the Project's environmental setting and provides a comprehensive assessment of the Project's potential effects on physical, biological, visual, cultural, and socioeconomic resources and describes the numerous measures that Atlantic Shores will employ to avoid, minimize, and mitigate those potential effects.

Project Design Envelope

Atlantic Shores is requesting BOEM review and authorization of the Project in accordance with their Project Design Envelope (PDE) guidance (BOEM 2018). The PDE identifies a reasonable range of designs for the proposed Project components and installation techniques. Key elements of the Project PDE are included in Table E-1.

Atlantic Shores has sited the Project facilities and developed the PDE to maximize renewable energy production, minimize environmental effects, minimize cost to ratepayers, and address stakeholder concerns. The PDE articulates the maximum design scenario for key project components, such as the type and number of WTGs, foundation types, OSS types, cable types, and installation techniques. The PDE also provides Atlantic Shores with the necessary flexibility to respond to anticipated advancements in industry technologies and techniques, that even under a maximum scenario will not exceed an unreasonable level of environmental effects.

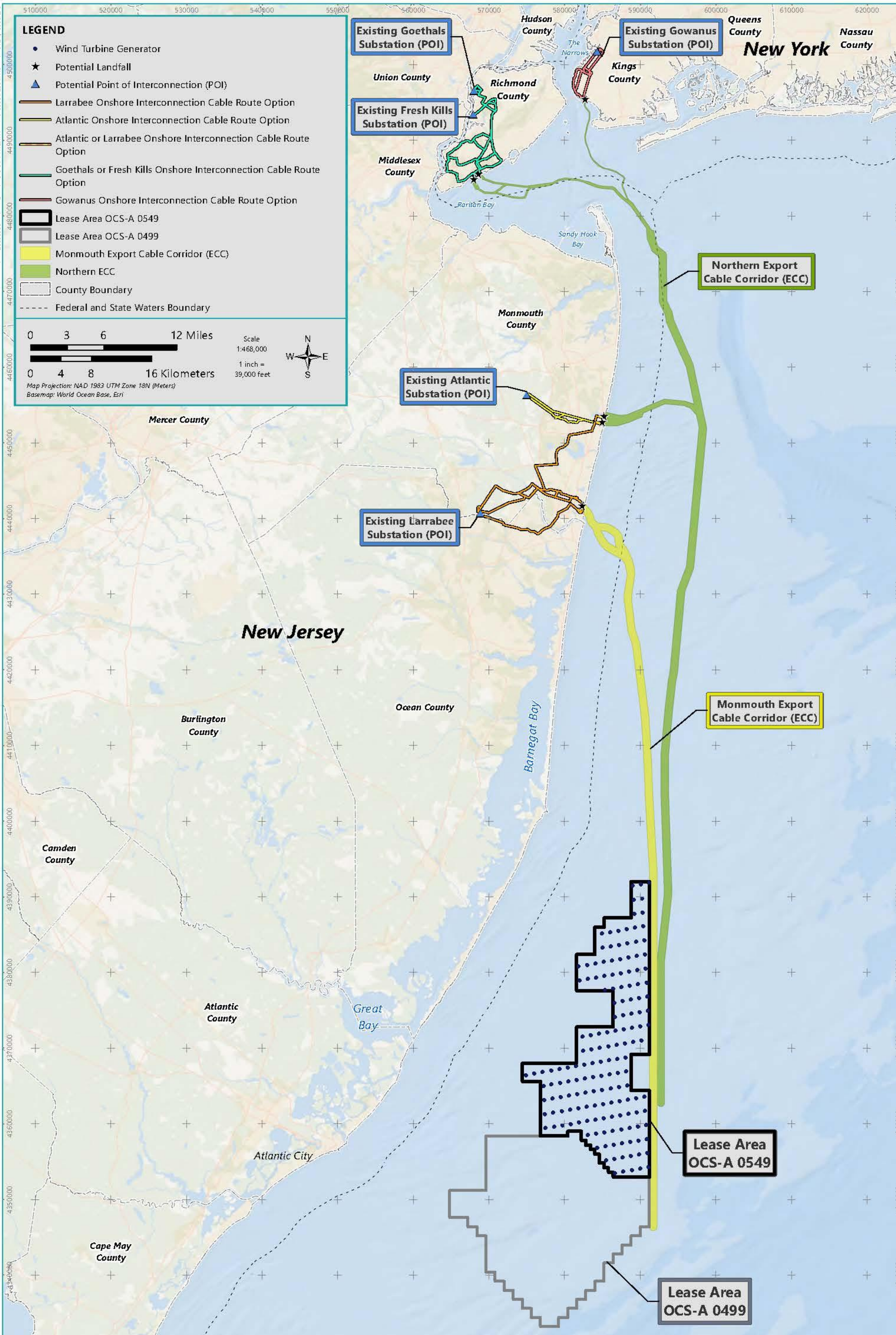

Figure E-1
Overview of the Project

Table E-1. Key Elements of the PDE

Element	Project Design Element	Total
WTGs	Max. Number of WTGs	157
	WTG Layout	Grid layout with ENE/WSW rows and approximately N/S columns, consistent with the predominant flow of vessel traffic
	Max. rotor diameter	967.8 ft (295.0 m)
	Max. tip height[a]	1,048.8 ft (319.7 m)
OSSs	Max. Number of OSSs	8 small, or
		4 medium, or
		3 large
	OSS Layout	Positioned along the same ENE/WSW rows as WTGs
	Min. Distance from Shore	Small OSS: 12 mi (19.3 km)
		Medium and large OSS: 13.5 mi (21.7 km)
WTG and OSS Foundations	Foundation types	
	Piled	Monopiles or piled jackets
	Suction bucket	Mono-buckets, suction bucket jackets, or suction bucket tetrahedron bases [b]
	Gravity	Gravity-base structures (GBS) or gravity-pad tetrahedron bases[b]
	Max. pile diameter at seabed for piled foundation types	Monopile: 49.2 ft (15.0 m)
		Piled jacket: 16.4 ft (5.0 m)
Inter-Array and Inter-Link Cables	Cable types and voltage	Inter-array: 66–150 kV high voltage alternating current (HVAC)
		Inter-link: 66–275 kV HVAC
	Max. Total Cable Length	Inter-array: 466 mi (750 km)
		Inter-link: 62 mi (100 km)
	Target burial depth range	5 to 6.6 ft (1.5 to 2 m)
Export Cables	Cable types and voltage	230–275 kV HVAC cables and/or 320–525 kV high voltage direct current (HVDC) cables
	Number of ECCs	Two: Monmouth ECC and Northern ECC
	Max. Total Cable Length	Monmouth ECC: 66.9 mi (107.6 km)
		Northern ECC: 90.4 mi (145.5 km) Asbury Branch of Northern ECC: 8.96 mi (14.4 km)
	Target burial depth range	5 to 6.6 ft (1.5 to 2 m)
Met Towers	Max. Number of met towers	1 (permanent)
Metocean Buoys	Max Number of metocean buoys	2 (Temporary, during construction)
Landfall Sites	Number of Landfall Sites	New Jersey - 3
		New York - 3
	Installation Method	HDD
Onshore Facilities	Location of Onshore Interconnection Cable Routes	New Jersey
		New York
	Approx. route length[c]	New Jersey – 6.99 mi (11.25 km) to 16.69 mi (26.87 km)
		New York – 5.0 mi (8.10 km) to 15 mi (24.14 km)
		230–345 kV HVAC cables installed in underground duct bank;

Element	Project Design Element	Total
	Onshore interconnection cable types and voltage	or 320–525 kV HVDC cables installed in underground duct bank
	Max. Number of Onshore Substations and/or Converter Stations	New Jersey - 3
		New York - 3
	Points of Interconnection (POI)	Larrabee POI – New Jersey
		Atlantic POI – New Jersey
		Fresh Kills POI – New York
		Goethals POI – New York
		Gowanus POI – New York
O&M Facility	Location	Existing Ports and Facilities

Notes: a) All elevations are provided relative to Mean Lower Low Water (MLLW).

b) Tetrahedron base foundations are included in the PDE for WTGs but not OSSs.

c) Several onshore routes from the potential landfall sites to the POIs are currently being evaluated in both States. These will be refined in 2022 based on the results of environmental field surveys and constructability analyses.

Construction

Construction of the Project will begin with the onshore facilities, including the onshore substations and/or converter stations and onshore interconnection cables. The onshore interconnection cables will be installed within a buried concrete duct bank. Trenchless techniques such as HDD, pipe jacking, or jack-and-bore are anticipated at unique or sensitive features such as road crossings, wetlands, and waterbodies to avoid impacts.

Construction of the offshore facilities is expected to commence with installation of the export cables and the foundations. Once the OSS foundations are installed, the OSS topsides and the inter-link cables (if used) can be installed. After the foundation is installed at each WTG position, the associated inter-array cables and WTG will be installed. Scour protection may be installed at the base of the foundations, and cable protection may be installed over a portion of the offshore cables. During commissioning, the WTG and OSS electrical and safety systems will be tested, and the OSSs and WTGs will be energized.

Offshore construction may require multiple types of vessels, including heavy transport vessels, heavy lift vessels, tugboats and barges, jack-up vessels, cable laying vessels, crew transfer vessels, and service operation vessels (SOV). Atlantic Shores may also use helicopters for crew transfer and visual equipment inspections as well as fixed-wing aircraft to support environmental monitoring and mitigation. Atlantic Shores has identified several existing port facilities in New Jersey, New York, the Mid-Atlantic, and New England that may be used for major Project-related construction staging activities. In addition, some components, materials, and vessels could originate from existing U.S. Gulf Coast or international ports. Port activities include, but are not limited to component fabrication and assembly, offloading and loading of Project components, preparing vessels to transport components to the Lease Area, crew transfer, refueling, and restocking supplies.

Operations and Maintenance

Once installed and commissioned, the Project is designed to operate for up to 30 years[1]. Operations and maintenance (O&M) activities will ensure that the Project functions safely and efficiently. To minimize equipment downtime and maximize energy generation, Atlantic Shores will conduct O&M activities through scheduled, predictive, and remote-controlled activities.

The Project facilities are designed to operate autonomously without attendance by technicians. The Project will be equipped with a supervisory control and data acquisition (SCADA) system, which provides an interface between the Project facilities and all environmental and condition monitoring sensors and provides detailed performance and system information. The operator will monitor the status, production, and health of the Project, 24 hours a day. O&M activities associated with the Project will be supported by existing ports and facilities. No new O&M facilities are proposed for the Project.

Decommissioning

At the end of its operational life, the Project will be decommissioned, which will broadly occur in the reverse order of construction. Decommissioning will be conducted in accordance with the requirements of Atlantic Shores' Lease Agreement, 30 CFR Part 585, and the Decommissioning Application that Atlantic Shores will submit to BOEM prior to decommissioning.

Health, Safety, Security, and Environmental Protection

Health, safety, security, and environmental (HSSE) protection are critical components of Atlantic Shores' culture as well as Project-related planning and activities. The health and safety of Atlantic Shores' team members, contractors, and the public is a key priority; Atlantic Shores upholds safety as a core value and fosters a culture of "Goal Zero" that focuses on eliminating safety related incidents. Atlantic Shores also prioritizes the responsible integration of the Project into the New Jersey and New York coastal and marine environments.

Atlantic Shores is committed to full compliance with applicable Federal and State HSSE regulations and codes throughout the pre-construction, construction, O&M, and decommissioning phases of the Project. Plans that will be implemented, in accordance with BOEM and other applicable regulations to ensure HSSE protection throughout the Project lifecycle will include Project-specific Safety Management Systems (SMS), Oil Spill Response Plans, and Spill Prevention, Control, and Countermeasure (SPCC) Plans.

Stakeholder Engagement

Atlantic Shores has engaged with stakeholders and interested parties since the initial assignment of Lease OCS-A 0499 in 2019. Coordination and engagement efforts over the past three years have focused on Atlantic Shores' plans to develop a portfolio of projects within both OCS-A 0499 and subsequently OCS-A 0549 off the coast of New Jersey. This portfolio approach to stakeholder

[1] Atlantic Shores' Lease Agreement OCS-A 0549 includes a 25-year operating term, which may be extended or otherwise modified in accordance with applicable regulations in 30 CFR Part 585.

engagement has enabled continuity in project planning, siting, design as well as the adaptive management of lessons learned across Lease and Project Areas to ensure Atlantic Shores remains responsive and consistent to stakeholder interest and concerns.

Atlantic Shores has conducted numerous meetings and working sessions with stakeholders, suppliers, interest groups, and local communities that have an interest in or may be affected by its portfolio of projects. In support of project development specifically within Lease Area OCS-A 0549, Atlantic Shores has and will continue to host and participate in project-specific meetings, community events, informational sessions, open houses, and workshops in both New Jersey and New York. Atlantic Shores will also continue to disseminate information through the Project's interactive website and social media platforms. As the Project progresses, Atlantic Shores will continue to evolve its stakeholder engagement strategy and mechanisms for capturing, documenting, and responding to stakeholder feedback to ensure that the outcomes of each interaction are incorporated into not only the Project development efforts but that of the overall portfolio.

Benefits, Effects, and Environmental Protection Measures

The Project will provide clean, renewable energy to the Northeastern U.S. by displacing electricity from fossil fuel power plants. The Project will result in a significant net decrease in harmful air pollutant emissions region-wide. For every megawatt-hour of power generated by the Project, there will be an associated reduction in GHG emissions, reported as carbon dioxide equivalents (CO_2e), of approximately 2,625 tons per year. By reducing regional GHG emissions, the Project can help mitigate additional effects of climate change (e.g., sea level rise, shifts in species' distributions, and increases in energy system costs) that impact both public health and the environment. The Project will also reduce regional emissions that are linked to increased rates of early death, stroke, heart attacks, and respiratory disorders and contribute to acid rain, ocean acidification, and ground level ozone/smog.

Beyond its environmental and public health benefits, the Project will provide significant economic and community benefits to the Mid-Atlantic and Northeast, including the creation of substantial new employment opportunities. Atlantic Shores estimates that the Project will create approximately 27,000 full time equivalent (FTE) direct jobs, 13,000 FTE indirect jobs, and over 23,000 FTE induced jobs, for a total of more than 63,000 FTE jobs throughout the Project lifecycle. Atlantic Shores will use local supply chains, increase revenues collected by Federal, State, and local governments, and contribute to the establishment of facilities and development of ports that will be instrumental in attracting and supplying future U.S. offshore wind developments to New Jersey and New York.

Atlantic Shores is working to maximize the benefits and minimize the effects of the Project. Volume II of this COP describes the Project's environmental setting, assesses the Project's potential effects to physical, biological, visual, cultural, and socioeconomic resources, and identifies environmental protection measures (EPMs) that could avoid or reduce those potential effects. Environmental resource assessments contained within Volume II combine years of site-specific onshore and offshore surveys, research, and modeling. The Project's EPMs include studies, assessments, design elements, best management practices (BMPs), and potential mitigation measures. These EPMs will evolve through ongoing consultations with applicable regulatory agencies and stakeholders. As detailed within this COP, the environmental and economic benefits associated with the Project throughout its operational life significantly outweigh its potential effects.

1.0 Introduction

Atlantic Shores Offshore Wind, LLC (Atlantic Shores) is a 50/50 joint venture between EDF-RE Offshore Development, LLC (an indirect, wholly owned subsidiary of EDF Renewables, Inc. [EDF Renewables]) and Shell New Energies US LLC (Shell). Atlantic Shores is submitting this Construction and Operations Plan (COP) to the Bureau of Ocean Energy Management (BOEM) for the development of the Atlantic Shores North Project (the Project), an offshore wind energy generation project, located within Lease Area OCS-A 0549 (Lease Area). The Lease Area is approximately 81,129 acres (328.3 square kilometers [km^2]) in size and is located on the Outer Continental Shelf (OCS) within the New Jersey Wind Energy Area (NJWEA) (see Figure 1.1-1). The NJWEA was identified as suitable for offshore renewable energy development by the Bureau of Ocean Energy Management (BOEM) through a multi-year, public environmental review process. Through this review process, the NJWEA was sited to exclude areas of high value habitat and conflicting water and air space uses (see Section 1.3.1).

In accordance with the New Jersey Offshore Wind Economic Development Act (OWEDA), the State of New Jersey will be awarding Offshore Wind Renewable Energy Certificate (OREC) allowances to offshore wind energy projects through a competitive solicitation process every two years through 2030 to meet New Jersey's procurement goal of 11,000 megawatts (MW)/11 gigawatts (GW) by 2040.

Similarly, the New York State Energy and Research Development Authority (NYSERDA) is supporting the development of 9,000 megawatts (MW) of offshore wind energy by 2035. Atlantic Shores is actively evaluating opportunities to participate in upcoming solicitations for development of the Lease Area.

This Construction and Operations Plan (COP) has been developed in accordance with 30 CFR Part 585 and the stipulations in Atlantic Shores' Lease Agreement OCS-A 0549. Atlantic Shores is requesting BOEM's review and authorization of the Project in accordance with BOEM's (2018) Project Design Envelope (PDE) guidance. The PDE described in this Volume of the COP provides a reasonable range of designs for proposed components and installation techniques that provide Atlantic Shores some measure of flexibility to adjust for rapidly evolving offshore wind technology and state solicitation requirements while providing BOEM with the information required to fulfill its expected role as the lead Federal agency under the National Environmental Policy Act (NEPA). The COP will also provide information used to support the other Federal and State environmental regulatory review processes.

1.1 Project Overview

Atlantic Shores' proposed offshore wind energy generation facilities will be located in Lease Area OCS-A 0549, which is 81,129 acres (328.3 square kilometers [km^2]) in area (see Figure 1.1-1). Lease Area OCS-A 0549 is located north of and adjacent to Atlantic Shores' Lease Area OCS-A 0499. Atlantic Shores applied to BOEM in 2021 to formally segregate Lease Area OCS-A 0549 from Lease Area OCS-A 0499. The segregation was approved by BOEM in April 2022. In addition to the Lease Area, the Project may include two offshore Export Cable Corridors (ECCs) within Federal, New Jersey, and New York State waters as well as onshore interconnection cable routes and onshore substation and/or converter station sites in both States (see Figure 1.1-2).

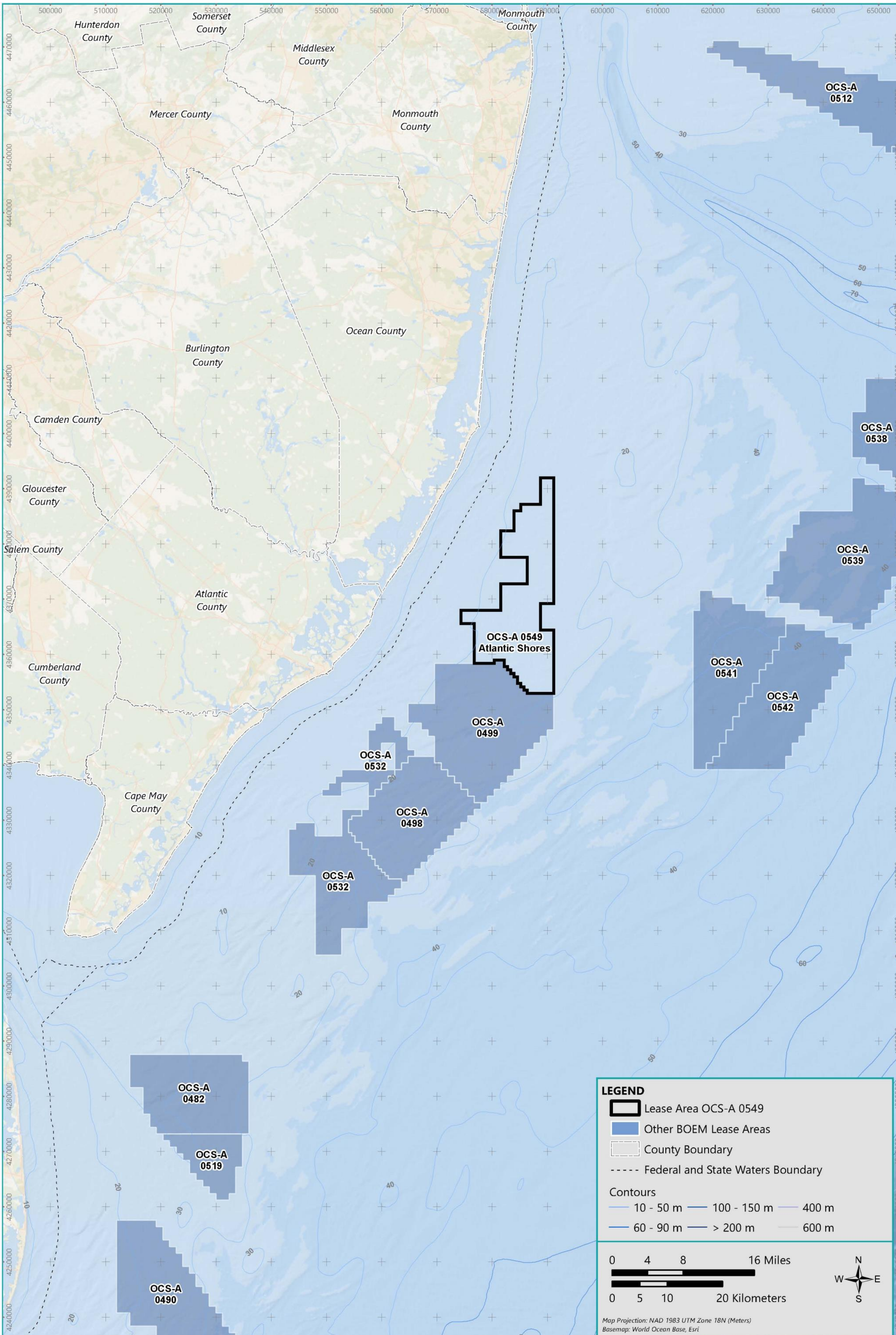

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Figure 1.1-1

Atlantic Shores Lease Area OCS-A 0549

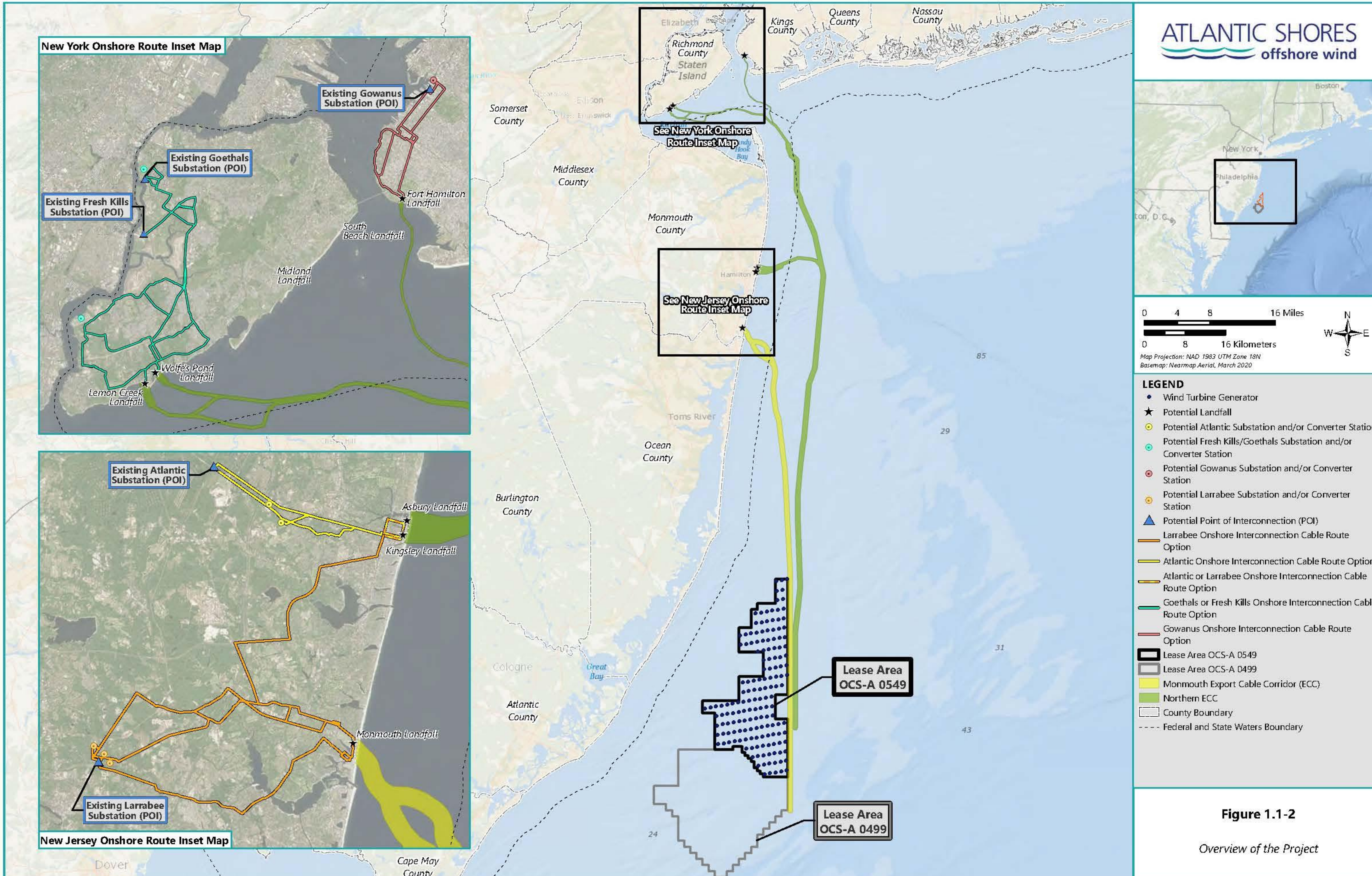

Figure 1.1-2

Overview of the Project

At its closest point, the Lease Area is approximately 8.4 miles (mi) (13.5 kilometers [km]) from the New Jersey coast and approximately 60 mi (96.6 km) from the New York State coast. As depicted on the location plat provided as Figure 1.1-2, water depths in the Lease Area range from 66 to 98 feet (ft) (20 to 30 meters [m]), gradually increasing with distance from shore (see Figure 1.1-3). Within the Lease Area, the Project will include:

- a maximum of up to 157 wind turbine generators (WTGs)
- up to 8 small, 4 medium, or 3 large offshore substations (OSSs)
- up to one permanent meteorological (met) tower
- up to two temporary meteorological and oceanographic (metocean) buoys.

The Project includes three options for WTG, OSS, and meteorological (met) tower foundations: piled, suction bucket, or gravity foundations. The WTGs and OSSs will be connected by a system of 66-kilovolt (kV) to 150 kV high voltage alternating current (HVAC) inter-array cables. OSSs within the Lease Area may be connected to each other by 66 kV to 275 kV HVAC inter-link cables.

The Lease Area layout is designed to maximize offshore renewable wind energy production while minimizing effects on existing marine uses (see Section 3.1). The offshore structures will be aligned in a uniform grid with multiple lines of orientation allowing straight transit through the Lease Area. Given the proximity to and shared border between the two Atlantic Shores lease areas, the layouts of both lease areas form a continuous regular grid. In developing the layout, existing vessel traffic patterns and feedback from agencies and stakeholders (including the U.S. Coast Guard [USCG] and commercial and recreational fishermen) were considered.

The primary east-northeast to west-southwest transit corridors through the Lease Area were selected to align with the predominant flow of vessel traffic; accordingly, WTGs will be placed along east-northeast to west-southwest rows spaced 1.0 nautical mile (nm) (1.9 km) apart to allow for two-way vessel movement (see Figure 1.1-2). The proposed grid also facilitates north to south transit by positioning WTGs along rows in an approximately north to south direction spaced 0.6 nm (1.1 km) apart. The WTG grid will also create diagonal corridors of 0.54 nm (1.0 km) running approximately northwest to southeast as well as diagonal corridors of 0.49 nm (0.9 km) running approximately north-northeast to south-southwest. Under the proposed COP, the OSS positions will be located along the same east-northeast to west-southwest rows as the proposed WTGs, preserving all of the primary east-northeast transit corridors and the majority of the secondary transit corridors (see Section 3.1).

Energy collected by the OSSs will be delivered to landfall sites in New Jersey and/or New York via 230 kV to 275 kV HVAC and/or 320 kV to 525 kV high voltage direct current (HVDC) export cables. Atlantic Shores has identified potential landfall sites in southern Monmouth County, New Jersey (the Monmouth Landfall Sites); in the vicinity of Asbury in northern Monmouth County, New Jersey (the Asbury Landfall Sites); on southwest Staten Island, New York (the Lemon Creek and Wolfe's Pond Landfall Sites); and on northeast Staten Island as well as in Brooklyn, New York (The Fort Hamilton Landfall Site) (see Section 4.7 for details on the landfall sites).

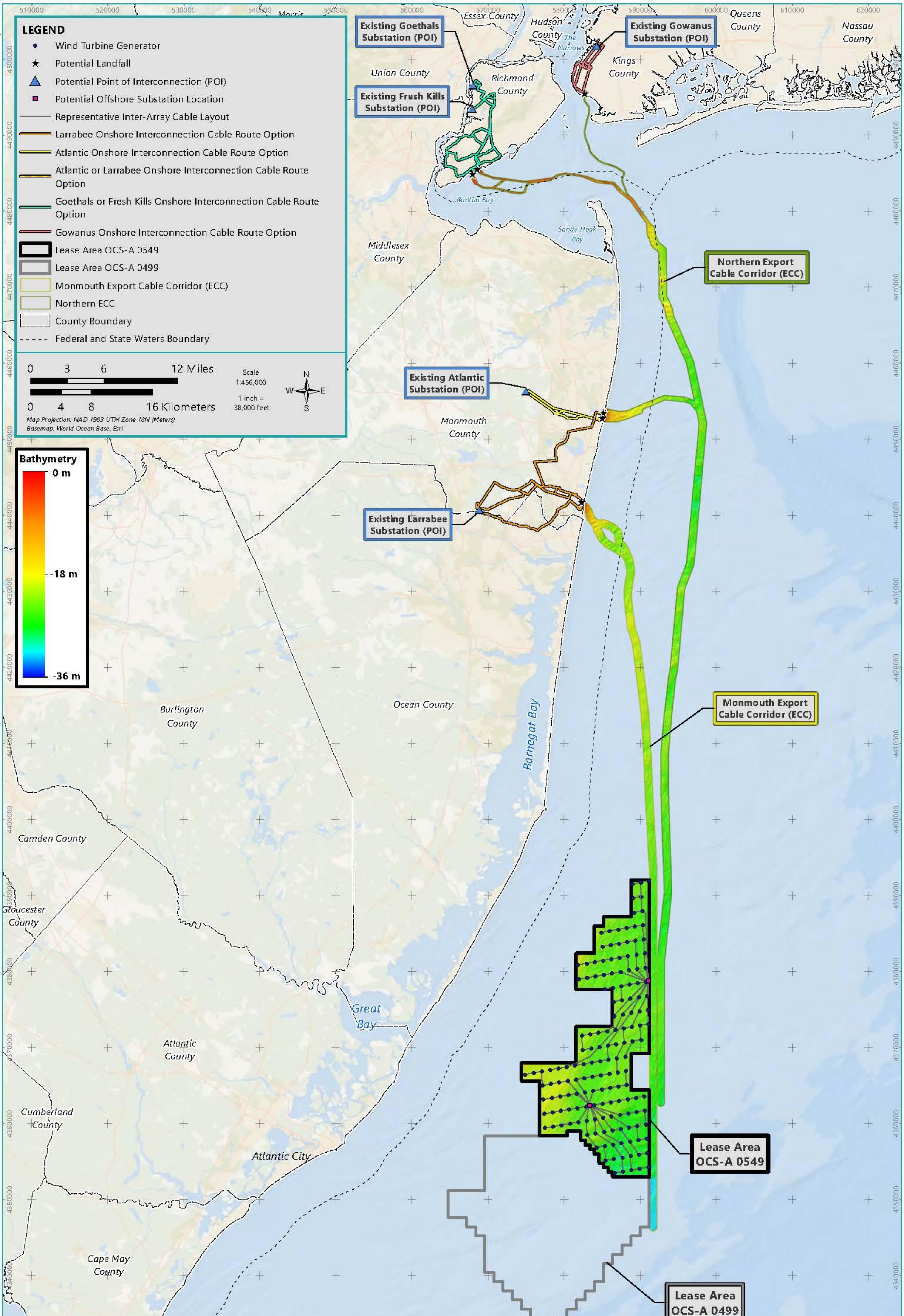

Figure 1.1-3
Bathymetric Overview

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As shown on Figure 1.1-2, two ECCs have been identified:

- The Monmouth ECC extends from the Lease Area to the potential Monmouth Landfall Sites in southern Monmouth County, New Jersey. The total length of the Monmouth ECC associated with the Project is approximately 66.9 mi (107.6 km) from the Lease Area to the farthest landfall site in New Jersey. While the Monmouth ECC is also included in the COP for Lease Area OCS-A 0499, there is sufficient space within the ECC to co-locate the export cables associated with the Project with those associated with Lease Area OCS-A 0499.
- The Northern ECC extends north from the Lease Area to the New York State waters boundary, where it splits into branches to reach the Lemon Creek and Wolfe's Pond Landfall Sites on Staten Island in Richmond County, New York and The Fort Hamilton Landfall Site in Brooklyn in Kings County, New York. The total length of the Northern ECC associated with the Project from the Lease Area to the furthest potential landfall location is approximately 90.4 mi (145.5 km).
    - Approximately 57 mi (91.7 km) from the start of the Northern ECC, the Asbury Branch of the Northern ECC extends westward from the Northern ECC approximately 8.96 mi (14.4 km) to the potential Asbury Landfall Sites in northern Monmouth County, New Jersey.

At the landfall sites in both New Jersey and New York, horizontal directional drilling (HDD) will be employed to support each export cables' offshore-to-onshore transition. The HDD landfall technique has been selected both to ensure stable cable burial along the coast and to avoid nearshore and shoreline impacts. From each landfall site, new 230 to 275 kV HVAC and/or 320 to 525 kV HVDC onshore interconnection cables will travel underground primarily along existing roadways and/or utility rights-of-way (ROW) to new onshore substation and/or converter station sites. Two potential onshore substation and converter station sites in New Jersey and three potential onshore substation and converter sites in New York City (Staten Island and Brooklyn) have been identified and will be finalized as the Project progresses. At the onshore substations and/or converter stations, HVDC will be converted to HVAC (if required) and the transmission voltage will be stepped up or stepped down in preparation for interconnection with the electrical grid at one of the identified POIs.

Atlantic Shores has identified five potential POIs in both New Jersey and New York. These POIs are typically existing electric transmission substations with direct connectivity into the electric grid. The POIs currently under consideration are the Larrabee and Atlantic Substations in Monmouth County, New Jersey and the existing Fresh Kills, Goethals and Gowanus substations in Richmond and Kings Counties, respectively, in New York (See Figure 1.1-2). The Project requires the ability to interconnect at the identified POIs to not only accommodate the maximum amount of electricity that could be generated by the Project but also to enable the delivery of reliable renewable offshore wind energy into both the New Jersey and New York markets (see Section 1.2 for additional information regarding Project purpose and need). Atlantic Shores has formally filed requests for a queue position at each of the POIs under consideration.

During construction and operation of the Project, Atlantic Shores will use port facilities in New Jersey, New York, the Mid-Atlantic, and/or New England. In addition, some components, materials, and vessels could come from U.S. Gulf Coast or international ports. During operation, the Project will be supported by existing O&M and port facilities. Key elements of the PDE are provided in Table 1.1-1.

Table 1.1-1 Key Elements of the PDE

Element	Project Design Element	Total
WTGs	Max. Number of WTGs	157
	WTG Layout	Grid layout with ENE/WSW rows and approximately N/S columns, consistent with the predominant flow of vessel traffic
	Max. rotor diameter	967.8 ft (295.0 m)
	Max. tip height[a]	1,048.8 ft (319.7 m)
OSSs	Max. Number of OSSs	8 small or
		4 medium or
		3 large
	OSS Layout	Positioned along the same ENE/WSW rows as WTGs
	Min. Distance from Shore	Small OSS: 12 mi (19.3 km)
		Medium and large OSS: 13.5 mi (21.7 km)
WTG and OSS Foundations	Foundation types	
	Piled	Monopiles or piled jackets
	Suction bucket	Mono-buckets, suction bucket jackets, or suction bucket tetrahedron bases [b]
	Gravity	Gravity-base structures (GBS) or gravity-pad tetrahedron bases[b]
	Max. pile diameter at seabed for piled foundation types	Monopile: 49.2 ft (15.0 m)
		Piled jacket: 16.4 ft (5.0 m)
Inter-Array and Inter-Link Cables	Cable types and voltage	Inter-array: 66–150 kV high voltage alternating current (HVAC)
		Inter-link: 66–275 kV HVAC
	Max. Total Cable Length	Inter-array: 466 mi (750 km)
		Inter-link: 62 mi (100 km)
	Target burial depth range	5 to 6.6 ft (1.5 to 2 m)
Export Cables	Cable types and voltage	230–275 kV HVAC cables and/or 320–525 kV high voltage direct current (HVDC) cables
	Number of ECCs	Two: Monmouth ECC and Northern ECC
	Max. Total Cable Length	Monmouth ECC: 66.9 mi (107.6 km)
		Northern ECC: 90.4 mi (145.5 km) Asbury Branch of Northern ECC: 8.96 mi (14.4 km)
	Target burial depth range	5 to 6.6 ft (1.5 to 2 m)
Met Towers	Max. Number of met towers	1 (permanent)
Metocean Buoys	Max Number of metocean buoys	2 (Temporary, during construction)
Landfall Sites	Number of Landfall Sites	New Jersey - 3
		New York - 3
	Installation Method	HDD

Element	Project Design Element	Total
Onshore Facilities	Location of Onshore Interconnection Cable Routes	New Jersey
		New York
	Approx. route length[c]	New Jersey – 6.99 mi (11.25 km) to 16.69 mi (26.87 km)
		New York – 5.0 mi (8.10 km) to 15 mi (24.14 km)
	Onshore interconnection cable types and voltage	230–345 kV HVAC cables installed in underground duct bank;
		or 320–525 kV HVDC cables installed in underground duct bank
	Max. Number of Onshore Substations and/or Converter Stations	New Jersey - 3
		New York - 3
	Points of Interconnection (POI)	Larrabee POI – New Jersey
		Atlantic POI – New Jersey
		Fresh Kills POI – New York
		Goethals POI – New York
		Gowanus POI – New York
O&M Facility	Location	Existing Ports and Facilities

Notes: a) All elevations are provided relative to mean lower low water (MLLW).
b) Tetrahedron base foundations are included in the PDE for WTGs and met towers but not OSSs.
c) Several onshore routes from the potential landfall sites to the POIs are currently being evaluated in both states. These will be refined in 2024 based on the results of anticipated market updates as well as continued constructability and environmental analyses.

1.2 Applicant's Purpose and Need

The purpose of the Project is to develop offshore wind energy generation facilities within BOEM Lease Area OCS-A 0549 to provide clean, renewable energy to the Northeastern U.S by the mid-to-late 2020s. Specifically, Atlantic Shores' is designed to provide clean, renewable energy to the New Jersey and/or New York electrical grids. Atlantic Shores has submitted a COP to BOEM for review and approval that describes the proposed Project, including all necessary information required under BOEM's regulations at 30 CFR Part 585 and its Lease. The Project would include up to 157 wind turbine generators (WTGs), up to eight offshore substations, one permanent meteorological (met) tower, up to two temporary meteorological and oceanographic (metocean) buoys, inter-array and interlink cables, up to five onshore substations, and up to five transmission cables in each ECC. The Monmouth ECC will make landfall in Sea Girt, New Jersey; the Asbury Branch of the Northern ECC will make landfall at up to three locations in New Jersey; and the Northern ECC will make landfall at up to two locations on Staten Island and one location in Brooklyn, New York.

As described in Section 2.0, the Project will help the U.S., New Jersey and New York achieve their renewable energy goals, diversify the States' electricity supplies, increase electricity reliability, and reduce greenhouse gas emissions (GHGs). The Project will also provide numerous environmental, health, community, and economic benefits and will create substantial new employment opportunities.

This project also fulfills Congress' intent expressed in the Outer Continental Shelf Lands Act to make the Outer Continental Shelf "available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs" (43 U.S.C. 1332(3)). In the Energy Policy Act of 2005, Congress made clear that offshore renewable energy development such as wind development was a permissible form of development, subject to review and authorization by the Interior's Secretary. *Id.* at 1337(p).

In furtherance of Congress' intent, Presidential Executive Order 14008 (*Tackling the Climate Crisis at Home and Abroad*), signed on January 27, 2021, directs the Secretary of the Interior, in consultation with other Federal agencies, to review siting and permitting processes to identify steps to double offshore wind energy production by 2030 (see Section 207; White House 2021). The States of New Jersey and New York have also set ambitious renewable energy goals and mandates. New Jersey's Global Warming Response Act of 2007, as amended in 2019, mandates a reduction in the State's GHG emissions to 80% below its 2006 levels by 2050. New Jersey's renewable energy goals also include reaching 11,000 MW of offshore wind energy capacity by 2040, as outlined in the 2022 Executive Order 307 (State of New Jersey 2022). On July 18, 2019, New York State enacted the Climate Leadership and Community Protection Act (Climate Act) which aims at reducing greenhouse gas emissions 40% by 2030 and by 85% by 2050 from 1990 levels. The Climate Act sets goals of 70% renewable electricity by 2030 and 9,000 MW of offshore wind capacity by 2035.

Both New Jersey and New York have recognized the limitations associated with the conventional generator lead-line approach to offshore wind project development and grid interconnection. As a result, both states are pursuing their own state-led approach to coordinated offshore wind interconnection, including the designation of required grid interconnection points, the expansion and/or the replacement of existing grid transmission facilities, and potentially the identification of specific nearshore, landfall, and onshore cable routing locations that must be used by future OSW projects. The New Jersey Legislature has enshrined in Law the concept of an "open access transmission facility, located either in the Atlantic Ocean or onshore to facilitate the collection of offshore wind energy or its delivery to the electric transmission system" and has committed to two or more "competitive solicitations for open access offshore wind transmission facilities" (NJ BPU 2023a).

Similarly, the NYISO has awarded one Public Policy Transmission Need (PPTN) Project for Long Island focusing on offshore wind delivery and is currently planning for a second PPTN to accommodate incremental expandability for offshore wind delivery in NYISO's Zone J. The upcoming NY PPTN solicitation is seeking to enable an "end-to-end" proposal of onshore and offshore components with an in-service date of January 1, 2033 (NYSPSC 2023). However, as these state-led offshore wind transmission planning processes are still evolving at the state level, offshore wind developers currently progressing with project maturation and development do not yet know the offshore cable corridors, onshore landfall locations, or onshore routes to POIs that may be part of the requirements of future solicitations into New Jersey or New York.

These state-led initiatives to evaluate and direct changes to the onshore transmission approaches in New Jersey and New York, occurring during the pendency of BOEM's review of this COP, may result in Atlantic Shores not being responsible for construction of some or all of the onshore interconnection infrastructure (and potentially some associated offshore infrastructure).

A flexible PDE is also critically important for enabling future offtake opportunities which may require interconnection into a designated transmission solution. Transmission planning has been identified by the Department of Energy, Department of the Interior (USDOE 2023), the NJBPU and NYISO as critical for enabling the realization of offshore wind procurement goals. Transmission planning has the potential to enable timely offshore wind project development with reduced environmental and community impacts and significant cost savings for rate payers. As seen in the most recent requirements set in the NJBPU Round 3 Solicitation (NJBPU 2023b), all projects were required to utilize the State Agreement Approach (SAA) coordinated transmission solution at the newly created Larrabee Collector Station (LCS) Point of Interconnection (POI), immediately adjacent to the existing Larrabee POI), and were required to make landfall at the National Guard Training Center at Sea Girt. The transmission route and associated civil construction required to deliver up to four offshore wind projects' export cables from the National Guard Training Center to the LCS is called the Pre-Build Infrastructure (PBI), which is being competitively bid separate from New Jersey's OREC solicitations.

As noted above, because all or parts of the onshore interconnection may be developed separately by an awarded entity through a solicitation process, those affected components would no longer be part of the Proposed Action set forth in the COP. While this COP considers the radial delivery of transmission routes by Atlantic Shores, it's possible that upon award of a separate transmission solution, the export cable corridors (onshore and possibly offshore), substation and/or converter stations, or other project components may be developed and delivered by others. However, given at this time only limited details of the competitive solicitation processes have been released regarding these interconnection plans the onshore interconnection infrastructure remains included in this COP as part of the Proposed Project. The Lease Area is one of 11 lease areas in proximity to New Jersey and New York (see Figure 1.2-1). Of these 11 lease areas, portions of Lease Area OCS-A 0499, Lease Area OCS-A 0512 and portions of Lease Areas OCS-A 0498 and OCS-A 0519 are already associated with offshore wind projects that have received awards under offshore wind solicitations from the States of New York, New Jersey, and Maryland, respectively. Atlantic Shores has submitted a COP to BOEM for the proposed development of two projects within Lease Area OCS-A 0499 (Atlantic Shores South Project) which is located directly south of and adjacent to Lease Area OCS-A 0549. Additionally, six of the nearby lease areas (Lease Areas OCS-A 0537, OCS-A 0538, OCS-A 0539, OCS-A 0541 and OCS-A 0542, and OCS-A 0544) are part of the New York Bight lease areas that were awarded in February 2022 and are therefore much earlier in the development process than Lease Area OCS-A 0549.

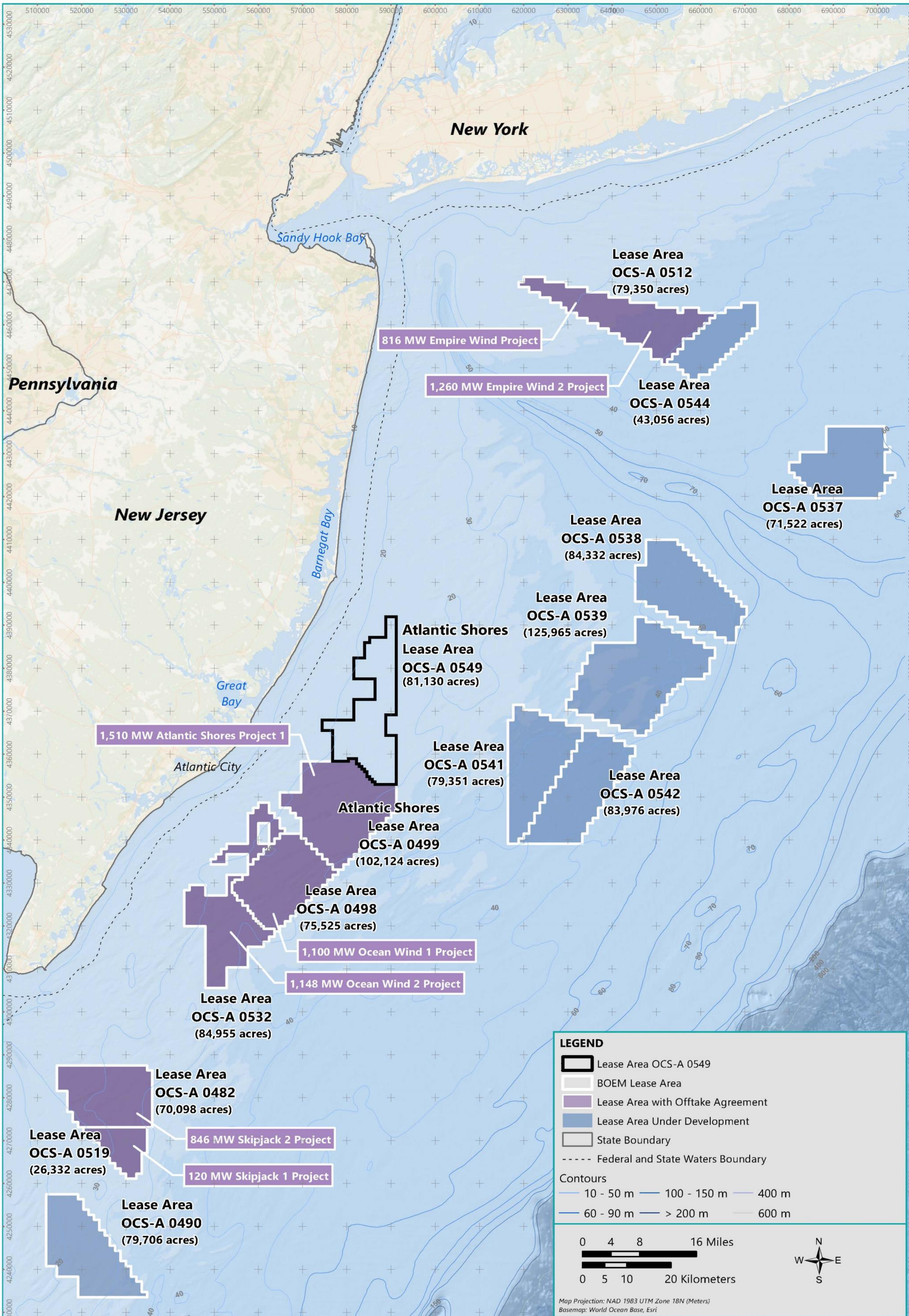

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Figure 1.2-1

BOEM Lease Areas in Proximity to New Jersey and New York

Based on successful completion of the regulatory review process, Atlantic Shores anticipates that the Project will be constructed and operational by 2028. This in-service date is expected to be approximately one to two years earlier than other potential projects within the newly awarded lease areas within the New York Bight, and the Project, along with the development of Lease Area OCS-A 0499, will represent a significant contribution to the overall goals of 11,000 MW and 9,000 MW of wind energy in New Jersey and New York, respectively, by 2040 and 2035. Without the construction and operation of the Project, New Jersey and New York may be unable to fulfill their renewable energy targets within the State-mandated timeframes.[2] In addition, this Project is essential to fulfilling the Federal target of deploying 30 gigawatts of offshore wind by 2030 to meet commitments to strengthen domestic supply chain, create jobs and to reduce carbon emissions while building toward a clean energy future. See *White House Fact Sheet: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs* (Mar. 29, 2021).

1.3 Leasing History and Regulatory Framework

This section provides a description of the regulatory framework for the Project, including a history of BOEM's process to designate lease areas for wind energy development in Federal waters of the outer continental shelf. And a description of the Project's permitting process. This section also demonstrates the Project's consistency with the requirements in Lease Agreement OCS-A 0549 and contains a guide to the location of information required in a COP pursuant to BOEM regulations codified at 30 CFR Part 585.

1.3.1 BOEM's Offshore Wind Leasing Program of the Coast of New Jersey

The identification of offshore wind energy areas for leasing in Federal waters of the U.S. is an extensive multiyear process that includes collaboration between BOEM and adjacent State Renewable Energy Task Forces. The purpose of the State Task Forces is to facilitate intergovernmental communications regarding OCS renewable energy activities and development.

New Jersey has been planning for commercial-scale offshore wind development and has been an active BOEM State Task Force participant since the early 2000s. Early in the planning process for offshore wind of the coast of New Jersey, the NJBPU sponsored the 2004 *New Jersey Offshore Wind Energy: Feasibility Study* to investigate the feasibility of utility-scale wind energy development in the waters offshore of New Jersey. This desktop investigation characterized the geophysical, environmental, regulatory, and commercial siting considerations that would need to be addressed to develop New Jersey's offshore wind industry. Of the 2,465 square nautical miles (nm^2) studied (from Sandy Hook to Egg Island Point and out to water depths of 100 ft [30 m]), approximately half (1,223 nm^2) was deemed conditionally viable for offshore wind development after excluding areas with insufficient wind resources and conflicting water and air space uses (AREC and AWS 2004).

2 According to BOEM (2020), the technical capacity of the uncommitted portions of the lease areas offshore New York/New Jersey and Delaware/Maryland is 3,996 MW and 1,908 MW, respectively. Based on this assessment, Lease Area OCS-A 0549 serves a critical role in achieving the New Jersey target of 7,500 MW of offshore wind energy capacity by 2035 and the New York target of 9,000 MW of offshore wind energy by 2035.

In 2004, the Governor of New Jersey authorized a State of New Jersey Blue Ribbon Panel on Development of Offshore Wind Turbine Facilities to identify and weigh the costs and benefits of developing offshore wind turbine facilities for New Jersey. The Blue-Ribbon Panel's final report, submitted to the Governor in 2006, recommended that New Jersey conduct scientific baseline studies to collect data about the existence, location, and nature of New Jersey's offshore natural resources (see 76 FR 22130).

In response, the New Jersey Department of Environmental Protection (NJDEP) contracted Geo-Marine, Inc. to conduct Ocean/Wind Power Ecological Baseline Studies (OWPEBS) offshore New Jersey. The OWPEBS included 24 months of field studies in 2008 and 2009 to address data gaps on birds, sea turtles, marine mammals, and other natural resources. As part of the OWPEBS, desktop reviews of fish and fisheries resources in the 1,360 nm^2 study area were also conducted (GMI 2010).

The results of the OWPEBS field surveys and desktop analyses were instrumental in identifying suitable areas for siting future wind energy facilities offshore of New Jersey. Specifically, the results of the studies were used to delineate the New Jersey Call Area identified by BOEM in the "Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore New Jersey – Call for Information and Nominations" (the Call) published on April 20, 2011 (see 76 FR 22130). The purpose of the Call was to determine if competitive interest existed for the development of offshore wind generation facilities offshore New Jersey within the New Jersey Call Area. The New Jersey Call Area was delineated through consultation with the New Jersey Renewable Energy Task Force using the 1,360 nm^2 OWPEBS study area as a starting point. Areas of the OWPEBS study area excluded from the Call Area included (see 76 FR 22130):

- "no build areas" such as shipping lanes, traffic separation schemes, pipelines and cables, artificial reefs, and shipwrecks
- areas of high avian density (particularly in shoals and within 7 nm of the New Jersey coast)
- areas of high marine mammal and sea turtle density
- fishing hotspots for recreational and commercial fishermen.

In addition, the Call gathered comments from interested and affected parties regarding site conditions, resources, or other uses within the area. BOEM received 11 commercial indications of interest to obtain a commercial lease for an offshore wind facility and numerous comments from the public.

In February 2012, BOEM published an Environmental Assessment (EA) and issued a Finding of No Significant Impact (FONSI) for commercial wind lease issuance and site assessment activities on the Atlantic OCS offshore New Jersey, Delaware, Maryland, and Virginia (see 77 FR 5560). As a result of subsequent discussions with the U.S. Coast Guard (USCG), the New Jersey Renewable Energy Task Force, and maritime stakeholders in December 2012, BOEM decided to remove certain OCS Lease Blocks from the area offshore New Jersey studied in the EA to alleviate navigational safety concerns resulting from vessel transits out of New York Harbor (see 79 FR 42361). This revised area constitutes the NJWEA. The NJWEA was divided into two leasing areas: Lease Area OCS-A 0498 and Lease Area OCS-A 0499.

In September 2015, BOEM announced that it had published a Final Sale Notice for the sale of Lease Areas OCS-A 0498 and OCS-A 0499 (see 80 FR 57862); the competitive lease sale was held on November 9, 2015. U.S. Wind Inc. was the winning bidder for Lease Area OCS-A 0499 (see Figure 1.1-1). In December 2018, the lease was assigned to EDF Renewables Development, Inc. The lease was subsequently assigned to Atlantic Shores Offshore Wind, LLC in August 2019. In April 2022, BOEM approved the segregation of the Project Lease Area from the remainder of Lease Area OCS-A 0499. This new lease area is designated as Lease Area OCS-A 0549.

1.3.2 Permits, Approvals, and Consultations

BOEM has jurisdictional authority under the Outer Continental Shelf Lands Act of 1953, as amended by the Energy Policy Act of 2005, to grant leases, easements, and ROWs for the development of renewable energy on the OCS. BOEM will ensure that all activities conducted on the OCS are carried out in a manner that provides for safety, environmental protection, protection of national security interests, and protection of the rights of others to use the OCS and its resources. A Site Assessment Plan (SAP) and COP are the authorization pathways BOEM uses to review and approve renewable energy site assessment and site development on the OCS, respectively. BOEM will be the lead federal agency for the Project and will coordinate with other Federal agencies participating in consultations and/or issuing permits/clearances for the Project (e.g., Environmental Protection Agency [EPA], National Marine Fisheries Services [NMFS], U.S. Army Corps of Engineers [USACE], Federal Aviation Administration [FAA], USCG [PATONS]).

In reviewing the COP, BOEM must comply with various requirements under NEPA, Clean Air Act, Clean Water Act (CWA), Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Management Act, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, Marine Mammals Protection Act (MMPA), and National Historic Preservation Act (NHPA). To facilitate BOEM's review under NHPA, a description of the Preliminary Area of Potential Effects (PAPE) is provided in Section 6.0 of Volume II. BOEM will coordinate and consult with numerous other federal agencies, including NMFS, U.S. Fish and Wildlife Service (USFWS), EPA, the U.S. Department of Defense (DoD), the USCG, and USACE during the review process. Under the Coastal Zone Management Act (CZMA), BOEM will coordinate with the States of New Jersey and New York to ensure that the Project is consistent with State-level coastal zone management plans.

The onshore facilities and portions of the offshore facilities (within State waters extending approximately 3 nm from shore) associated with the Project are located in the States of New Jersey and New York and are also subject to applicable state and local regulatory review processes. Table 1.3-1 lists the anticipated federal, New Jersey, New York, regional (county), and local reviews and permits required for the Project; the table does not include permits that vessel operators or contractors may need to obtain for purposes that are not specific to construction and operation of the Project.

Table 1.3-1 Required Permits/Approvals for the Atlantic Shores Lease Area OCS-A 0549

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
Federal Permits/Approvals			
BOEM	SAP approval	December 6, 2019	Received Q1 2021
	COP approval/Record of Decision (ROD)	03/31/23	Expected Q1 2026
	NEPA Environmental Review	To be initiated by BOEM. Expected Q4 2023	Expected Q1 2026
	Consultation under Section 7 of the ESA with NMFS and USFWS, coordination with New Jersey under the CZMA, government-to-government tribal consultations, consultation under Section 106 of the NHPA, consultation with DoD, consultation with NMFS under the MMPA, and consultation with NMFS for Essential Fish Habitat.	To be initiated by BOEM.	Conducted concurrently with NEPA and COP review and approval process.
	Facility Design Report (FDR) and Fabrication and Installation Report (FIR)	Expected Q1 2025	Expected Q1 2025
EPA	OCS Air Permit	OCS Air Permit Application submission expected Q3 2024	Expected Q2 2026
	NPDES Permit HVDC Cooling Water Intake System and for GBS or Suction Bucket Foundation Installation	NPDES Permit Application submission expected Q3 2024	Expected Q2 2026
USACE	CWA Section 404 (required for discharge of dredged materials and placement of foundations, scour protection, and cable protection) Rivers and Harbors Act of 1899 Section 10 Individual Permit (required for all offshore structures and dredging activities) Alteration to, temporary or permanent occupation or use of a USACE Civil Works project under 33 USC 408 (Section 408) Section 103 of the Marine Protection, Research, and Sanctuaries Act (for dredged material disposal, if required)	Expected Q4 2024	Expected Q2 2026

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
NMFS	Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA)	Expected Q3 2024	Expected Q2 2026
USCG	Private Aid to Navigation (PATON) authorization	Expected Q2 2025	Expected Q2 2026
FAA	Determination of No Hazard to Air Navigation	Expected Q3 2024	Expected Q3 2025
New Jersey State Permits/Approvals			
NJBPU	Approval of Petition from electric distribution company for interconnection	To be determined (TBD)	TBD
NJDEP, Division of Land Resource Protection (DLRP)	Waterfront Development Individual Permit – Water/Upland Coastal Area Facility Review Act Permit Coastal Wetlands Permit CWA Section 401, State Water Quality Certificate Freshwater Wetlands General or Individual Permit Flood Hazard Area Individual Permit or Verification Dredging-related permits, as applicable Dredged material disposal permits, as applicable	Application submission expected Q2 2024	Expected Q2 2025
NJDEP, Division of Parks and Forestry, Natural Heritage Program	State Species Consultation	Initiated upon submittal of the NJDEP DLRP application	In conjunction with NJDEP review and approval (expected Q2 2025)
NJDEP, Historic Preservation Office (HPO)	Review Procedures under the New Jersey Register of Historic Places Act	Initiated prior to or upon submittal of the NJDEP DLRP application	In conjunction with NEPA review and NJDEP review and approval (expected Q2 2025)
	Consultation under Section 106 of the NHPA of 1966	Initiated prior to or upon submittal of the NJDEP DLRP application	In conjunction with NEPA review and NJDEP review and approval (expected Q2 2025)
NJDEP, Coastal Management Program	Concurrence with Federal Coastal Zone Consistency Determination	Expected Q4 2024 to be filed in conjunction with the NJDEP DLRP application)	Expected Q2 2025

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
NJDEP, Bureau of Tidelands Management, Tidelands Resource Council	Tidelands License, Lease, or Grant	Expected Q4 2024 (to be filed in conjunction with the NJDEP DLRP application)	Expected Q4 2025
NJDEP, Department of Water Quality Bureau of Nonpoint Pollution Control	NJPDES 5G3 Stormwater General Construction Permit	To be filed minimum of 90 days prior to the start of construction	TBD
Green Acres	Green Acres Diversion	Expected Q4 202	Expected Q2 2025 (highly dependent on State House Commission meeting schedule)
NJDEP, Division of Parks and Forestry, Natural Heritage Program	State Species Consultation	Initiated upon submittal of the NJDEP DLRP application	In conjunction with NJDEP review and approval (expected Q2 2025)
NJDEP, Water Allocation and Well Permitting	Water Use (dewatering during construction)	To be filed at least 30 days prior to dewatering activities	TBD
New Jersey Department of Transportation (NJDOT), Division of Right of Way and Access Management	Access Permits	Expected Q4 2025	Expected Q2 2025
New Jersey Local Permits / Approvals			
Freehold Soil Conservation District	Soil Erosion Sediment Control	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
Monmouth County Highway Division of Inspections	Road Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Site Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Building Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Site Development Stormwater Plan	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Township of Wall	Major Site Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Site Development Stormwater Plan	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
	Development/Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Construction Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Tree Removal Plan	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Conditional Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
Township of Howell	Division of Land Use and Planning – Land Development Application	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Division of Engineering – Plot Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Tree Removal Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
Borough of Sea Girt	Site Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Building Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Site Development Stormwater Plan	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Borough of Point Pleasant	Road Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
Township of Lakewood	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Planning Board Application	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Township of Brick	Construction Permit Application	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
	Zoning Permit Application	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Borough of Brielle	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Planning/Zoning Bord Application	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Tree Removal Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Site Plan	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Borough of Neptune City	Site Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Street Excavation Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Tree Removal Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Construction Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
City of Asbury Park	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Application for Development	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Site Plan	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Application for Variance	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Borough of Tinton Falls	Street Excavation Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Tree Removal Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Development Application	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
Township of Colts Neck	Tree Removal Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Development Application	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Zoning Application	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
Borough of Manasquan	Site Plan	To be filed at least 12 months prior to start of construction activities (expected Q1 2024)	Expected Q1 2026
	Street Excavations	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2024)	Expected Q1 2026
	Tree Removal Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2024)	Expected Q1 2026
Township of Neptune	Street Excavation Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2024)	Expected Q1 2026
	Construction Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2024)	Expected Q1 2026
	Site Plans	To be filed at least 12 months prior to start of construction activities (expected Q1 2024)	Expected Q1 2026
	Zoning Permit Application	To be filed at least 12 months prior to start of construction activities (expected Q1 2024)	Expected Q1 2026
New York State Permits / Approvals			
New York State Department of Public Service (NYSDPS)	Article VII – Major Electric and Gas Transmission Facilities	Expected Q2 2025	Expected Q2 2026
NYSDPS, in coordination with New York State Department of Environmental Conservation (NYSDEC)	CWA Section 401, State Water Quality Certificate	Expected Q2 2025	Expected Q2 2026
NYSDPS, in coordination with New York State Department of Environmental Conservation (NYSDEC)	Environmental Conservation Act (ECL) Article 24 Freshwater Wetlands Permit	Expected Q2 2025	Expected Q2 2026
NYSDPS, in coordination with New York State Department of Environmental Conservation (NYSDEC)	Article 25 Tidal Wetlands Permit	Expected Q2 2025	Expected Q2 2026

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
NYSDPS, in coordination with New York State Department of Environmental Conservation (NYSDEC)	Article 15 Protection of Streams and Navigable Waters- Wild, Scenic, and Recreational Rivers Permit	Expected Q2 2025	Expected Q2 2026
New York State Department of State (NYSDOS)	Coastal Zone Management Program Federal Consistency Certification/ Compliance with State Executive Law Article 42	Expected Q2 2025	Expected Q2 2026
NYDEC, Department of Environmental Conservation	Endangered and Threatened Species Consultation- Incidental Take Permit (ITC)	Expected Q2 2025	Expected Q2 2026
NYS Office of Parks, Recreation and Historical Preservation (NYS OPRHP), State Historic Preservation Office (SHPO)	Section 106 Consultation under the National Historic Preservation Act (NHPA) and Section 14.09 NYS Historical Preservation Act	Expected Q2 2025	Expected Q2 2026
NYSDEC	State Pollutant Discharge Elimination System (construction stormwater discharge)	Expected Q2 2025	Expected Q 2026
NYS DOT, Department of Transportation	Highway Work and Right-of Way Permits	Expected Q2 2025	Expected Q2 2026
NYS OGS, Office of General Services	State Submerged Lands Easement	Expected Q2 2025	Expected Q2 2026
NYDEC, Department of Environmental Conservation/ NYPSC, NY Public Services Commission	Coastal Environmental Impacts/ Coastal Erosion Management Permit (Coastal Erosion Hazard Area (CEHA) Permit)	Expected Q2 2025	Expected Q2 2026
New York State Local Permits/Approvals			
New York City Planning Commission	Local Waterfront Redevelopment Permit	Expected Q2 2025	Expected Q2 2026
Richmond County, NY Dept of Transportation Operations Division	Highway Occupancy Work Permit / Utility Permit	Expected Q2 2025	Expected Q2 2026
Kings County, NY Dept of Transportation Staten Island, NY	Highway Occupancy Work Permit/Utility Permit	Expected Q2 2025	Expected Q2 2026
Richmond County, Staten Island Burrough, NY	Site Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q3 2026
	Land Use/Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q1 2025)	Expected Q1 2026
	Construction Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026

Agency/Regulatory Authority	Permit/Approval	Submission Date	Approval/ Completion Date
	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Stormwater Control for Major Development (if required)	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Stormwater Plan Approval	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
Kings County, Brooklyn Burrough, NY	Site Plan Approval	To be filed at least 12 months prior to start of construction activities (expected Q3 2024)	Expected Q3 2025
	Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q3 2024)	Expected Q3 2025
	Land Use/Zoning Permit	To be filed at least 12 months prior to start of construction activities (expected Q3 2024)	Expected Q3 2025
	Construction Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Street Opening Permit	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Stormwater Control for Major Development (if required)	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
	Stormwater Plan Approval	To be filed at least 90 days prior to soil disturbance activities (expected Q4 2025)	Expected Q1 2026
NYC Environmental Protection- New York City Burroughs	Tier II Reporting for all Hazardous Substances, including petroleum, oils, lubricants for substations/HDD installation	Submission Due March 1 every Year	TBD

1.3.3 Commercial Lease Stipulations and Compliance

Table 1.3-2 demonstrates how Atlantic Shores and the affiliate Project Companies are currently complying with or will comply with the stipulations outlined in Lease Agreement OCS-A 0549.

Table 1.3-2 Compliance with Stipulations in Lease Agreement OCS-A 0549

Stipulation	Compliance
Section 4(a): The Lessee must make all rent payments to the Lessor in accordance with applicable regulations in 30 CFR Part 585, unless otherwise specified in Addendum "B".	Atlantic Shores has made and will continue to make all rent payments in accordance with applicable regulations, unless otherwise specified in Addendum "B" of the Lease Agreement.
Section 4(b): The Lessee must make all operating fee payments to the Lessor in accordance with applicable regulations in 30 CFR Part 585, as specified in Addendum "B".	Atlantic Shores will make all operating fee payments in accordance with applicable regulations.
Section 5: The Lessee may conduct those activities described in Addendum "A" only in accordance with a SAP or COP approved by the Lessor. The Lessee may not deviate from an approved SAP or COP except as provided in applicable regulations in 30 CFR Part 585.	Atlantic Shores will conduct activities as described in the approved SAP and COP.
Section 7: The Lessee must conduct, and agrees to conduct, all activities in the leased area in accordance with an approved SAP or COP, and with all applicable laws and regulations.	Atlantic Shores will conduct all activities in the leased area in accordance with the approved SAP and COP and all applicable laws and regulations.
Section 10: The Lessee must provide and maintain at all times a surety bond(s) or other form(s) of financial assurance approved by the Lessor in the amount specified in Addendum "B".	Atlantic Shores will provide the necessary financial assurances as described in Section 6.3 of Volume I of this COP.
Section 13: Unless otherwise authorized by the Lessor, pursuant to the applicable regulations in 30 CFR Part 585, the Lessee must remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by activities on the leased area, including any project easements within two years following lease termination, whether by expiration, cancellation, contraction, or relinquishment, in accordance with any approved SAP, COP, or approved Decommissioning Application, and applicable regulations in 30 CFR Part 585.	Preliminary decommissioning plans are described in Section 6.2 of Volume I of this COP. Decommissioning will be conducted in accordance with the applicable regulations.
Section 14: The Lessee must: (a) Maintain all places of employment for activities authorized under this lease in compliance with occupational safety and health standards and, in addition, free from recognized hazards to employees of the Lessee or of any contractor or subcontractor under this lease; (b) Maintain all operations within the leased area in compliance with regulations in 30 CFR Part 585 and orders from the Lessor and other Federal agencies with jurisdiction, intended to protect persons, property and the environment on the OCS; and (c) Provide any requested documents and records, which are pertinent to occupational or public health, safety, or environmental protection, and allow prompt access, at the site of any operation or activity conducted under this lease, to any inspector authorized by the Lessor or other Federal agency with jurisdiction.	(a) Atlantic Shores has and will continue to maintain all places of employment in compliance with applicable occupational safety and health standards. (b) Atlantic Shores will maintain all operations within the lease area in compliance with applicable regulations. (c) Atlantic Shores will provide any requested documents and records that are pertinent to occupational or public health, safety, or environmental protection, and allow prompt access to the site of Project activities to authorized inspectors.
Section 15: The Lessee must comply with the Department of the Interior's Non-procurement debarment and suspension regulations set forth in 2 CFR Parts 180 and 1400 and must communicate the requirement to comply these regulations to persons with whom it does business related to this lease by including this requirement in all relevant contracts and transactions.	Atlantic Shores will comply with the applicable Department of Interior (DOI) non-procurement debarment and suspension regulations.

Stipulation	Compliance
Section 16: During the performance of this lease, the Lessee must fully comply with paragraphs (1) through (7) of section 2020 of Executive Order 11246, as amended (reprinted in 41 CFR 60-1.4(a)), and the implementing regulations, which are for the purpose of preventing employment discrimination against persons on the basis of race, color, religion, sex, or national origin.	Atlantic Shores will fully comply with paragraphs (1) through (7) of section 2020 of Executive Order 11246, as amended.
Addendum "B", Section III (Payments): Unless otherwise authorized by the Lessor in accordance with the applicable regulations in 30 CFR Part 585, the Lessee must make payments as described below.	Atlantic Shores will make payments as specified in Addendum "B," Section III.

1.3.4 Guide to Location of Required Information for a COP

This COP, which has been developed in accordance with 30 CFR Part 585 and the stipulations in Atlantic Shores' Lease Agreement OCS-A 0549, is organized in two volumes:

- Volume I provides detailed descriptions of the Project's offshore and onshore facilities and how the Project plans to construct, operate, and decommission those facilities.
    - Section 1.0 provides an overview of the Project and its purpose, describes the regulatory framework under which the Project will be evaluated, summarizes Atlantic Shores' stakeholder outreach efforts, and details Atlantic Shores' commitment to health, safety, security, and environmental (HSSE) protection.
    - Section 2.0 describes the Project's economic, community, environmental, and public health benefits.
    - Section 3.0 summarizes Atlantic Shores' siting process and explains how the PDE was developed.
    - Section 4.0 provides a detailed description of the Project's PDE and proposed construction activities, including an overview of the Project's construction schedule.
    - Section 5.0 describes Atlantic Shores' O&M activities, including surveys and inspections.
    - Section 6.0 provides the Project's general decommissioning concept and describes financial assurance.
    - Section 7.0 describes the chemical products used and wastes generated by the Project.
- Volume II provides a comprehensive assessment of the Project's potential effects on physical, biological, visual, cultural, and socioeconomic resources and describes the numerous measures that Atlantic Shores' will employ to avoid, minimize, and mitigate those potential effects. Volume II also characterizes the Project's environmental setting.

Table 1.3-3 lists BOEM's requirements for a COP pursuant to 30 CFR Part 585 and the corresponding sections of this COP that provide the responsive information.

Table 1.3-3 COP Requirements for Commercial Leases Pursuant to 30 CFR §§ 585.105(a), 621(a-g), 626(a) and (b), 627(a-d)

Requirement	Location in COP
30 CFR §585.105(a)	
1) Design your projects and conduct all activities in a manner that ensures safety and will not cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components to the extent practicable; and take measures to prevent unauthorized discharge of pollutants including marine trash and debris into the offshore environment.	Section 1.3.3 of Volume I Section 1.5.2 of Volume I Section 1.5.3 of Volume I Section 3.0 of Volume I Section 4.0 of Volume I Section 5.0 of Volume I Section 6.0 of Volume I Section 7.0 of Volume I Appendix I-C Appendix I-D Section 2.0 of Volume II Section 3.0 of Volume II Section 4.0 of Volume II Section 9.0 of Volume II Appendix II-I Appendix II-K
30 CFR §585.621(a-g)	
a) The Project will conform to all applicable laws, implementing regulations, lease provisions, and stipulations or conditions of the lease.	Section 1.3 of Volume I Section 1.5 of Volume I Section 4.0 of Volume I Section 5.0 of Volume I Section 6.0 of Volume I
b) The Project will be safe.	Section 1.3.3 (Table 1.3-2) of Volume I Section 1.5 of Volume I Appendix I-D Section 9.0 of Volume II
c) The Project will not unreasonably interfere with other uses of the OCS, including those involved with National security or defense.	Section 7.3 of Volume II Section 7.4 of Volume II Section 7.6 of Volume II Section 7.7 of Volume II Section 7.8 of Volume II Appendix II-S Appendix II-T Appendix II-U
30 CFR §585.621(a-g)	
d) The Project will not cause undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance.	Section 2.0 of Volume II Section 3.0 of Volume II Section 4.0 of Volume II Section 5.0 of Volume II Section 6.0 of Volume II Section 7.0 of Volume II Section 8.0 of Volume II Section 9.0 of Volume II

Requirement		Location in COP
d)	Continued)	Appendix II-A Appendix II-C Appendix II-D Appendix II-E Appendix II-F Appendix II-G Appendix II-H Appendix II-I Appendix II-J Appendix II-K Appendix II-M Appendix II-N Appendix II-O Appendix II-P Appendix II-Q Appendix II-R Appendix II-V Appendix II-W
e)	The Project will use the best available and safest technology.	Section 1.3.3 of Volume I Section 1.5.2 of Volume I Section 1.5.3 of Volume I Section 3.0 of Volume I Section 4.0 of Volume I Appendix I-D
f)	The Project will use best management practices.	Section 2.0 of Volume II Section 3.0 of Volume II Section 4.0 of Volume II Section 5.0 of Volume II Section 6.0 of Volume II Section 7.0 of Volume II Section 9.0 of Volume II
30 CFR §585.621(a-g)		
g)	The Project will use properly trained personnel.	Section 1.5.2 of Volume I Section 1.5.3 of Volume I Section 5.0 of Volume I Appendix I-D Section 9.0 of Volume II
30 CFR §585.626(a)		
(1) Shallow Hazards		
i.	Shallow faults;	Appendix II-A
ii.	Gas seeps or shallow gas;	Appendix II-A
iii.	Slump blocks or slump sediments;	Appendix II-A
iv.	Hydrates; or	Appendix II-A
v.	Ice scour of seabed sediments	Appendix II-A

Requirement		Location in COP
(2) Geological survey relevant to the design and siting of facility		
i.	Seismic activity at your proposed site;	Appendix II-A
ii.	Fault zones;	Appendix II-A
iii.	The possibility and effects of seabed subsidence; and	Appendix II-A
iv.	The extent and geometry of faulting attenuation effects of geological conditions near your site.	Appendix II-A
(3) Biological		
i.	A description of the results of biological surveys used to determine the presence of live bottoms, hard bottoms, and topographic features, and surveys of other marine resources such as fish populations (including migratory populations), marine mammals, sea turtles, and sea birds.	Section 4.0 of Volume II Appendix II-E Appendix II-G Appendix II-J Appendix II-L
(4) Geotechnical Survey		
i.	The results of a testing program used to investigate the stratigraphic and engineering properties of the sediment that may affect the foundations or anchoring systems for your facility.	Appendix II-A
ii.	The results of adequate *in situ* testing, boring, and sampling at each foundation location, to examine all important sediment and rock strata to determine its strength classification, deformation properties, and dynamic characteristics.	Appendix II-A
30 CFR §585.626(a)		
iii.	The results of a minimum of one deep boring (with soil sampling and testing) at each edge of the project areas and within the project areas as needed to determine the vertical and lateral variation in seabed conditions and to provide the relevant geotechnical data required for design.	Appendix II-A
(5) Archaeological Resources		
i.	A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act (NHPA) (16 U.S.C. 470 et. seq.), as amended.	Section 6.0 of Volume II Appendix II-N Appendix II-O Appendix II-P Appendix II-Q
(6) Overall Site Investigation		
i.	Scouring of the seabed;	Appendix II-A
ii.	Hydraulic instability;	Appendix II-A
iii.	The occurrence of sand waves;	Appendix II-A
iv.	Instability of slopes at the facility location;	Appendix II-A
v.	Liquefaction, or possible reduction of sediment strength due to increased pore pressures;	Appendix II-A
vi.	Degradation of subsea permafrost layers;	Appendix II-A

Requirement	Location in COP
vii. Cyclic loading;	Appendix II-A
viii. Lateral loading;	Appendix II-A
ix. Dynamic loading;	Appendix II-A
x. Settlements and displacements;	Appendix II-A
xi. Plastic deformation and formation collapse mechanisms; and	Appendix II-A
xii. Sediment reactions on the facility foundations or anchoring systems.	Appendix II-A
30 CFR §585.626(b)	
1) Contact information	Section 1.5.1 of Volume I
2) Designation of operator, if applicable	Section 1.5.1 of Volume I
3) The construction and operation concept	Section 1.1 of Volume I Section 4.0 of Volume I Section 5.0 of Volume I
30 CFR §585.626(b)	
4) Commercial lease stipulations and compliance	Section 1.3.3 (Table 1.3-2) in Volume I
5) A location plat	Section 1.1 (Figure 1.1-2) of Volume I
6) General structural and project design, fabrication, and installation	Section 3.0 of Volume I Section 4.0 of Volume I
7) All cables and pipelines, including cables on project easements	Section 1.3.1 of Volume I Section 4.5 of Volume I Section 4.7 of Volume I Section 4.8 of Volume I Section 5.4.4 of Volume I Section 5.4.5 of Volume I Section 5.4.6 of Volume I Section 6.2 of Volume I
8) A description of the deployment activities	Section 1.5.3 of Volume I Section 4.0 of Volume I
9) A list of solid and liquid wastes generated	Section 7.0 of Volume I
10) A listing of chemical products used (if stored volume exceeds EPA Reportable Quantities)	Section 7.0 of Volume I
11) A description of any vessels, vehicles, and aircraft you will use to support your activities	Section 4.10 of Volume I Section 5.6 of Volume I
12i) A general description of the operating procedures and systems under normal conditions	Section 5.0 of Volume I
12ii) A general description of the operating procedures and systems in the case of accidents or emergencies, including those that are natural or manmade	Section 1.5.3 of Volume I Section 5.4 of Volume I Section 9.0 of Volume II Appendix I-C Appendix I-D
13) Decommissioning and site clearance procedures	Section 6.0 of Volume I

Requirement	Location in COP
14i) A listing of all Federal, State, and local authorizations, approvals, or permits that are required to conduct the proposed activities, including commercial operations. The list should contain U.S. Coast Guard, U.S. Army Corps of Engineers, and any authorizations pertaining to energy gathering, transmission or distribution (e.g., interconnection authorizations).	Section 1.3 (Table 1.3-1) of Volume I
30 CFR §585.626(b)	
14ii) A listing of all Federal, State, and local authorizations, approvals, or permits that are required to conduct the proposed activities, including commercial operations, along with a statement indicating whether you have applied for or obtained such authorization, approval, or permit.	Section 1.3 (Table 1.3-1) of Volume I
15) Your proposed measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	Section 2.0 of Volume II Section 3.0 of Volume II Section 4.0 of Volume II Section 5.0 of Volume II Section 6.0 of Volume II Section 7.0 of Volume II
16) Information you incorporate by reference	Section 8.0 of Volume I Section 10.0 of Volume II
17) A list of agencies and persons with whom you have communicated, or with whom you will communicate, regarding potential impacts associated with our proposed activities	Section 1.4 of Volume I Appendix I-A
18) Reference	Section 8.0 of Volume I Section 10.0 of Volume II
19) Financial assurance	Section 6.3 of Volume I
20) CVA nominations for reports required in subpart G of this part	Section 1.5.2 of Volume I
21) Construction schedule	Section 4.1 (Table 4.1-1) of Volume I
22) Air quality information	Section 3.1 of Volume II Appendix II-C
23) Other information	Section 1.0 of Volume I Appendix II-B
30 CFR §585.627(a)	
1) Hazard information	Section 2.1.4 of Volume II Appendix II-A
2) Water quality	Section 3.2 of Volume II
3)(i) Benthic communities	Section 4.5 of Volume II Appendix II-G
3)(ii) Marine mammals	Section 4.7 of Volume II
3)(iii) Sea turtles	Section 4.8 of Volume II
3)(iv) Coastal and marine birds	Section 4.3 of Volume II Appendix II-F
3)(v) Fish and shellfish	Section 4.5 of Volume II Section 4.6 of Volume II Appendix II-G

Requirement	Location in COP
	Appendix II-J
3)(vi) Plankton	Section 4.6 of Volume II
3)(vii) Seagrasses	Section 4.2 of Volume II Appendix II-E
(3)(viii) Plant life	Section 4.1 of Volume II Section 4.2 of Volume II
4) Threatened or endangered species	Section 4.0 of Volume II
5) Sensitive biological resources or habitats	Section 4.0 of Volume II Appendix II-D Appendix II-E Appendix II-F Appendix II-G Appendix II-J
6) Archaeological resources	Section 6.2 of Volume II Section 6.3 of Volume II Appendix II-P Appendix II-Q
7) Social and economic resources	Section 7.0 of Volume II Appendix II-R
30 CFR §585.627(a)	
8) Coastal and marine uses	Section 7.3 of Volume II Section 7.4 of Volume II Section 7.5 of Volume II Section 7.6 of Volume II Section 7.7 of Volume II Appendix II-K Appendix II-R Appendix II-S Appendix II-T
9) Consistency certification	Appendix I-B
10) Other resources, conditions, and activities	Section 7.8 of Volume II Section 7.9 of Volume II Section 8.0 of Volume II Section 9.0 of Volume I Appendix II-I Appendix II-T Appendix II-U
FR §585.627(b)	
Consistency certification	Appendix I-B
FR §585.627(c)	
Oil spill response plan	Section 1.5.3.2 of Volume I Appendix I-C
30 CFR §585.627(d)	
Safety management system	Section 1.5.3.1 of Volume I Appendix I-D

1.4 Agency and Stakeholder Outreach

1.4.1 Coordination with Agencies, Tribes, and Municipalities

Atlantic Shores proactively engages with federal, state, and local agencies to discuss development of the Lease Area, to present Project-specific details, to collaboratively identify resource issues of concern and mitigation strategies, and to design scientific research and monitoring studies that satisfy all regulatory review requirements. Atlantic Shores meets bi-weekly and quarterly with key agencies including BOEM, the USCG, the NJDEP, the NYSDEC, the NYSDOS, and the NYSDPS and has collaborated on research activities with other agencies (e.g., the red knot satellite tagging study with the USFWS). Meetings held to date between agencies and Atlantic Shores are listed in Appendix I-A.

Atlantic Shores recognizes the importance of ensuring local elected officials are familiar with the Project and their potential benefits and impacts to their constituents. Atlantic Shores has held meetings with local municipalities and leaders in Monmouth, and Ocean Counties in New Jersey (see Appendix I-B), and Richmond and Kings counties in New York. These meetings with local officials have focused on introducing and soliciting input on PDE elements, the Project's potential environmental effects, and opportunities aligned with local workforce development.

Engagement with federally recognized tribes with historical ties to the Lease Area off the coast of New Jersey, including Shinnecock Indian Nation, and the Narragansett Indian Tribe is required per Lease. While there are no Federally recognized tribes in New Jersey, Atlantic Shores has or will also engage with other interested Federal (may include the Delaware Tribe of Indians, the Delaware Nation, the Stockbridge-Munsee Community Band of Mohican Indians, the Shawnee Tribe, the Absentee-Shawnee Tribe of Indians of Oklahoma, Seneca Nation of Indians, Tonawanda Band of Seneca, Tuscarora Nation, St. Regis Mohawk Tribe, Oneida Indian Nation of New York, Onondaga Nation and Cayuga Nation) and State (may include Unkechaug Indian Nation, Nanticoke Lenni-Lenape Nation, Powhatan Renape Nation, Ramapough Munsee Lenape Nation and the Lenape Tribe of Delaware) recognized tribes in New Jersey and New York. Atlantic Shores uses multiple means of communication (i.e., email, telephone, contacts in other tribes) to engage each tribe and has reached out to BOEM's, the NJDEP's and New York OPRHP's State Historic Preservation Officer (SHPO) to obtain the most current lists of tribal points of contact. Meetings conducted with tribal representatives to date are listed in Appendix I-A.

In addition to fulfilling regulatory requirements to notify tribes prior to specific milestones, Atlantic Shores has worked to establish early relationships to address tribal concerns. Atlantic Shores' approach to tribal engagement first focused on understanding the histories of the tribes, learning about their traditions, and providing opportunities for tribes to provide input into the Project. In responding to tribes' request to learn about the Project's activities, Atlantic Shores provided tribal members with a virtual platform to participate in the real-time assessment of deep-sea borings from the Project Area by Qualified Marine Archaeologists.

As the Project advances, Atlantic Shores will continue to consult with federal, state, local agencies and municipalities as well as federal and state-recognized tribes.

1.4.2 Stakeholder Outreach

Atlantic Shores is actively engaged with stakeholders in both New Jersey and New York to identify and discuss their interests and concerns regarding offshore wind and the development of the Project. Since early 2019, Atlantic Shores has conducted hundreds of meetings and working sessions with stakeholders, suppliers, interest groups, and local communities that have an interest in or may be affected by the Project (see Appendix I-A). The community groups and stakeholders that Atlantic Shores is engaged with include the following:

- **Residents of Monmouth County, New Jersey and Richmond and Kings Counties, New York.** Residents of these counties may live near the Project's landfall sites, onshore interconnection cable routes, onshore substations and/or converter stations, and/or O&M facility. Some residents may have a view of some Project components.
- **Business groups/associations**. Atlantic Shores has strategically identified business groups and associations that it can join in diverse partnerships. The goals of these partnerships include information sharing, workforce training, and supply chain contacts. As described in Section 2.1, Atlantic Shores is also working to create local employment opportunities within both States through collaboration with existing local supply chain partners and by attracting new suppliers to the Northeastern U.S. As part of this effort, Atlantic Shores has signed a first-of-its-kind memorandum of understanding (MOU) with six local unions to help train and employ a productive, safe, skilled, local offshore wind workforce.
- **Environmental non-governmental organizations (eNGOs)**. Atlantic Shores has conducted environmental resource and issue-focused meetings with representatives from local, regional, and national eNGOs (e.g., New Jersey Sierra Club, New Jersey Energy Coalition, Clean Water Action, New Jersey Audubon, Surf Rider, National Wildlife Federation, Barnegat Bay Partnership, Conservation Law Foundation, the Natural Resources Defense Council, etc.) to educate them about the Project and to identify shared objectives, opportunities for collaboration, and topics requiring further discussion. Appendix I-B provides a complete list of meetings between Atlantic Shores and eNGOs.
- **Academia and research/scientific institutes**. Atlantic Shores is coordinating with educational and technical institutions in both States to support cooperative science, engineering, research, and next generation workforce training that may benefit from the Project's development, construction, and operations (see Appendix I-A). These activities also contribute to broader regional research efforts (see Section 2.2). Atlantic Shores has asked more than 52 different institutions to declare their interest in collaboration on academic and educational work in relation to the Project, of which approximately eight have expressed an interest in doing so to date.
- **Commercial and recreational fishermen and boaters**. Atlantic Shores engages with commercial and recreational boaters and fishermen that are active in and around the Atlantic Shores' Offshore Project Area. Atlantic Shores' engagement with fishermen is described further in Section 1.4.2.1.

To engage in productive and effective dialogue with key stakeholders, Atlantic Shores has assembled a Stakeholder Communications Team comprised of Atlantic Shores management, Community Liaison Officers, community relations staff, and government relations staff. All have prior experience working cooperatively within New Jersey and New York coastal communities, allowing Atlantic Shores to better understand the interests and concerns of stakeholder groups.

Atlantic Shores has developed and implemented an array of stakeholder engagement tools to establish two-way dialogue with interested parties and to educate people and organizations about Atlantic Shores and more broadly offshore wind. Atlantic Shores engages stakeholders through the following means:

- attending community events and hosting in-person community meetings
- maintaining an up-to-date and interactive website
- distributing quarterly newsletters containing Project updates to over 1,000 stakeholders
- using social media platforms (e.g., Facebook and Twitter) for educational videos, project updates, promoting opportunities
- hosting informational sessions and open houses (in-person and/or virtually)
- participating in and organizing workshops with key local, regional, and national eNGOs
- conducting polling and focus groups.

These tools also provide opportunities for people and organizations to express interest in partnering with Atlantic Shores on workforce, supply chain, port development, or other related activities.

Atlantic Shores' stakeholder engagement strategy creates effective mechanisms for capturing, documenting, and responding to stakeholder feedback to ensure that the outcomes of each interaction can be incorporated into the Project's development efforts.

1.4.2.1 Fisheries Engagement

Atlantic Shores understands the socioeconomic importance of commercial and recreational fishing to Atlantic Shores understands the socioeconomic importance of commercial and recreational fishing to the States of New Jersey and New York and is committed to achieving coexistence with those who fish within the Offshore Project Area and nearshore areas of the ECCs. Atlantic Shores has developed a Project-specific Fisheries Communication Plan (FCP) (See Volume II, Appendix II-R), that defines outreach and engagement with fishing interests during all phases of the Project, from development through decommissioning. To support the execution of the FCP, Atlantic Shores will employ a Fisheries Liaison Officer (FLO) and a Recreational Fishing Industry Representative (FIR). Additional FIRs may be nominated to represent specific fisheries identified within the Lease Area or along the ECCs as the Project progresses or a need is identified.

To facilitate open engagement with the fishing community that is active in and around the Offshore Project Area, Atlantic Shores maintains a "For Mariners" webpage, distributes updates on Atlantic Shores' activities (via an email distribution list, print and online industry publications, local news outlets, etc.), coordinates with the USCG to issue Notices to Mariners, plans to establish a 24-hour phone line, and attends fishing conferences, trade shows, and tournaments. Atlantic Shores will continue to hold and attend meetings with local fishermen, professional associations/organizations representing commercial and recreational fishermen, and local offshore fishing clubs during the lifetime of the Project. Atlantic Shores will also continue to participate in Fisheries Management Council meetings, university-sponsored activities (e.g., webinars held by Rutgers New Jersey Cooperative Extension), and regional efforts led by BOEM, National Oceanic and Atmospheric Administration (NOAA), and the commercial fishing industry (including the Responsible Offshore Development Alliance [RODA] and the Responsible Offshore Science Alliance [ROSA]).

Additionally, Atlantic Shores is committed to finding ways to integrate both the skills and infrastructure of the local fishing communities into the Project by planning, brainstorming, and executing early economic opportunities. Atlantic Shores is already employing local fishermen and their facilities for scouting and dock-side vessel support. Building on this model, Atlantic Shores is actively pursuing avenues to help fishermen meet Atlantic Shores' HSSE standards for vessels and workforce, so that they can be eligible to apply as contractors to support environmental surveys as well as the Project's construction and operations activities. In September 2020, Atlantic Shores distributed a formal Request for Interest to identify fishing businesses that had available docks and port real estate that could support Atlantic Shores' construction and operations; Atlantic Shores received strong responses from four local fishing companies in New Jersey, indicating that the fishing industry does find valuable economic opportunities in the offshore wind industry. Subsequent to that request, Atlantic Shores has engaged with several of these companies and organizations in support of the ongoing marine investigation work associated with the Project.

Section 7.3 Recreation and Tourism and Section 7.4 Commercial and For-Hire Recreational Fisheries of Volume II as well as the Navigation Safety Risk Assessment (NSRA) to be provided as Appendix II-S further describe Atlantic Shores' methods to communicate and engage with the regional fisheries industry.

1.5 Other Project Information

1.5.1 Authorized Representative and Operator

The Project's Authorized Representative is Atlantic Shores' Vice President and Development Director, Jennifer Daniels. Her contact information is as follows:

Jennifer Daniels
Vice President and Development Director
Atlantic Shores Offshore Wind, LLC
1 Dock 72 Way, Floor 7
Brooklyn, NY 11205
858-946-3235
jennifer.daniels@atlanticshoreswind.com

1.5.2 Certified Verification Agent

Pursuant to 30 CFR §§ 585.705-585.714 a third-party Certified Verification Agent (CVA) will be employed by Atlantic Shores to conduct an independent assessment of the design of the Project's facilities as well as the planned fabrication and installation activities (to be provided as Appendix I-F when available). The CVA will certify to BOEM that the Project is designed to withstand the site-specific environmental and functional load conditions appropriate for its intended service life. The CVA will also monitor fabrication and installation activities through periodic on-site inspections and certify to BOEM that the Project is fabricated and installed in accordance with accepted engineering practices, the COP, and each Project's Facility Design Report (FDR) and Fabrication and Installation Report (FIR).

1.5.3 Health, Safety, Security, and Environmental Protection

HSSE protection are critical components of all Atlantic Shores' planning and activities. The health and safety of Atlantic Shores' team members, contractors, and stakeholders is a key priority; Atlantic Shores upholds safety as a core value and fosters a culture of "Goal Zero" that focuses on eliminating safety related incidents. Atlantic Shores also prioritizes the responsible integration of the Project into the New Jersey and New York coastal and marine environment.

Atlantic Shores is committed to full compliance with applicable HSSE regulations and codes throughout the pre-construction, construction, O&M, and decommissioning phases of the Project. The following sections highlight the systems and plans that will be implemented, in accordance with BOEM and other applicable regulations, to ensure HSSE protection throughout the Project's lifecycle. These plans include the Project's Safety Management System (SMS), Oil Spill Response Plan (OSRP), and Spill Prevention, Control, and Countermeasure (SPCC) Plan. Volume I of this COP includes a draft OSRP (Appendix I-C). The Project-specific SMS is currently being prepared and will be submitted upon completion. These draft plans are representative of the requirements, procedures, and best practices that will be implemented in support of the Project. Individual plans for the Project will be developed for BOEM review and acceptance prior to construction with the Project's FDR and/or FIR. Public safety, public access, and low probably events such as spills are discussed further in Section 9.0 Public Health and Safety of Volume II.

1.5.3.1 Safety Management System

Atlantic Shores is currently in the process of assembling a draft SMS for the Project. The SMS contains Atlantic Shores' overall safety approach and management commitment as well as safety-related policies and procedures that will guide work on the Project. The SMS draws upon the extensive experience of Atlantic Shores' team members and its parent companies (EDF Renewables and Shell New Energies US, LLC) with executing work on large infrastructure and energy projects, both onshore and offshore, and will incorporate lessons learned as the Project progresses. All Project-related activities will be conducted in accordance with a Project-specific SMS to ensure avoidance or minimization of potential safety-related impacts to anyone on or near the Project facilities. The Project-specific SMS is currently being prepared and will be submitted upon completion.

The draft SMS meets BOEM's requirements contained in 30 CFR §585.810 by including a description of the following:

- how Atlantic Shores will ensure the safety of personnel or anyone on or near the Project facilities
- remote monitoring, control, and shutdown capabilities
- site-specific emergency response procedures
- fire suppression equipment
- procedures for testing the SMS
- methods for ensuring Project personnel are properly trained.

The SMS also contains company specific HSSE policies beyond those prescribed in 30 CFR §585.810, including the following:

- other applicable HSSE regulations (e.g., Occupational Safety and Health Administration [OSHA] regulations)
- hazard identification and risk management procedures
- communication protocols
- qualifications and authority to perform work
- safe work procedures to ensure safe access to all systems (e.g., Permit to Work, Lockout/Tagout).

A final, Project-specific SMS will be submitted for BOEM review and acceptance prior to construction with the Project FDR and/or FIR.

1.5.3.2 Spill Response Plans

A Project-specific OSRP will be developed and issued to all vessels and offshore contractors working on the Project. In accordance with 30 CFR §585.627(c) and 30 CFR Part 254, the OSRP will define spill prevention measures as well as provisions for communication, coordination, containment, removal, and mitigation in the event of an unforeseen incident involving an offshore spill. The OSRP will also describe training, equipment testing, and periodic drills to prepare for a spill response. A draft OSRP that is representative of the requirements, procedures, and best practices that will be implemented in support of the Project has been provided as Appendix I-C. A final Project-specific OSRP will be submitted for BOEM review and acceptance prior to construction with the Project FDR and/or FIR.

In addition to the OSRP, contractors will be required to have plans to immediately contain and stop a spill in accordance with applicable regulations (see Section 7.0). All contractor plans will be reviewed to ensure they comply with the applicable regulations, the requirements of Atlantic Shores and are consistent with the Project OSRP procedures. Routine training and audits on the content of the OSRP will be conducted on a regular basis to ensure personnel are familiar with plan requirements and are prepared to respond to emergencies, should they occur.

Since the onshore facilities will have more than 1,320 gallons (4,997 liters) of oil in aboveground equipment (see Table 7.0-3 in Section 7.0), a Project-specific SPCC Plan will also be developed and maintained per 40 CFR Part 112. The SPCC Plan will identify what oil materials are stored at the onshore facilities, how oil is delivered and transferred, facility spill prevention and control procedures, spill response and notification procedures, inspections, recordkeeping, and reporting requirements. An individual Discharge Prevention, Containment, and Countermeasure (DPCC) Plan and a Discharge Cleanup and Removal (DCR) Plans per N.J.A.C. 7:1E will be submitted to the NJDEP. The SPCC Plan will also be submitted to the NYSDEC in accordance with the Petroleum Bulk Storage regulations (6 NYCRR Part 613). In addition, horizontal directional drilling (HDD) Inadvertent Release Plans for construction activities at the landfall sites will be developed for the Project.

2.0 Benefits of the Project

The Project will provide clean, renewable energy to the Northeastern United States, which will help the region achieve its renewable energy goals, diversify the region's electricity supply, and increase electricity reliability. The Project will be a meaningful contributor to the region's economy by creating thousands of well-paid jobs in the burgeoning renewable energy sector.

In its Working Group III Sixth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2022) States that extreme events such as marine and terrestrial heatwaves, increased intensity storms and floods and elevated water temperatures are causing profound negative effects across all realms of the world (marine, terrestrial, freshwater and polar). The magnitude of these extreme events has collapsed the timeline organisms and natural communities have to acclimate or adapt to climate change. During 2010 to 2019, average annual global greenhouse gas emissions were at their highest levels in human history, but the rate of growth has slowed. Without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5°C is beyond reach (IPCC 2022).

The importance of the renewable energy sector in combatting the climate crisis while also revitalizing the U.S.' economy is exemplified in Presidential Executive Order 14008 (Tackling the Climate Crisis at Home and Abroad), which describes clean energy jobs as a central pillar of the President's Build Back Better and economic recovery plan and directs the Secretary of the Interior to review siting and permitting processes to identify steps to double offshore wind energy production by 2030 (see Section 207; White House 2021). As described in the Executive Order, the construction, manufacturing, engineering, and skilled-trades jobs needed to build a clean energy economy will bring opportunity to communities "that have suffered as a result of economic shifts and places that have suffered the most from persistent pollution, including low-income rural and urban communities, communities of color, and Native communities."

A significant portion of the Project's economic and community benefits will be realized in New Jersey and New York. As identified in the New Jersey Offshore Wind Strategic Plan, the development of offshore wind energy, such as the Project, is critical to addressing climate change and to building the State's clean energy economy (Ramboll 2020). As described by New Jersey Governor Phil Murphy, "Developing New Jersey's offshore wind industry will bring thousands of good-paying jobs and millions of dollars in economic development to our state to aid our economic recovery from COVID-19" (NJBPU 2020). Similarly, New York is recognizing the significant economic benefits associated with offshore wind. In her 2022 State of the State address, New York Governor Kathy Hochul announced a $500 million investment proposal for offshore wind ports, manufacturing and supply chain infrastructure (NYSDERA 2022).

The Project's economic, community, environmental, and public health benefits are detailed in the following sections.

2.1 Economic and Community Benefits

The Project will provide several benefits to the Northeast's economy and communities (particularly within New Jersey and New York) including:

- **Direct job creation**.[3] The Project is expected to directly create more than 27,450 full time equivalent (FTE)[4] jobs throughout their lifecycle. During the development and construction period, direct jobs will primarily be in construction, manufacturing, professional services (e.g., engineering and general management), transport, and warehousing. During O&M and decommissioning, direct jobs will include jobs in operations and maintenance (e.g., WTG technicians) as well as professional services.
- **Indirect and induced job creation**. Atlantic Shores estimates that the Project will create approximately 27,000 FTE direct jobs, 13,000 FTE indirect jobs, and over 23,000 FTE induced jobs, for a total of more than 63,000 FTE jobs throughout the Project lifecycle. Atlantic Shores intends to procure local suppliers and use local manufacturing facilities to the maximum extent practicable. Atlantic Shores anticipates that hiring local suppliers and manufacturing facilities will provide continued support of existing jobs and potentially create thousands of additional jobs in New Jersey, New York and, more broadly, the Northeastern U.S. Indirect jobs created by the Project will primarily be in management services, wholesale trade, and transportation, but may also include real estate, finance, insurance, and several other regional industries that will benefit from increased economic activities. The Project may also support other sectors, such as health care and social assistance, retail trade, and accommodation and food services. Please see Volume II – Section 7.1 for additional information on the socioeconomic benefits associated with the Project.
- **Use of local supply chains**. Atlantic Shores has prioritized using local suppliers for a significant amount of development activities, including survey activities, technical analysis, environmental and economic analysis, and legal services. As the development of the Project progresses, Atlantic Shores will continue to expand its list of local suppliers. Atlantic Shores has proposals from major suppliers for local manufacturing that would bring hundreds of jobs to New Jersey, New York and, more broadly, the Northeastern U.S. Atlantic Shores is also seeking ways to maximize the use of organized union labor and employers wherever feasible. To demonstrate that commitment, Atlantic Shores has signed a first-of-its kind memorandum of understanding (MOU) with six local unions in New Jersey (UBCJA [Carpenters, Divers, Dock builders and Piledrivers], LIUNA [Laborers], IBEW [Electricians], IUOE [Operating Engineers], Ironworkers, and Union Millwrights) to help train and employ a productive, safe, skilled, local workforce. Atlantic Shores will look to build on this effort with similar agreements in New York.

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3 Job creation estimates are based on a capacity assumption of 2,355 MW (15 MW turbines x 157 positions) with New Jersey and New York each receiving half of the total Project capacity (i.e., 1,117.5 MW). However, the exact amount that will be allocated to each state is dependent on future Offshore Renewable Energy Credit (OREC) solicitations in each state.

4 Based on a 35-hour work week.

- **Revenues, taxes, and fees**. The Project will increase revenues collected by Federal, State, and local governments via personal income taxes, payroll taxes, sales taxes, property taxes, corporate taxes, and other fees (e.g., permit application fees) paid by Atlantic Shores, its contractors, and their employees. Economic activity resulting from the Project will generate additional revenue throughout the Northeast. Atlantic Shores will also make substantial annual rent payments and operating fee payments to the Federal government in accordance with its Lease Agreement.
- **Facilitation of future offshore wind and other green developments**. The Project is anticipated to contribute to the establishment of facilities and development of ports that would be instrumental in attracting, supplying future U.S. offshore wind developments, and positioning talent, expertise, and research and development (R&D) activities within the Northeastern United States. In addition, the Project has the potential to help provide stability to the offshore wind supply chain through the guaranteed need for these services through the life of the Project.
- **Workforce development and training**. Atlantic Shores will support workforce initiatives, which will be developed in connection with its proposals submitted in response to offshore wind solicitations. These initiatives will have a strong focus on providing support to minorities, women, veterans, and underserved communities. Workforce development initiatives contained in Atlantic Shores' proposal in response to the New Jersey Offshore Wind Solicitation #2 include initiatives with Rutgers University, Rowan College, the Barnegat Bay Partnership, and the Boys & Girls Club of Atlantic City, as well as workforce training with several manufacturers and suppliers. Atlantic Shores anticipates continued support and expansion of these initiatives in New Jersey as well as implementation of similar workforce initiatives in New York. Additional or alternative workforce initiatives may be developed as part of other procurement processes within both States.
- **Educational and Community Outreach (ECO) Center**. In 2020, Atlantic Shores opened its new ECO Center in partnership with Stockton University in Atlantic City, New Jersey. The ECO Center will serve as an educational hub; the Center will be the primary location for community informational events, including educational visits from local school groups, and act as a resource center for university students. The ECO Center constitutes a major local New Jersey investment.
- **Fostering innovation, research, and university outreach**. As part of its project development efforts, Atlantic Shores has established robust working relationships with several research organizations and universities in New Jersey to foster innovative and environmentally responsible approaches to offshore wind development (see Section 1.4.2) and anticipates establishing similar relationships with applicable research organizations and universities in New York. Through its participation in the New Jersey Offshore Wind Solicitation #2, Atlantic Shores has committed to numerous initiatives to support research and innovation, including supporting a green hydrogen pilot project and funding clean energy start-ups within the Minority & Women Owned Business Incubator at the Rutgers EcoComplex located in

Bordentown, New Jersey. Additional or alternative innovation, research and outreach programs may be developed as part of other procurement processes in both New Jersey and New York.

- **Support for women, minorities, and veterans**. Atlantic Shores has developed MOUs with organizations (e.g., Boys & Girls Club of Atlantic City, Helments2Hardhats) to provide opportunities for employment, education, and training to women, minorities, and veterans as the Lease Area is developed. Atlantic Shores will continue pursuing contracts with women- and minority-owned businesses in both New Jersey and New York. To build awareness of opportunities in offshore wind, Atlantic Shores is a member of several chambers of commerce supporting minority groups, including the African American Chamber of Commerce, the Statewide Hispanic Chamber of Commerce, and the Chapter of Professional Women in Construction.

  Tourism and reactional opportunities. The Project's offshore facilities may act as artificial reef habitat that attract fish (BOEM 2012) and become popular fishing locations for fishermen. The Project's offshore facilities may also become tourist attractions (Carr-Harris and Lang 2019; Parsons et al. 2020). Atlantic Shores will work with the impacted communities to develop economic development opportunities by leveraging the offshore facilities' potential for recreation and tourism in furtherance of Atlantic Shores commitment to being a "good neighbor." See Section 7.3 Recreation and Tourism and Section 7.4 Commercial and For-Hire Recreational Fisheries of Volume II for additional details.

2.2 Environmental and Public Health Benefits

Atlantic Shores is working to maximize the environmental benefits and minimize the environmental effects of the Project. The recurring and accumulating benefits created by the Project over its operational life represent significant cumulative increases in environmental quality compared to the localized, temporary construction effects that can be mitigated. Overall, Atlantic Shores expects that the Project's anticipated benefits will significantly outweigh the potential impacts.

The environmental and public health benefits provided by the Project include the following:

- **Reductions in greenhouse gas (GHG) and criteria air pollutant emissions**. The Project will result in a significant net decrease in harmful air pollutant emissions region-wide by displacing electricity from fossil fuel power plants. For every megawatt-hour of power generated, the Project is expected to reduce GHG emissions, reported as carbon dioxide equivalents (CO_2e), by approximately 2,625 tons per year (tpy).[5] Per megawatt-hour, the Project is expected to reduce nitrogen oxide (NOx) emissions by 1.43 tpy, sulfur dioxide (SO_2) emissions by 1.69 tpy,

5 Avoided air emissions estimates are based on the latest-available non-baseload output emission rates for the Reliability First Corporation (RFC) East subregion as published by the Environmental Protection Agency (EPA 2020), assuming a 50% capacity factor and 4% transmission losses for the Project.

and fine particulate matter ($PM_{2.5}$) emissions by 0.10 tpy. The Project will also reduce regional emissions of other pollutants typically emitted by fossil fuel power plants such as mercury, carbon monoxide, methane, and nitrous oxide. The Project's avoided air emission estimates are further discussed in Section 3.1 Air Quality of Volume II.

- **Air quality benefits and avoided public health costs**. By reducing regional emissions, the Project is expected to improve air quality thereby reducing the harmful effects of air pollutants such as NOx, SO_2, and $PM_{2.5}$, which are linked to increased rates of early death, stroke, heart attacks, exacerbation of asthma, and respiratory disorders as well as increased absenteeism at school and work. The Project will also reduce emissions that contribute to acid rain, ocean acidification, and ground level ozone/smog, which can damage sensitive ecosystems and other resources.
- **Climate benefits**. Climate change, which is strongly associated with GHG emissions from fossil-fuel combustion and industrial practices, has been identified as possibly the greatest public health threat of the twenty-first century (WHO 2021). The impacts of climate change on the environment and human health include sea level rise and population displacement, property damage from floods, shifts in species' distributions worldwide, changes in agricultural productivity, increases in energy system costs (e.g., air conditioning costs), and impacts to water security, food security, and nutrition. The IPCC states that limiting global warming requires shifting energy investments away from fossil-fuels and towards low-carbon technologies (such as offshore wind) (IPCC 2022). By reducing reliance on fossil fuel-derived electricity that generates GHGs, the Project can help to mitigate additional climate change damages that impact both public health and the environment.
- **Environmental research and monitoring programs**. As described in Section 4.1.2, environmental monitoring surveys will be conducted to support the assessment of the Project's potential effects and, more broadly, to inform agency, stakeholder, and public understanding of the potential benefits and impacts of offshore wind project development. Atlantic Shores will conduct fisheries studies (see Appendix II-K) and benthic habitat monitoring (see Appendix II-H). Additional environmental studies and monitoring programs supported by Atlantic Shores to date include:
    - **Study on red knot migratory patterns**. Atlantic Shores has partnered with Dr. Larry Niles of the New Jersey-based Wildlife Restoration Partnerships, the New Jersey Audubon Society, the USFWS, and professional wildlife research organizations Normandeau Associates and Biodiversity Research Institute to research the movement of threatened red knots (*Calidris canutus*) off the coast of New Jersey during their southbound and northbound migration.
    - **Climate, storm, and wildlife research**. Atlantic Shores has collaborated with the Rutgers University Center for Ocean Observing Leadership (RUCOOL) and the Rutgers University Marine Field Station to install a wind light detection and ranging (LIDAR) instrument in Tuckerton, New Jersey. The LIDAR will be in place for the next several years to collect real-

time weather observations. This information will contribute to Rutgers' research on sea breezes and coastal storms, as well as future research initiatives conducted by RUCOOL and Atlantic Shores.

    - Atlantic Shores also expects to participate in regional monitoring initiatives and coordinate with research organizations and universities to develop additional environmental study programs. Atlantic Shores provides funding and scientific expertise sharing to the Responsible Offshore Science Alliance (ROSA), where Atlantic Shores serves on the Board and Advisory Committee. Atlantic Shores and its parent companies are also early adopters and funders of the Regional Wildlife Science Entity, the parallel organization to ROSA that covers regional bird, mammal, and sea turtle science.

- **Addition of hard substrate and structures offshore**. The Project is expected to produce ecological benefits by providing new, diverse habitat for structure-oriented species (e.g., black sea bass, tautog, cunner). The offshore facilities (i.e., foundations, scour protection, and cable protection) will create new, hard substrate that provide shelter and feeding opportunities as well as spawning and nursery grounds in an area that is largely comprised of flat, sandy habitat (ICF 2020). For example, Leonhard et al. (2011) studied fish assemblages one year before and eight years after the construction of the Horns Rev Wind Farm in the North Sea and observed an increase in species diversity close to WTGs, specifically in reef fishes (Leonhard et al. 2011). See Sections 4.5.2.5 and 4.6.2.6 of Volume II for further discussion of the Project's ecological benefits to benthic and shellfish resources as well as finfish and invertebrates.

3.0 Evolution of the Project Design Envelope

Atlantic Shores is requesting review and authorization of the Project using a PDE approach as outlined in BOEM's (2018) draft PDE guidance. Under the PDE approach, the full range of parameters are articulated in the PDE's maximum design scenario in the COP, which provides the framework for BOEM's NEPA review (40 CFR § 1502.4(a)). The COP provides detailed information regarding the Project's design, reasonably foreseeable effects on resources and wildlife, as well as mitigation measures, facilitating BOEM's ability to conduct the necessary "hard look" required under NEPA (40 CFR § 1500.1; see e.g., *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n.21 (1976)). The PDE approach also facilitates BOEM's selection of a preferred, final design range that has benefited from a comprehensive and broad assessment of reasonably foreseeable effects (40 CFR § 1508.1(g)). Thus, the inclusion of a maximum design scenario in the effects analysis ensures that the NEPA review is comprehensive and avoids a more limited analysis that omits viable options, in turn, saving valuable resources and time by eliminating the need for supplementation during subsequent stages. This approach also does not preclude consideration of a no action alternation or an environmentally preferred alternative, while ensuring that a feasible range of options are fully evaluated and enriched by this multi-faceted and layered approach.

The use of a PDE approach is consistent with not only BOEM's offshore wind guidance and industry practice, but also with the current Administration's policy priority of achieving the production of 30 GW of offshore wind power by 2030.[6] To achieve this diversification of the nation's energy portfolio, the federal government is seeking to foster innovation in energy technologies and domestic economic growth in the offshore wind sector. For example, in response to President Biden's Americas Supply Chain Executive Order,[7]the Department of the Energy issued the Report *America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition* in February 2022, finding that the offshore wind supply chain is in its infancy and rapid expansion will be necessary to achieve the delivery of 5GW/year to meet the Administration's clean energy goals.[8] Similarly, Congress has expressed its support for offshore wind in the Infrastructure Investment and Jobs Act, which includes funding for research, development and commercialization opportunities to develop offshore wind.[9] These ongoing efforts to identify potential new technologies, spur domestic production, and adopt market incentives, are consistent with the goals of the PDE approach, which is to allow for consideration of a variety of potential design configurations and contingency planning in the face of evolving market dynamics and policy implementation.

In this context, the PDE will enable Atlantic Shores to employ the best available technology, which often outpaces the permitting process, to maximize renewable energy production, minimize adverse environmental effects, address stakeholder concerns, and minimize cost to ratepayers. The PDE allows Atlantic Shores to maintain continued engagement with multiple technology providers to identify the

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

7 https://www.federalregister.gov/documents/2021/03/01/2021-04280/americas-supply-chains.

8 https://www.energy.gov/policy/articles/americas-strategy-secure-supply-chain-robust-clean-energy-transition, p. 10.

9 Public Law No: 117-58 (Nov. 15, 2021).

best solutions that meet development timelines and at competitive prices to rate payers. Having this design flexibility allows Atlantic Shores' the ability to proactively engage and collaborate with the market of current and potential suppliers in their efforts to develop new technologies and establish domestic capability that will drive local economic growth. Continued engagement and evaluation, over time, will inform which technology within the bounds of the proposed PDE is most suitable for the Project.

The Project's PDE is summarized in Section 1.1 and more completely described in Section 4.0. This section summarizes Atlantic Shores' siting process and explains how the PDE was developed.

The Project's PDE includes a reasonable range of designs for proposed components (e.g., foundations, WTGs, export cables, onshore components) and installation techniques (e.g., use of anchored, jack-up, or dynamic positioning [DP] vessels). In developing the PDE, Atlantic Shores focused on ensuring all components and systems included in the PDE:

- provide safety of structures, equipment, personnel, the public, and the environment
- comply with all federal, state, and local regulations, permit requirements, and Lease Agreement stipulations
- have design integrity to withstand operational and environmental loads, extreme events (including hurricanes), and accidental events
- have adequate durability against environmental conditions over the asset's life
- optimize energy yield of the Lease Area
- maintain high generation reliability
- enable ease of offshore handling, transport, installation, testing, commissioning, operations, maintenance, repairs, decommissioning, and dismantling
- consider all phases of fabrication, transport, installation, operations, and decommissioning
- optimize the use of resources and technology to reduce initial and lifetime costs
- allow the use of local services, suppliers, and labor to the maximum extent possible
- avoid, minimize or mitigate impacts to the public and the environment.

The following sections describe how key Project attributes were developed in accordance with these principles, including the Project's layout, onshore and offshore routing, foundation types, and WTG dimensions.

3.1 Development of the Lease Area Layout

Atlantic Shores considered the following criteria to develop the layout of the Project WTGs and OSSs in the Lease Area:

- **Technical considerations.** Wind resource in the Lease Area and the energy generation potential of many different layouts were assessed.
- **Existing uses and sensitive areas.** Existing vessel traffic patterns and feedback from agencies and stakeholders (including the USCG and commercial and recreational fishermen) were considered. Layout orientations that minimize impacts to existing marine uses were preferred. Layouts that minimize visual impacts by locating OSSs farther from shore were also preferred. Layouts that minimize impacts to known, sensitive, seabed resources were also preferred.

Based on these criteria, with a specific focus on minimizing effects to existing marine uses, the WTGs for the Project will be aligned in a uniform grid with multiple lines of orientation allowing straight transit through the Lease Area. The primary east-northeast to west-southwest transit corridors were selected to align with the predominant flow of vessel traffic across the entire OCS-A 0499 and OCS-A 0549 area. Accordingly, WTGs will be placed along east-northeast to west-southwest rows spaced 1.0 nautical mile (nm) (1.9 kilometers [km]) apart to allow for two-way vessel movement (see Figure 3.1-1). The proposed grid also facilitates north to south transit by positioning WTGs along rows in an approximately north to south direction[10] spaced 0.6 nm (1.1 km) apart. The WTG grid will also create diagonal corridors of 0.54 nm (1.0 km) running approximately northwest to southeast as well as diagonal corridors of 0.49 nm (0.9 km) running approximately north-northeast to south-southwest (see Figure 3.1-1).

The OSSs for the Project may be placed between WTGs at various locations within the shaded areas shown in Figure 3.1-2. The OSSs may be placed between WTGs in the north to south direction (see Figure 3.1-2); however, Atlantic Shores will only position the OSSs in up to two north to south rows to preserve most of the north to south transit corridors. The two corridors where OSSs may be placed include a setback from the shoreline to minimize visual impacts: small OSSs will be placed no closer than 12 miles (mi) (19.3 km) from shore and medium or large OSSs will be placed no closer than 13.5 mi (21.7 km) from shore (OSS sizes are described in Section 4.4).

Atlantic Shores undertook an analysis of the predominant flow of vessel traffic across the entirety of Lease Area OCS-A 0499 and OCS-A 0549 and initiated consultations to determine the preferences of both commercial fishermen and the USCG.

[10] The north to south rows are oriented at 357 degrees true north.

An independent study was conducted by Last Tow LLC on behalf of representatives of the New Jersey surf clam industry to provide Oceanside Marine (a clam fishing fleet based in Atlantic City) and LaMonica Fine Foods (a seafood processor in Millville, New Jersey) with a better understanding of fishing vessel traffic characteristics within the entirety of the Atlantic Shores Lease Areas (Azavea 2020). Based on 2008-2019 Vessel Monitoring System (VMS) data for several surf clam/quahog fishing vessels that operate in the Lease Area, the study found that a significant majority of fishing vessel traffic (towing and transiting) had headings between east to west and east-northeast to west-southwest (with an average heading of 80 degrees from true north). This finding was supported by an analysis of VMS data for period 2014 to 2019 conducted by BOEM for original Lease Area as well as by an analysis of three years (2017-2019) of Automatic Identification System (AIS) data which showed that 48% of fishing vessels transit across the two Lease Areas along tracks that range in orientation between east to west and northeast to southwest. A large proportion of the fishing vessel traffic (approximately 40%) and the recreational vessel traffic (50%) also transit approximately north to south (a sector defined by track orientations of north-northwest to south-southwest and north-northeast and south-southwest). While the study identified some variability between predominant fishing vessel traffic direction between Lease Areas OCS-A 0499 and OCS-A 0549, consultations with the fishing community and the USCG have indicated a preference for a uniform and continuous layout across both Atlantic Shores' Lease Areas to facilitate navigation and SAR missions by the Coast Guard. The layout of facilities across Atlantic Shores' Lease Areas were then specifically configured, based on this study and these consultations to facilitate commercial fishing patterns, particularly the surf clam/quahog dredging fleet which is the predominant commercial fishery and to promote safe navigation (see Section 7.4 Commercial Fisheries and For-Hire Recreational Fishing of Volume II and Section 7.6 Navigation).

Atlantic Shores anticipates that larger commercial vessels (e.g., cargo, tanker, passenger, and tug-barge vessels), which have dominant north to south transit headings, will route around the Lease Area and not through it. The additional time required to travel around versus through the Lease Area was estimated to be on the order of 15 to 20 minutes. This re-routing of commercial traffic is clearly recognized in the recent Atlantic Coast Port Access Routing Study (ACPARS) performed by the USCG in 2016, which has led into an Advanced Notice of Proposed Rulemaking (USCG 2020b) with the identification of a deep draft fairway to the east of the Lease Area, termed the St. Lucie to New York Fairway, and a proposed Tow Tug Extension Lane to the west of the Lease Area. The proposed fairways are also supported by the recent New Jersey and Northern New York Bight Port Access Route Studies (USCG, 2021a and 2021b; CPAPARS, 2022). However, the Lease Area will not be closed to commercial vessel traffic. Should commercial vessels choose to transit the Lease Area, based on USCG recommended guidelines for corridor spacing (USCG 2020a), the 0.6 nm-wide (1.1 km-wide) approximately north to south transit corridors are expected to facilitate commercial vessel traffic for vessels 87 to 144 feet (ft) (27 to 44 meters [m]) in length.

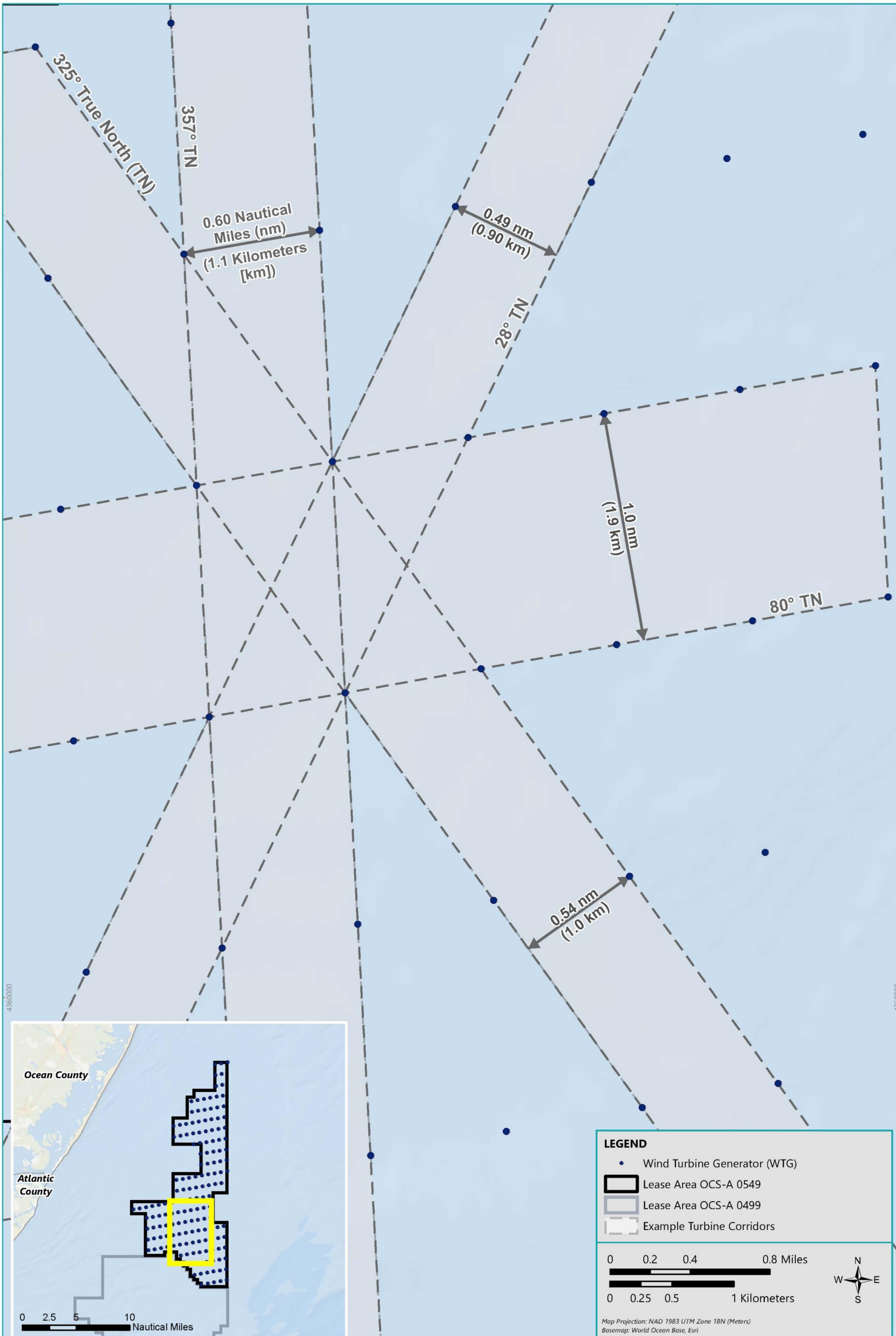

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Figure 3.1-1
Lease Area Layout

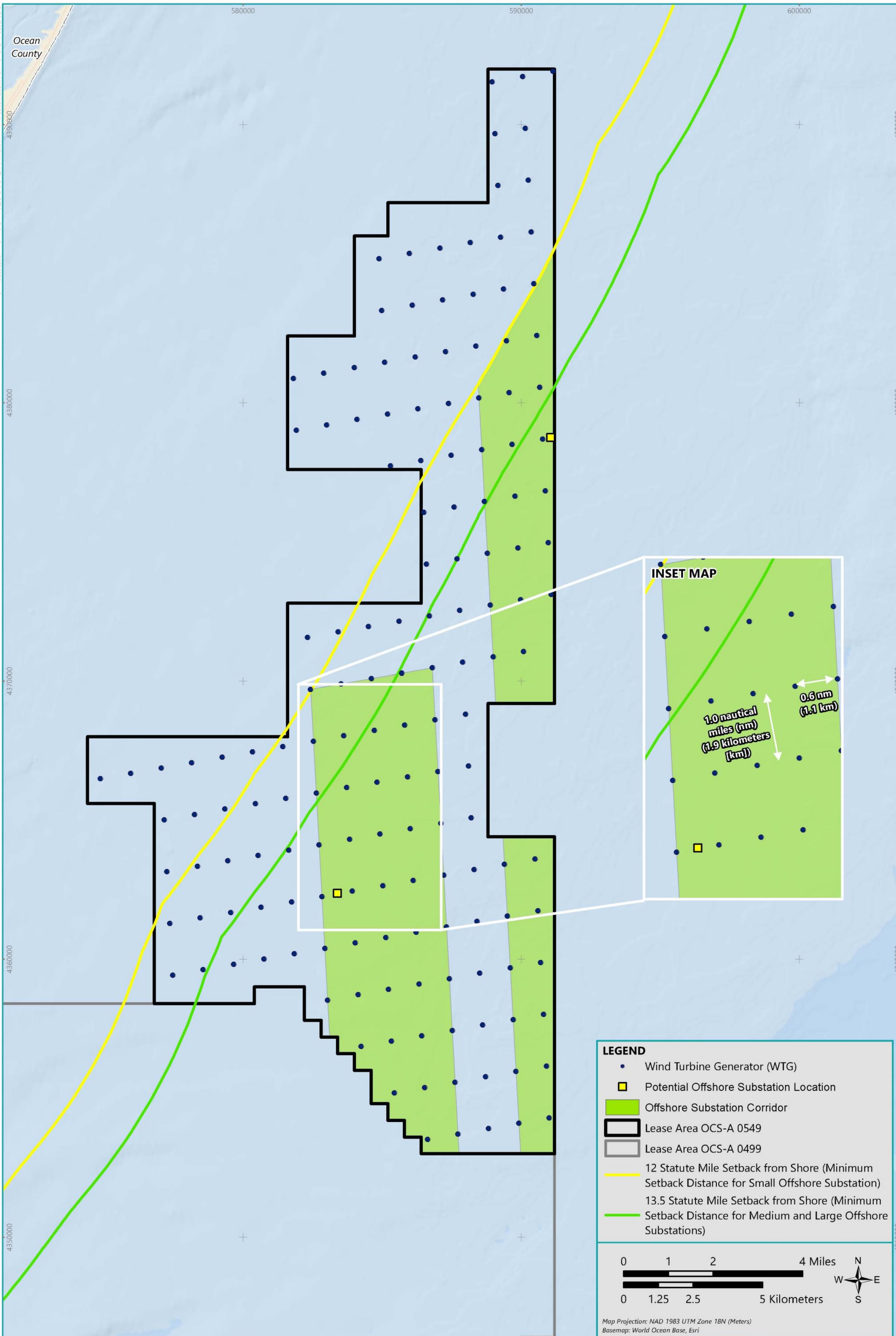

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Figure 3.1-2
Offshore Substation Locations

3.2 Onshore Facility Siting

To identify the locations of the Project's onshore facilities, Atlantic Shores conducted an onshore siting and routing assessment through an inter-related process that identified options for landfall sites and onshore interconnection cable routes to existing POIs. Identification of landfall sites and onshore interconnection cable routes in New Jersey and New York is constrained by the density of development along the shorelines and built infrastructure inland. The siting and routing assessment also accounted for the space required for HDD staging areas as well as the physical dimensions required to install an underground transition vault that connects the export cables and the onshore interconnection cables.

3.2.1 Points of Interconnection

Atlantic Shores has identified two potential POIs within New Jersey and three potential POIs in New York (see Table 3.2-1) based on their proximity to the coastline and environmental and technical attributes (e.g., substation voltage, potential for expansion, upgrades required to accommodate the Project interconnection, ability to reasonably access via offshore and onshore routing). Atlantic Shores has formally filed a request for a queue position with PJM or NYISO for these POIs under consideration. These POIs were used to evaluate potential onshore interconnection cable routes from the landfall sites to the POIs.

Table 3.2-1 Potential Points of Interconnection

<table>
<tr><th>Potential POIs</th><th>County</th><th>State</th></tr>
<tr><td>Larrabee Substation</td><td rowspan="2">Monmouth</td><td rowspan="2">New Jersey</td></tr>
<tr><td>Atlantic Substation</td></tr>
<tr><td>Fresh Kills Substation</td><td rowspan="2">Richmond</td><td rowspan="3">New York</td></tr>
<tr><td>Goethals Substation</td></tr>
<tr><td>Gowanus Substation</td><td>Kings</td></tr>
</table>

3.2.2 Landfall Sites

Atlantic Shores conducted a siting assessment of potential landfall sites that analyzed available open space, surrounding land use, offshore cable routing constraints and proximity to established linear development corridors (e.g., roadway and utility rights-of-way [ROWs]) that could serve as an onshore interconnection cable route. The specific siting criteria used to identify potential landfall sites included the following:

- **Technical considerations**
  - The landfall sites themselves require adequate open space onshore and in proximity to the coastline to accommodate the underground transition vaults and required HDD staging and operational areas.
  - Landfall sites with offshore water depths that are deep enough to accommodate a cable laying vessel at the offshore HDD entrance/exit point are preferred, although solutions can typically be adapted to accommodate cable installation in shallower depths.

- The landfall sites must be reasonably accessible for cables routed from offshore meaning the export cable approach to shore must avoid offshore obstructions; be reconcilable with competing offshore uses; mitigate impacts to sensitive habitats; and be of sufficient width to support the number of cables including spacing requirements. Section 3.3 provides additional information regarding marine constraint considerations.

- **Site characteristics.** The Project requires areas that are either undeveloped or consist of surface development (i.e., parking lots), with minimal conflicting subsurface infrastructure.
- **Existing uses and sensitive areas.** Preferred landfall sites would be located in previously developed and disturbed areas (e.g., parking lots, roads) and avoidance of sensitive areas such as protected open spaces or sensitive wildlife habitat is strongly preferred.

Based on these criteria, aerial photographs of the coastline were manually analyzed to determine candidate landfall sites. Atlantic Shores then conducted field reconnaissance of the candidate sites and identified a total of six potential landfall site options, as presented in Table 3.2-2 and shown on Figure 3.2-1. Technical feasibility analyses for the Monmouth landfall sites have been completed. Atlantic Shores is in the process of completing feasibility analyses to support further refinement of the preferred landfall site(s) for each of the potential POIs in New Jersey and New York. Information regarding existing land use and coastal infrastructure can be found in Section 7.5 of Volume II.

Table 3.2-2 Landfall Sites

Landfall Site	Potential POI
New Jersey	
Asbury	Atlantic/Larrabee
Kingsley	Atlantic/Larrabee
Monmouth National Guard Base	Larrabee
New York	
Wolfe's Pond	Fresh Kills/Goethals
Lemon Creek	Fresh Kills/Goethals
Fort Hamilton	Gowanus

3.2.3 Reduction of Landfall Site Locations

Two of the landfall sites, Midland and South Beach landfalls along the northeastern coast of Staten Island, were removed from the PDE following consultation with the United States Army Corps of Engineers (USACE) regarding constraints due to a permanent seawall to be built along the coastline where the cables would make landfall. The South Shore of Staten Island Coastal Storm Risk Management Project is a fully funded jointly planned project by the USACE, NYCDEC, USFWS, City of New York, NYC Parks Department, and NYCDOT. Upon review of the schedules associated with the pending design and construction Atlantic Shores determined that removing these two landfalls from the PDE was the best course of action. Subsequently, the associated Northern ECC branches and onshore interconnection cable routes that were associated with these two landfalls and routed to the Fresh Kills/Goethals and Gowanus Substation POIs were removed from the PDE. This removal also included the trenchless cable crossing from Staten Island to Brooklyn, New York and associated trenchless crossing landfall sites along the Gowanus route (Murray Hubert, Rosebank, Brooklyn North and Brooklyn South). The sole remaining landfall site associated with the Gowanus route is the Fort Hamilton Landfall Site.

3.2.4 Onshore Interconnection Routes

From each of the identified landfall sites, Atlantic Shores conducted an iterative onshore interconnection cable routing assessment to each of the POIs (Figure 3.2-1). The routing assessment was supported by aerial photography, publicly available Geographic Information Systems (GIS) environmental data, and field reconnaissance. Based on this routing assessment, preliminary onshore interconnection cable routes were identified as shown in Figure 3.2-2.

A set of environmental and feasibility criteria were identified and weighted to establish and evaluate each onshore interconnection cable route. Route ranking was based on the following criteria:

- **Technical considerations**
  - Shorter route lengths are preferred to reduce overall potential impacts and installation costs.
  - A lower number of hard route angles requiring a dead-end or corner transmission structure is preferred since hard route angles are more challenging and costly to construct.
- **Site characteristics**
  - Routes utilizing established linear ROWs for larger highways, State routes, existing transmission lines, or railroads are preferred as the widespread existing development along the Atlantic coast generally prevents the establishment of a new ROW.
  - Routes that require fewer complex trenchless crossings (such as crossing under railroads, rivers, or major highways) are generally preferred.
- **Existing uses and sensitive areas**
  - Routes that avoid or minimize the distance of the onshore interconnection cable route in or within proximity to residential neighborhoods are preferred to reduce temporary, construction-related noise impacts.
  - Routes that minimize impacts to mapped threatened and endangered species habitat, tidelands, and wetlands are preferred.

Based on this routing assessment, preliminary onshore interconnection cable routes were identified as shown in Figure 3.2-2. Each provides suitable landfall sites and shorter, more direct routes that utilize existing linear infrastructure with established ROWs and that avoid or minimize impacts to residential and natural areas when compared with other alternatives. Given that multiple routes to the POIs were identified, the onshore interconnection cable routes were further analyzed by conducting windshield surveys. The final interconnection cable routes will be based on observations made during the windshield surveys, engineering considerations, real estate requirements, and consultation with the

New Jersey Department of Environmental Protection (NJDEP) and the New York State Department of Environmental Conservation (NYSDEC).

3.2.4.1 Reduction of Onshore Cable Routes

As stated in Section 3.2.2, onshore interconnection cable routes associated with the Midland and South Beach landfall sites to the Fresh Kills/Goethals and Gowanus substations were removed from the PDE following consultation with the USACE. This change included the removal of trenchless crossing across Narrows Bay from Staten Island to Brooklyn, New York. Therefore, only the Fort Hamilton landfall site and its associated onshore cable route in Brooklyn, New York, will connect to Gowanus Substation POI.

3.2.5 Onshore Interconnection

Based on the evaluation methods described above, landfall sites and onshore interconnection cable routes to the POIs in both New Jersey and New York are preferred. Each provides suitable landfall sites and shorter, more direct routes that utilize existing linear infrastructure with established ROWs and that avoid or minimize impacts to residential and natural areas when compared with other alternatives. Given that multiple routes to all POIs were identified, the onshore interconnection cable routes were further analyzed by conducting windshield and constructability surveys. Atlantic Shores selected the landfall sites and the corresponding interconnection cable routes for inclusion in the PDE based on observations made during the windshield surveys, engineering considerations, real estate requirements, and consultation with state and federal regulatory agencies (see Figure 3.2-2).

3.2.6 Onshore Substation Location Modification

Identification of parcels available for development within proximity to the existing substations has been an incredible challenge for the Project. For most of the project development history the only potentially available parcel for development near the Gowanus Substation was a littoral parcel in the Red Hook neighborhood of Brooklyn, New York. However, this Red Hook Substation and/or Converter Station was removed from the PDE following consultation with the USACE, NYSDOS, and USCG due to constraints identified associated with the siting of a substation in the coastal zone. The Red Hook Substation Site was replaced with the Sunset Industrial Park parcel which is located onshore to the east of the Red Hook Substation site. The onshore interconnection cable routes were then modified to connect from the Fort Hamilton landfall site to the Sunset Industrial Park Substation and/or Converter Station parcel.

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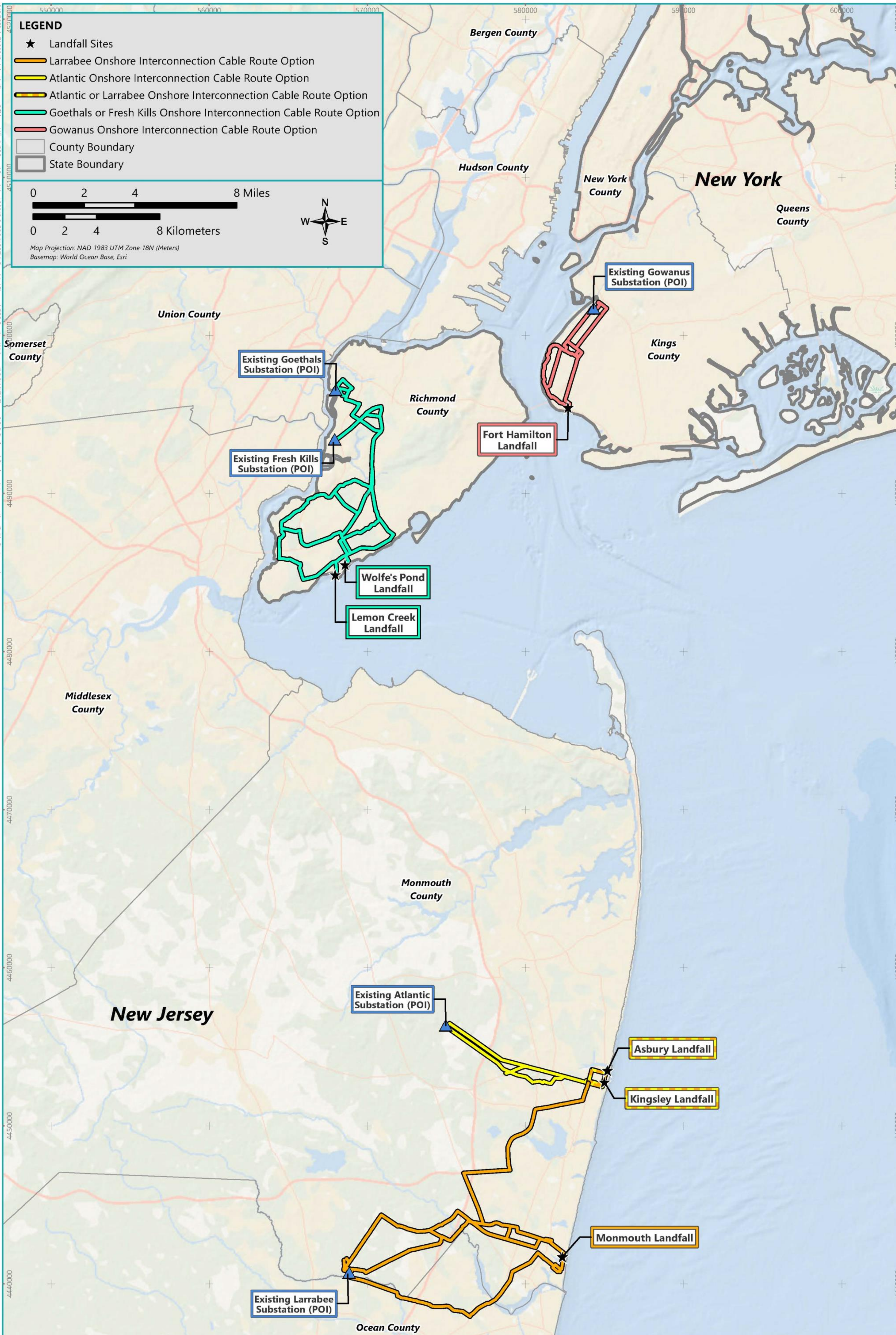
Figure 3.2-1

Onshore Interconnection Cable Routing Analysis



ATLANTIC SHORES offshore wind

Figure 3.2-2

Preliminary Onshore Interconnection Cable Routes

3.3 Export Cable Routing

Atlantic Shores has identified two primary export cable corridors (ECC) from the Lease Area boundary to the landfall sites as shown in Figure 3.3-1. The preliminary ECCs and associated branches extending to the landfall sites were subsequently refined using publicly available and existing survey data to map routes with the lowest risk for potential conflict with export cable installation as shown in Figure 3.3-2. Data sources and criteria used in this analysis included the following:

- **Technical considerations.** The physical attributes of a cable route, such as cable bending radius, length, and offset distance from installation hazards, were considered in the evaluation of each route.
- **Site characteristics**
  - Water depth maps were used to confirm feasibility for cable installation tools and to identify any areas of steep slopes, which are not preferred due to expected installation constraints.
  - Publicly identified surficial and shallow geological and geotechnical characteristics were used to confirm feasibility for cable installation tools and to assess whether mobile sediments were present; areas of mobile sediments are not preferred because they may pose a risk of over-burial or exposure of the cable. Sandy sediments are preferred over rocky, stiff, or very fine sediments to ensure cable burial to a sufficient depth can be more easily achieved.
- **Existing uses and sensitive areas**
  - Cable routes that avoid mapped shipwrecks are preferred to reduce potential impacts to cultural resources.
  - Cable routes that avoid sand resource areas or dredged material disposal sites currently or potentially used by the States of New Jersey, New York and / or the U.S. Army Corps of Engineers are preferred.
  - Cable routes that minimize impact on existing navigation fairways and minimize potential navigation conflicts within traditional maritime routes are preferred.
  - Cable routes that avoid managed navigation channels or cross such channels as close to perpendicular as possible to minimize the crossing distance are preferred.
  - Cable routes that avoid or maximize distances to sensitive habitats for fish and other marine wildlife, such as artificial and natural reefs and other known critical habitat locations, are preferred.

- Cable routes that avoid or minimize the number of crossings of mapped offshore cables and pipelines, or expected future offshore cables, are preferred. If a crossing is required, a route that allows the crossing to take place in a preferred location and at a crossing angle as near to perpendicular as possible is preferred.

- **Hazards:**
  - Cable routes were selected to avoid known hazards, including rock outcrops, submerged infrastructure, and other structures or objects that present a hazard to vessel navigation.
  - Cable routes were selected to avoid any mapped munitions and explosives of concern (MEC) (e.g., bombs, bullets, shells, grenades, mines, etc.) and military areas given safety considerations.
  - Cable routes were selected to avoid dredged material disposal areas and dumping grounds given the potential for cable installation constraints and the presence of contaminated sediments.

In addition to the ECC siting criteria, Atlantic Shores recognizes that the concept of a regional offshore wind transmission grid is being evaluated by both the New Jersey Board of Public Utilities (NJBPU) and the New York State Energy Research and Development Authority (NYSERDA). At the time of the filing of this COP, neither the State of New Jersey nor New York had formally selected plans for the development and/or permitting of such an offshore regional transmission solution. While Atlantic Shores has expressed general support for the concept envisioned by the States of New Jersey and New York; it was uncertain that such a solution would be viable within the development timeline proposed for the Project (See Section 4, Table 4.1-1). Since the initial COP Filing, New York and New Jersey have made clear intentions for the development of integrated transmission solutions. However, at this time detailed design and scheduling have not yet been released, Atlantic Shores has not considered the States' conceptual offshore wind regional transmission solutions as a viable option to support all of the Project's needs for a timely interconnection with the local electrical grids in either New Jersey or New York.

Atlantic Shores also considered the shortest technically feasible corridor length to minimize electrical line losses, the cost and complexity of cable installation, and environmental impacts associated with cable installation. Ultimately, the assessment described above identified feasible ECCs to the identified Landfall Sites in New Jersey and New York, as shown on Figure 3.3-1. These ECCs are preferred because they connect to the preferred landfall sites and POIs identified in Section 3.2.4.

The ECCs to the New Jersey and New York Landfall Sites, as shown on Figure 3.3-1, were further refined into the Monmouth and Northern Export Cable Corridors (ECCs). The Monmouth ECC was initially developed to support the export cables associated with Lease Area OCS-A 0499, and rather than developing a second ECC for the siting of the export cables from the Lease Area to the Monmouth Landfall Sites, Atlantic Shores determined that it is feasible to co-locate the Project export cables with those associated with Lease Area OCS-A 0499 in the Monmouth ECC. This co-location consolidates infrastructure and minimizes the potential Project-related effects associated with installation of the export cables to the Monmouth Landfall Sites. This collocation of resources also benefits from the expansive constructability and environmental surveys completed for this route to date.

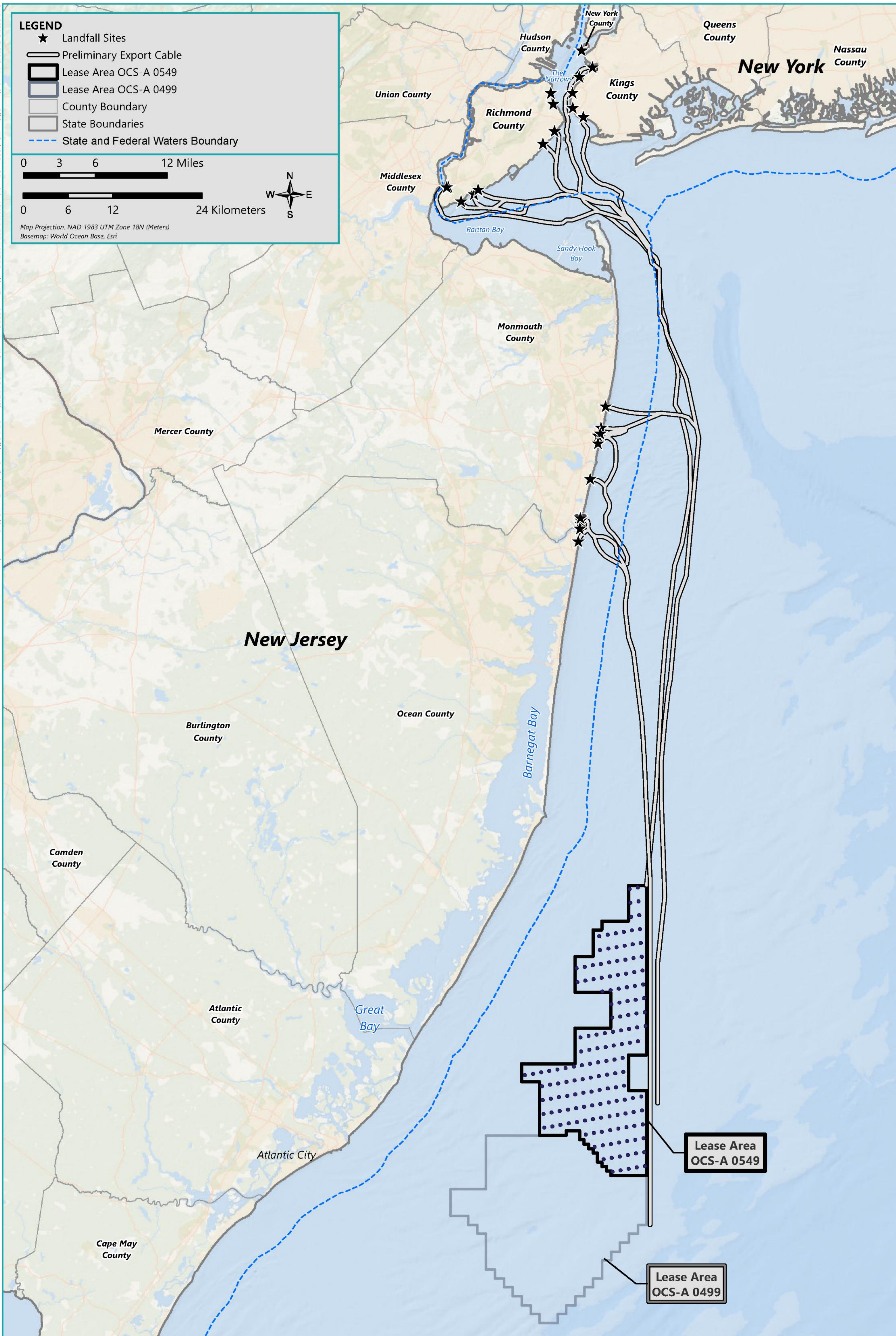
Following an evaluation of the above criteria, the Northern ECC was further developed by incorporating a minimum offset as much as practicably reasonable of approximately 1,312 ft (400 m) from known USACE, NJDEP, and BOEM MMP Sand Resource Areas and avoided proposed locations of other offshore wind project export cable corridors (where data is available). Two primary options were developed based on this information and were designed to either (1) accommodate an existing shipping lane to the extent practicable or (2) move the ECC farther east of the shipping lane. Atlantic Shores prefers the first option as an ECC routed east of the existing shipping corridor is more challenging from a technical perspective due to increased water depths and overall length. As the Northern ECC extends toward New York State waters, the ECC route is further constrained by sand resources, known shipwrecks as well as a dump site (Historic Area Remediation Site [HARS]) east of Sandy Hook.

Atlantic Shores employed similar analyses when routing the branches of the Northern ECC that extend to the New York Landfall Sites. For the Asbury Branch of the Northern ECC, the most significant constraint is the presence of BOEM-identified sand resources which creates a narrow east to west lane to site the ECC in a manner that ensures avoidance. With respect to the branches of the Northern ECC that extend to the landfall sites in New York, these routes were based on the same constraints that were applied to the main extent of the Northern ECC. Since there are fewer export cables within the ECC as it extends north into New York State waters, the branches of the ECC were narrowed significantly in width from approximately 3,300 ft (1,000 m) to 400 ft (120 m) to avoid identified constraints such as shipwrecks and obstructions. The branches of the Northern ECCs have been further refined based on additional surveys (including geology, underwater hazards, marine archaeology and munitions and explosives of concern), the results of which are provided within Volume II, Appendix II-A.

The width of each ECC ranges from approximately 984 ft (300 m) to 3,280 ft (1,000 m) for the Monmouth and Northern ECCs (including the Asbury Branch). The branches of the Northern ECC that extend to the New York landfall sites are significantly narrower: the branch to the Lemon Creek and Wolfe's Pond Landfall Sites is approximately 656 ft (200 m) and the branch to the Fort Hamilton Landfall Site is approximately 393 ft (120 m) in width (see Figure 1.1-2 and Section 4.5.2.1). Atlantic Shores defined these corridor widths to provide flexibility in the early stages of the geophysical and geotechnical evaluation of each ECC. Such an approach is consistent with recommended best practices for cable spacing at a project's initial permitting phase (such as DNV GL [2016]). Maintaining these corridor widths allow Atlantic Shores to optimize final cable alignments within the corridor to avoid resources, such as shipwrecks and sensitive habitats, to the greatest extent possible. These widths also provide adequate space for cable installation vessels and any associated anchoring lines (i.e., to ensure any anchoring occurs within the surveyed corridor), particularly near the landfall sites where anchoring may be required.

Specific cable alignments within the ECCs will be optimized pending ongoing analysis of geophysical and geotechnical data as part of the cable route engineering process. Once the cable route engineering process has sufficiently progressed, Atlantic Shores will formally request offshore cable easements from BOEM. To provide the minimum required spacing between the export cables in each ECC (see Section 4.5.2.1) and to allow adequate room for potential future cable repairs, Atlantic Shores anticipates requiring an easement within each ECC that is wider than the 200 ft (61 m) width listed in 30 CFR §§ 585.507(1) and 585.628(g). Atlantic Shores will coordinate with BOEM on the future easement request.

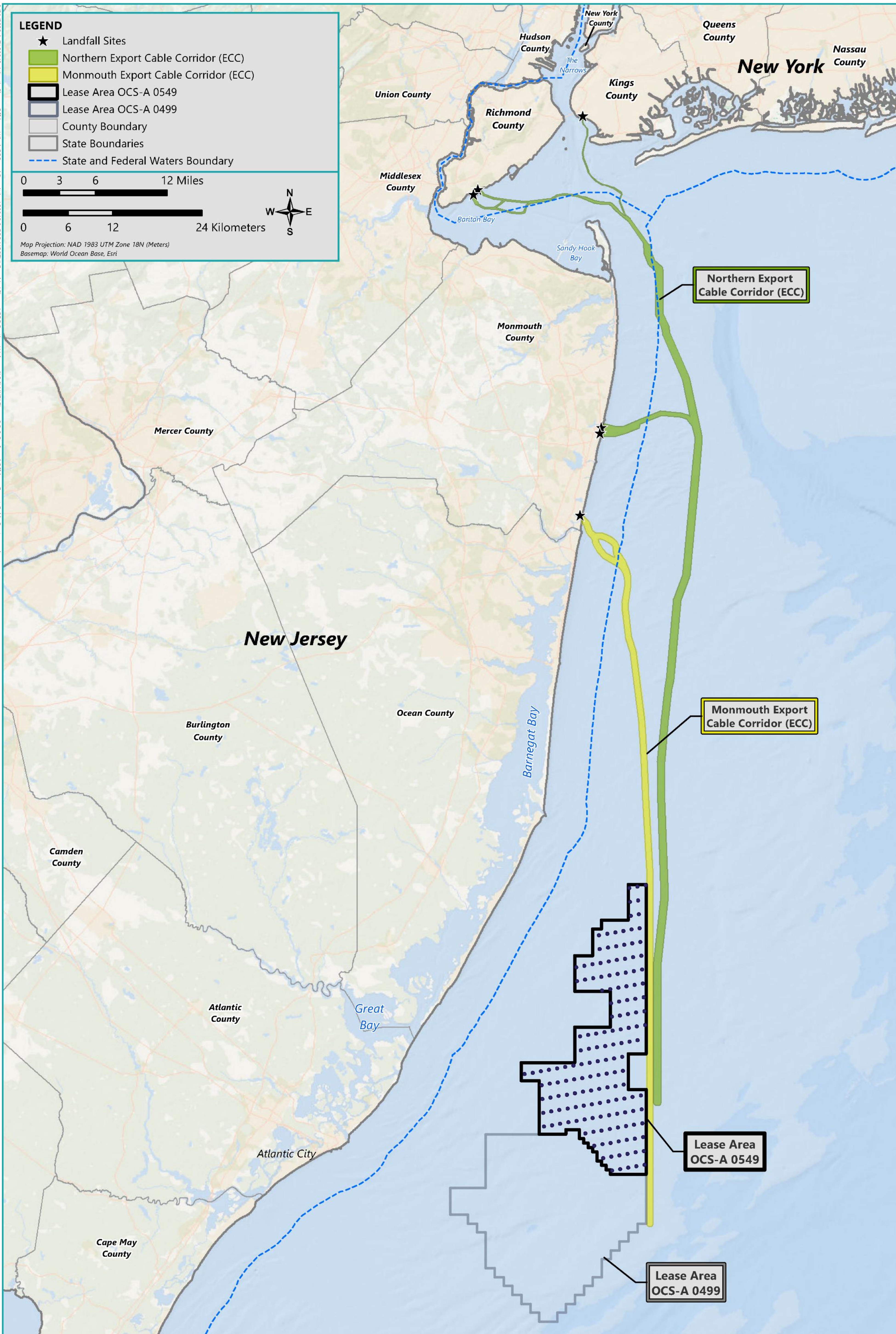
The Northern ECC was further refined to remove the Midland and South Beach landfall sites and associated ECC branches and approaches following consultation with the USACE regarding the schedules of planned construction of a permanent seawall in the same area. Therefore, Atlantic Shores revised the Northern ECC to only include branches to access the Lemon Creek and Wolfe's Pond landfall sites on Staten Island and Fort Hamilton landfall site in Brooklyn, New York.



ATLANTIC SHORES offshore wind

Figure 3.3-1

Preliminary Offshore Export Cable Routing Analysis



ATLANTIC SHORES offshore wind

Figure 3.3-2

Preferred Offshore Export Cable Routes

3.4 Foundation Type Selection

Atlantic Shores is considering fixed foundation types for both the WTGs and the OSSs. An extensive evaluation of all viable foundation types was undertaken. This evaluation of foundation types considered the following:

- **Technical and logistical considerations**
  - Each potential foundation's ability to support the sizes of the OSS topsides and WTGs included within the PDE was assessed.
  - Construction logistics for each potential foundation type were reviewed to evaluate the feasibility of each foundation type, including the availability of suitable ports within reasonable proximity to the Lease Area.
  - Each potential foundation's commercial and technical maturity as well as market availability was assessed.
- **Site characteristics.** Seafloor conditions, sediment characteristics, meteorological and oceanographic (metocean) conditions, and water depths within the Lease Area were used to evaluate the suitability of potential foundation types for the site.

Based on this analysis, Atlantic Shores determined that piled, suction bucket, and gravity foundations are all suitable to include in the PDE (see Sections 4.2 and 4.4). Any fixed foundation designs that are not technically mature or are not expected to be commercially available in time for the expected Project development schedule were omitted from further evaluation. Floating foundations were not considered because water depths in the Lease Area are too shallow for this foundation type to be technically and economically viable.

This approach of considering three foundation types enables Atlantic Shores to maintain continued engagement with multiple technology providers to identify the best solutions that meet development timelines and at competitive prices to rate payers. The proven viability of these technologies in other countries for use by offshore wind and other energy infrastructure projects provides a foundation for replicating the launch of these products/technologies within the U.S. market, with similar considerations of price, scheduling, and site-specific needs.

Atlantic Shores continues to proactively engage and collaborate with the foundation supplier market on their efforts to advance the foundations within our PDE to the U.S. market. Continued engagement and evaluation, over time, will inform which technology is suitable for the Project. This ongoing flexibility will enable Atlantic Shores to make a sound decision, at the right time, on the foundation that addresses the various non-technical and market factors for the Project within the COP area. To determine the sizing of the foundations, a combination of industry benchmarking and engineering studies was conducted using multiple WTG sizes and site-specific data for the Lease Area (e.g., metocean criteria and preliminary sediment profiles). Overall, the Lease Area is suited for a range of foundation types due to its shallow water depths, favorable geotechnical and geophysical conditions (see Section 2.0 Environmental Setting of Volume II), and proximity to local ports and industry (see

Section 4.10.3). All concepts identified in the PDE are technically feasible and sized to capture the potential development scenarios.

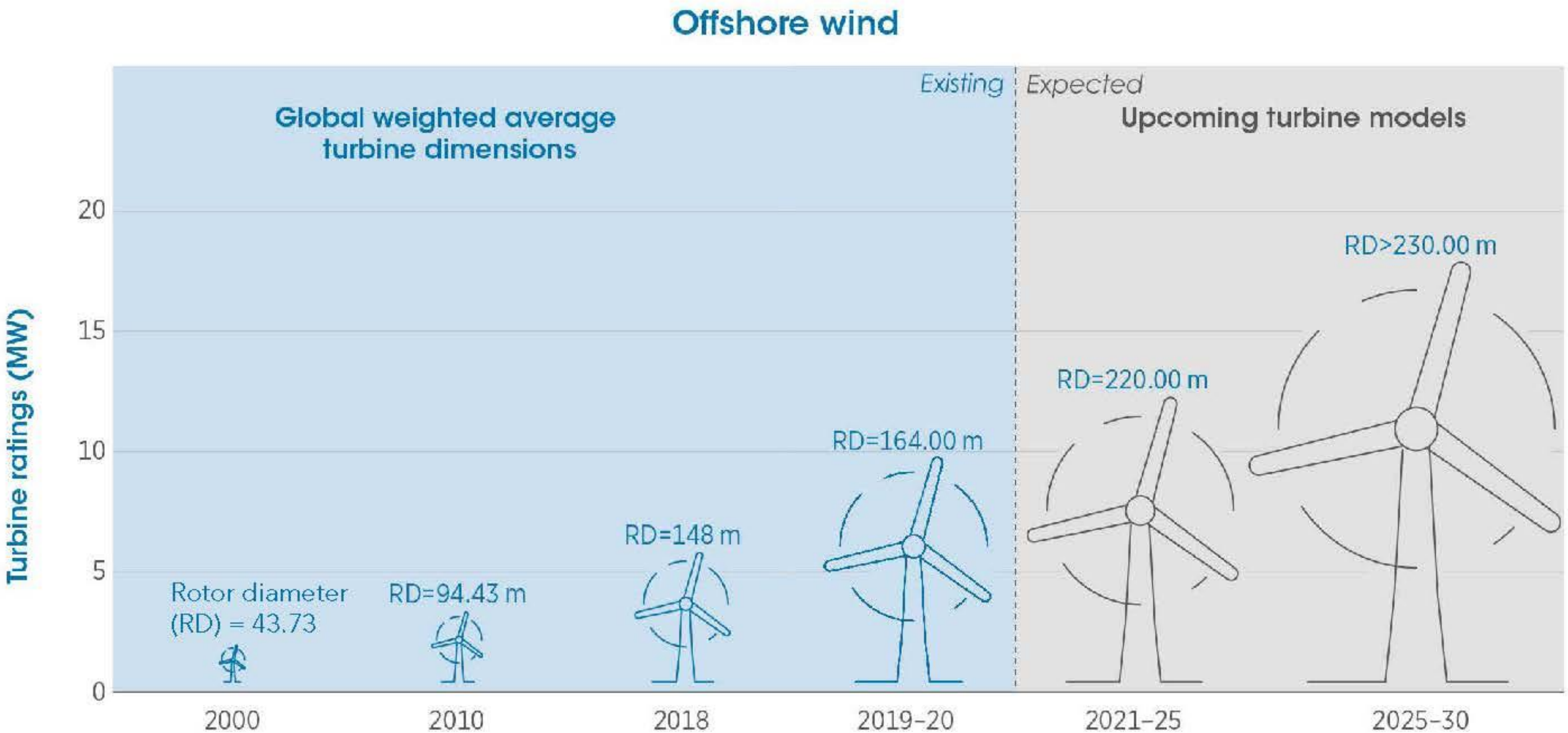
3.5 WTG Dimension Selection

Atlantic Shores conducted a market assessment to identify WTGs anticipated to be commercially available within the Project's expected development schedules. To perform this evaluation, Atlantic Shores worked with three leading global suppliers to assess historic and projected market trends. As part of assessing the potential WTGs that may be available, Atlantic Shores also considered the following key criteria:

- **Technical considerations.** The Project requires high reliability and sufficient energy yield to meet energy market demands in New Jersey and/or New York.
- **Site characteristics.** The Project requires WTGs that are suitable for the expected metocean conditions at the Lease Area, including severe weather events such as hurricanes.

The WTG dimensions included in the PDE are indicative of the maximum dimensions of WTGs anticipated to be commercially available within the Project's expected development schedule. As shown on Figure 3.5-1, WTG sizes are increasing significantly every few years. Within the last decade (2010-2020), rotor diameters have nearly doubled—increasing from an average of 295 ft (90 m) to an average of 538 ft (164 m). The rapid pace of increasing WTG size is apparent in the first few existing and planned projects in the United States. The Block Island Wind Farm completed installation in 2016 and includes five 6 MW WTGs (Green City Times 2020). The Coastal Virginia Offshore Wind project completed installation in 2020 and includes two 6 MW WTGs (Windfair 2020). The Vineyard Wind 1 project is under construction and includes 13 MW WTGs (Vineyard Wind 2020). Such increases in WTG sizes are expected to continue into the next decade and beyond, especially as more offshore wind projects are announced and constructed. Given current trends, the turbine sizes installed over the next few years (such as 10 to 12 MW WTGs) are expected to be phased out from commercial use, and hence unavailable for purchase, by the Project's expected development timeframe.

The PDE for WTGs includes the maximum rotor diameter and rotor area, blade tip height, and hub height for WTGs that may be commercially available, as well as a minimum blade tip clearance that may occur. Ultimately, the use of a PDE allows Atlantic Shores to define a range of dimensions for WTGs expected to be commercially available within the Project's development schedule so that Atlantic Shores has the flexibility to utilize available technology at the time of construction without permitting delays.



Source: Adapted from IRENA 2019

Figure 3.5-1
Wind Turbine Generator Size Projections

4.0 Project Design and Construction Activities

This section provides a detailed description of the Project's facilities (see Figure 1.1-2), which have been selected for the PDE based on the siting and design evolution process outlined in Section 3.0. This section also outlines the Project's construction sequence and schedule along with a detailed description of the design of each major component of the Project (e.g., WTGs, OSSs, offshore cables, and onshore facilities) and the process for construction and installation.

4.1 Infrastructure Overview and Schedule

4.1.1 Project Design Envelope Overview

The Project includes the following elements:

- Up to 157 WTGs, each with a maximum rotor diameter of approximately 967.8 ft (295 m), will be installed on three main foundation types (piled, suction bucket, and gravity foundations) (see Sections 4.2 and 4.3).
- Up to eight small, four medium or three large OSSs will serve as common collection points for power from the WTGs and also serve as the origin for the export cables that deliver power to shore (see Section 4.4).
- Up to 466 (mi) (750 km) of HVAC inter-array cables will connect strings of WTGs to the OSSs (see Section 4.5).
- Up to 62.1 mi (100 km) of HVAC inter-link cables may be used to connect OSSs to each other (see Section 4.5).
- Up to eight total HVAC and/or HVDC export cables will be installed in two offshore Export Cable Corridors (ECCs), the Monmouth ECC and the Northern ECC, that will be approximately 3,300 to 4,200 ft (1,000 to 1,280 m) wide along the majority of their lengths (see Section 4.5).
    - The length per cable is approximately 66.9 mi (107.6 km) in the Monmouth ECC to the farthest potential landfall in New Jersey.
    - The length per cable is approximately 90.2 mi (145.1 km) in the Northern ECC to the farthest potential landfall in New York.
- Up to one permanent met tower and up to two temporary metocean buoys may be installed within the Lease Area (see Section 4.6).
- The Project will utilize onshore interconnection cable routes, which will each contain up to 12 onshore interconnection cables that are installed within buried concrete duct banks (see Sections 4.7 and 4.8).
- The Project will utilize up to one onshore substation and/or converter station site per POI in both New Jersey and/or New York; the substations will step-up, step-down, and/or convert the

onshore interconnection cable voltage in preparation for grid interconnection (see Section 4.9).

- The Project has identified and filed queue positions at a total of five potential POIs—two in New Jersey (Larrabee and Atlantic) and three in New York (Fresh Kills, Goethals, and Gowanus).
- Atlantic Shores will utilize existing facilities to support the Project's operations and maintenance activities (see Section 5.5).
- Existing port facilities in New Jersey, New York, the Mid-Atlantic, New England, the U.S. Gulf Coast, and/or overseas will be used to support the Project's construction and operations (see Sections 4.10.3 and 5.5).

4.1.2 Project Construction Process and Schedule

The proposed construction schedule is shown in Table 4.1-1.

Table 4.1-1 Anticipated Construction Schedule

Activity	Duration[a]	Expected Timeframe[b]
Onshore Interconnection Cable Installation	9–12 months	2026–2027
Onshore Substation and/or Converter Station Construction	18–24 months	2026–2028
Export Cable Installation	6–9 months	2027
OSS Installation and Commissioning	5–7 months	2027–2028
WTG Foundation Installation[c]	10 months	2027–2028
Inter-Array Cable Installation	14 months	2027–2028
WTG Installation and Commissioning	17 months	2027–2028

Notes:

a. These durations assume continuous foundation structure installation without consideration for seasonal pauses or weather delays; anticipated seasonal pauses are reflected in the expected timeframe.

b. The expected timeframe is indicative of the most probable duration for each activity; the timeframe could shift and/or extend depending on the start of fabrication, fabrication methods, and installation methods selected.

c. The expected timeframe depends on the foundation type. If piled foundations are utilized, pile-driving will follow a proposed schedule from May through December to minimize risk to North Atlantic Right Whale. No simultaneous pile driving is proposed.

As shown in Figure 4.1-1, construction of the Project will initiate with the onshore facilities, including the onshore substations and/or converter stations and onshore interconnection cables. The onshore facilities will be constructed first so that power from the electrical grid can be used to energize, commission, and maintain the Project's offshore facilities (e.g., the OSSs and WTGs) as soon as possible after their installation. Construction of the offshore facilities is expected to begin with installation of the export cables and the WTG and OSS foundations (including scour protection). Once the OSS foundations are installed, the topsides can be installed and commissioned, and the inter-link cables (if used) can be installed. At each WTG position, after the foundation is installed, the associated inter-array cables and WTGs can be installed (if WTGs are not installed onto gravity-base structure [GBS] foundations at port). Given the number of WTG and OSS positions, there is expected to be considerable overlap in the various equipment installation periods. Installation of the Project's onshore and offshore facilities may occur over a period of up to 3 years (to accommodate weather and/or seasonal work restrictions); offshore construction is expected to last approximately 2 years.

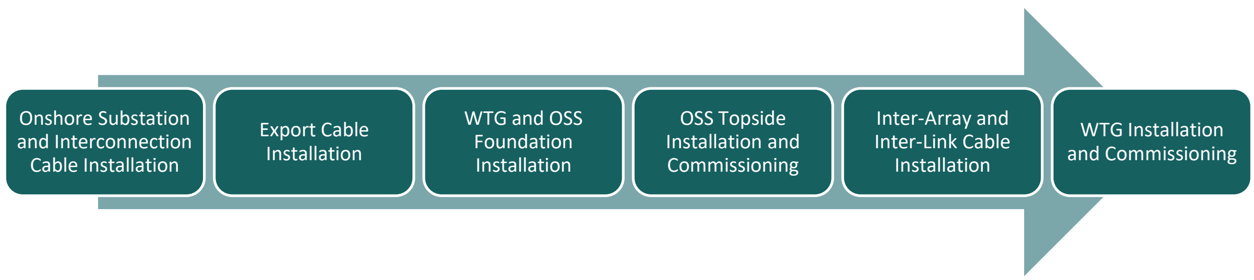


Figure 4.1-1 General Project Construction Sequence

Atlantic Shores has conducted high resolution geophysical and geotechnical surveys to verify site conditions prior to offshore construction, and geophysical surveys will be conducted post-construction to ensure proper installation of the components of the Project (Volume II, Appendix II-A). Geophysical survey equipment included side-scan sonar, multibeam echo-sounder, magnetometers, gradiometers, and sub-bottom profilers. Atlantic Shores has also conducted a munitions and explosives of concern (MEC) assessment (see Volume II, Appendix II-A6) as part of the Project's pre-construction geophysical survey campaign. Future geotechnical surveys to facilitate the final design and engineering of the Project's offshore facilities may include vibracores, cone penetrometer tests, and deep borings. Geotechnical surveys will only be performed in areas that are surveyed and cleared for cultural resources.

Environmental monitoring surveys will be conducted pre-construction, during construction, and post-construction to support the assessment of the Project's potential effects. The environmental monitoring survey plans are being developed in consultation with Federal, State, and local agencies, non-governmental organizations, and other relevant stakeholders and may be conducted as part of regional monitoring initiatives. These surveys and plans are identified and discussed further in Volume II.

Before starting any onshore work, Atlantic Shores will coordinate as appropriate with municipalities and work to inform members of the public regarding onshore construction locations and schedules (see Section 1.4). Prior to performing any offshore work, Atlantic Shores will adhere to its Fisheries

Communication Plan (FCP) (see Appendix II-R) and will communicate directly with its fishing industry contacts to avoid and minimize interactions with fishing vessels and fishing gear. Atlantic Shores will coordinate with the U.S. Coast Guard (USCG) to issue Notices to Mariners to inform fishermen and other mariners of the Project's activities.

4.2 Wind Turbine Generator Foundations

The WTG foundations will provide a robust, stable, and level base for the WTG towers. The foundations will also provide personnel access (via boat landings, ladders, and work platforms), contain aids to navigation in accordance with the USCG and BOEM requirements (see Section 5.3), include a crane for transferring materials and equipment, and house electrical equipment. The PDE includes three categories of WTG foundations that may be affixed to the seabed using piles, suction buckets, or gravity:

1. Piled foundations – monopiles or piled jackets
2. Suction bucket foundations – mono-buckets, suction bucket jackets, or suction bucket tetrahedron bases
3. Gravity foundations – GBS or gravity-pad tetrahedron bases.

The following sections describe each WTG foundation type, and the foundation installation processes for each type.

4.2.1 Piled Foundations

The PDE for the Project includes two sub-types of piled foundations; the dimensions for each foundation sub-type are provided in Table 4.2-1 (see Section 4.2.6):

- **Monopiles.** Monopile foundations, which are driven into the seabed, typically consist of a single steel tube composed of several sections of rolled steel plates that are welded together. A transition piece may be mounted on top of the monopile (see Figure 4.2-1). Alternatively, the monopile length may be extended to the interface with the WTG tower; this is referred to as an "extended monopile." The transition piece or the top of the extended monopile contains a flange for connection to the WTG tower and may include secondary structures such as a boat landing, ladders, a work platform, a crane, and other ancillary components. If a transition piece is used, it will be secured to the monopile via bolts, grout, a slip joint, and/or other mechanical joint connections. The monopile's top diameter and transition piece's bottom diameter are sized based on site-specific environmental and functional loads. The upper outer diameter of the transition piece is identical to the WTG tower's bottom diameter. Water exchange holes may be used to ensure a naturally driven system. Holes would be placed near the top and the bottom of the monopile to allow for sufficient mixing. Implementation and design of these holes will be verified at a later design stage by Computational Fluid Dynamic simulations.

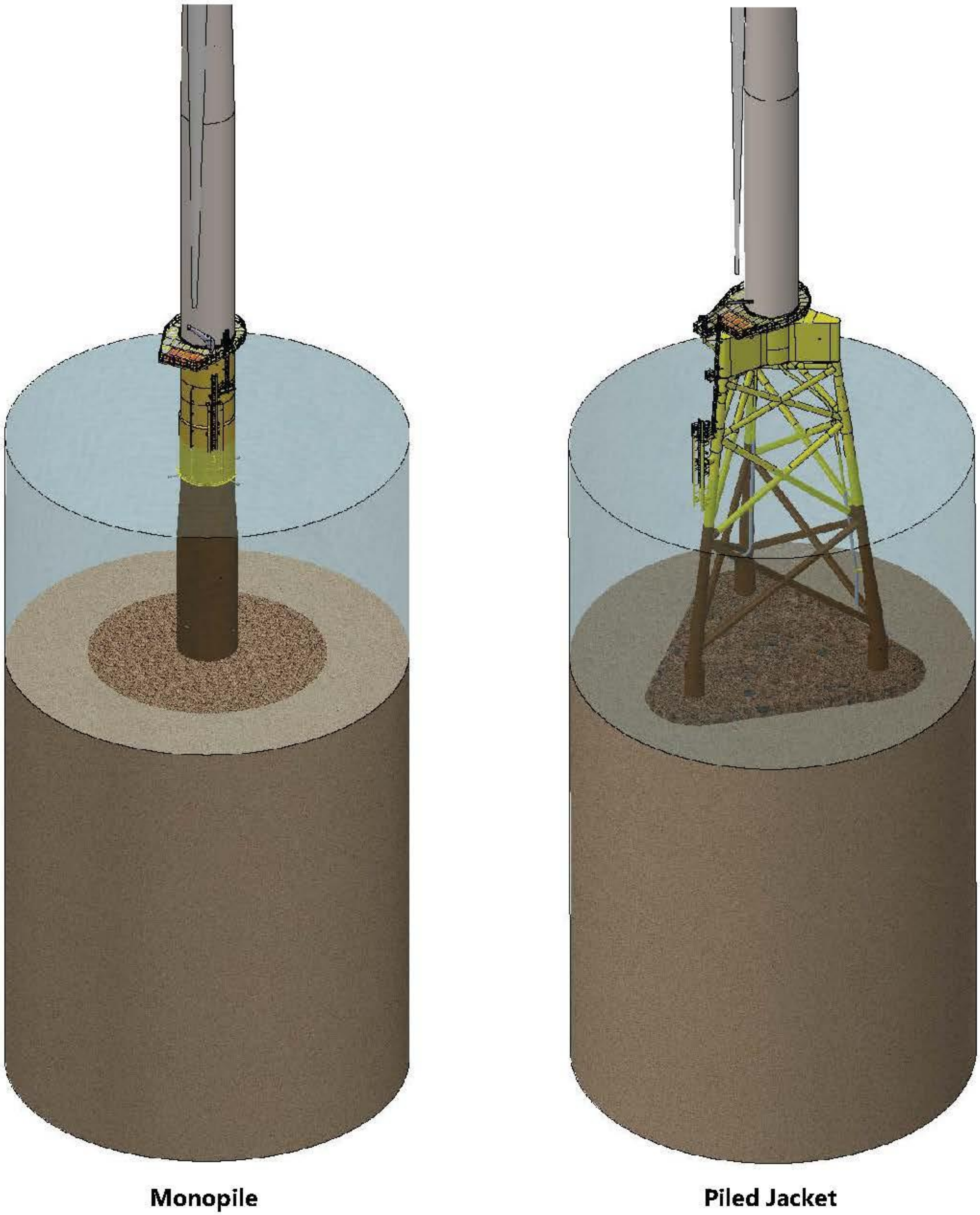


Figure 4.2-1
Piled Foundations

- **Piled jackets.** Piled jacket foundations are steel lattice structures comprised of tubular steel members and welded joints that are fixed to the seabed using piles connected to each leg of the jacket (see Figure 4.2-1). Piled jacket foundations may include three or four legs. Typically, piles are hollow steel cylinders that are driven into the seabed. The top of the jacket foundation contains a flange for connection to the WTG tower as well as secondary structures such as a boat landing, ladders, a work platform, a crane, and other ancillary components.

Monopiles or piled jacket components may be fabricated either in the United States or overseas and will be delivered either directly to the Lease Area or to a marshalling port for final assembly and staging. If storage at a marshalling port is required, equipment such as crawler cranes or self-propelled modular transporters (SPMTs) will be used to unload and transport foundations within the marshalling port. Depending on the location of fabrication and any subsequent staging activities, foundation components may be transported to the marshalling port or Lease Area by heavy transport vessels (HTVs), ocean-going barges, jack-up feeder vessels, or smaller feeder barges towed by local tugboats (see Figure 4.2-2 and Section 4.10.1).

Monopile and piled jacket design and installation methods may require seabed preparation prior to installation (see Section 4.2.4). Scour protection may be required and would be installed at the base of the monopiles or piled jackets (see Section 4.2.5). Within the Lease Area, piled foundations will be installed using one or two jack-up vessels or heavy-lift vessels (HLVs) using dynamic positioning (DP) or anchoring. At each foundation location, a crane on the installation vessel will lift the monopile or each piled jacket component from the transportation vessel into a vertical position and lower it to the seabed (see Figure 4.2-2).

Jacket foundations may have either pre-installed piles or post-installed piles. If pre-installed, a template will be used to properly position the piles so they can be driven into the seabed before the jacket arrives at the Lease Area. The jacket will then be lifted by a vessel crane and set directly onto the installed piles. If post-installed, a vessel crane will lift the jacket foundation and place it on the seabed, after which pin piles will be driven through the jacket’s pile sleeves to secure it in place. Mud mats may be used for piled jackets during installation to support the jacket during piling.

Once the monopile or jacket pin pile is lowered to the seabed, the weight of the pile itself will cause the pile to sink a distance into the seabed (but not to target penetration depth). With the pile resting on the seabed, the crane will release the pile and place a hydraulic hammer atop the pile in preparation for pile-driving. The maximum expected hammer size for installation of monopiles is up to 4,400 kilojoules (kJ) whereas the maximum expected hammer size for jacket pin piles is 2,500 kJ. Atlantic Shores anticipates that it will take a maximum of 7 to 9 hours to drive one monopile and that a maximum of 2 monopiles could be driven per day per vessel spread assuming no daylight restrictions and no concurrent piling (see the PDE in Section 4.2.6). For jackets, Atlantic Shores expects that the maximum installation rate will enable installation of all pin piles for a single jacket foundation (i.e., three or four piles) per day. A description of measures to mitigate underwater noise while pile-driving is provided in Section 4.7.2 of Volume II.

Pile Driving of a Monopile

Transition Piece Installation from a Jack-Up Vessel

Monopile Transport via Tugboat and Barge

Pile Driving of a Jacket Pile

Figure 4.2-2

Piled Foundation Transportation and Installation

Monopile installation may make use of a gripper frame to stabilize the foundation for driving. A vibratory hammer could be used to drive the monopile through surficial sediments in a controlled fashion to mitigate the potential for a "pile run," which is an event where the pile could drop quickly through a layer of surficial sediments and potentially destabilize the installation vessel. The extent to which a vibratory hammer may be needed will be evaluated once additional site-specific data are available and in consultation with the installation contractors. Once the pile has penetrated the surficial sediments with the vibratory hammer, the full remaining installation of the pile could be completed using either the same vibratory hammer or an impact hammer.

While not expected, drilling for pile installation may be required if pile driving encounters refusal (e.g., due to bedrock or a large boulder). This operation involves placing a rotary drilling unit on top of the pile to drill out material from the internal diameter of the pile so pile driving can continue more productively. Material drilled out of the inner diameter of the pile is expected to be deposited in the vicinity of any scour protection[11]. Fill material may be transferred into the pile after the drilling operation is complete to provide additional stability. The fill material may be sand, grout, or concrete and will be piped or conveyed from the installation or auxiliary vessel into the pile.

Following installation of a monopile, a vessel's crane will lift the transition piece (if used) onto the monopile, and the joint will be secured with grout, bolts, a slip joint, other mechanical joint, or a combination of these methods. If used, grout will be mixed onboard a vessel and pumped into the transition piece above a high-strength rubber grout seal to avoid leakage.

For jacket foundations, once the pin piles are driven to their target depths, the installation vessel will ensure the foundation is level and the piles will be fixed in place with grout. Grout will fill each pile sleeve, but the procedure will be monitored to ensure that grout does not spill over the sleeve. For both monopile and jacket foundations, proper grouting procedures will be utilized to minimize any overflow.

Any anchoring or jacking-up during WTG foundation installation will always occur within surveyed areas of the Lease Area. The PDE of seabed disturbance for monopile and piled jacket foundation installation is described in Table 4.2-1.

4.2.2 Suction Bucket Foundations

The PDE includes three variations of suction bucket foundations. The PDE of dimensions for each foundation variation is provided in Table 4.2-1 (see Section 4.2.6).

- **Mono-buckets:** A mono-bucket consists of a single suction bucket supporting a single steel or concrete tubular structure (similar to a monopile) upon which the WTG is mounted. The suction bucket is typically a hollow steel cylinder that is capped at the upper end; the open end of the bucket faces downward into the seabed (see Figure 4.2-3). A transition piece may be mounted on top of the mono-bucket (similar to the monopile foundation type described in Section 4.2.1).

[11] Any drilled material deposition adjacent to scour protection will occur within the maximum seabed disturbance footprint presented in Section 4.11.

- **Suction bucket jackets:** Suction bucket jacket foundations are steel lattice structures comprised of tubular steel members and welded joints that are fixed to the seabed by suction buckets installed below each leg of the jacket (see Figure 4.2-3). The suction bucket jacket may have three or four legs. Similar to piled jacket foundations, the top of the jacket foundation contains a flange for connection to the WTG tower as well as secondary structures such as a boat landing, ladders, a work platform, a crane, and other ancillary components.
- **Suction bucket tetrahedron bases:** A suction bucket tetrahedron base foundation is a tetrahedral-shaped (i.e., three-legged pyramidal) frame that rests on the seabed and is secured to the seafloor using suction buckets (see Figure 4.2-3). This foundation design has a maximum of three contact points with the seabed, and a suction bucket is located at each contact point. Like jacket foundations, the tetrahedron base foundation contains a flange for connection to the WTG tower as well as secondary structures (e.g., a boat landing, ladders, a work platform, and a crane).

The Project's suction bucket foundations may be fabricated either in the U.S. or overseas and will be delivered either directly to the Lease Area or to a marshalling port for final assembly and staging. If storage at a marshalling port is required, equipment such as crawler cranes or SPMTs will be used to unload and transport foundations within the marshalling port. Depending on the location of fabrication and any subsequent staging activities, foundation components may be transported to the marshalling port or Lease Area by HTVs, ocean-going barges, jack-up feeder vessels, or smaller feeder barges towed by local tugboats (see Section 4.10.1). Mono-bucket and suction bucket tetrahedron base designs may also enable wet transport (i.e., floating the foundations) to the Lease Area.

The majority of suction bucket foundations are not expected to require any seabed preparation although seabed preparation may be necessary where the seabed is not sufficiently level. Seabed preparation methods are discussed in Section 4.2.4. Suction bucket foundations may require scour protection (see Section 4.2.5).

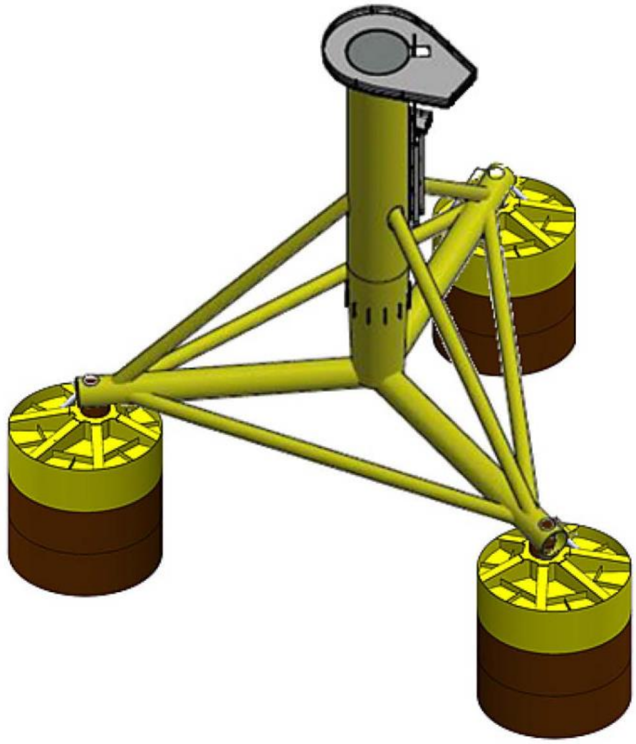
Suction bucket foundation installation can be completed with one or two HLVs (using anchoring or DP) or jack-up vessels (see Figure 4.2-4). After a crane lifts the suction bucket foundation from the transport vessel and places it on the seabed (or, for certain suction bucket tetrahedron bases, once the foundation is sunk to the seabed after being floated out to the Lease Area), the weight of the structure will cause partial penetration of the buckets into the seabed.

After the foundation is in place, the tops of each suction bucket are sealed, and pumps are used to remove water from each bucket to create a negative pressure differential that embeds the bucket into the seabed. Instrumentation within the pump infrastructure will monitor the progress of installation. Real-time monitoring will also ensure the foundation remains vertical, with the pumping speed for each suction bucket controlled individually. The pump will either be pre-installed on top of the suction bucket before it is lowered to the seabed or attached by a remotely operated vehicle (ROV) after the suction bucket is placed on the seabed. The seawater that is then pumped out of the suction bucket will be discharged at the pump's location. The flow rate of discharged water is low, and no disturbance to the seabed is expected to result from discharge of the water. Once the foundation is fully embedded, the pumps will be removed. The space inside the suction bucket (between the bucket lid and sediment inside the bucket) may be backfilled with a cement grout, if determined necessary.

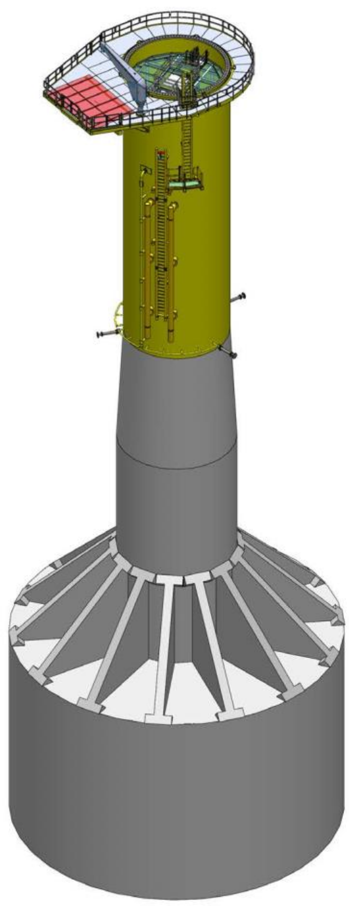
Suction bucket foundations do not require a hammer or drill for installation. Thus, the process of installing a suction bucket foundation is nearly noise-free and the foundation has the potential to be completely removed upon decommissioning.

The entire installation process for a mono-bucket, including lifting the foundation onto the seabed, self-penetration, pumping out water, retrieving the pumps, and grouting the buckets is expected to take less than approximately 7 to 9 hours per foundation. After a mono-bucket foundation is installed, a transition piece (if separate) may be installed by a vessel’s crane and secured with bolts, grout, a slip joint, other mechanical joint, or a combination of these methods. The entire installation process for a suction bucket jacket or suction bucket tetrahedron base foundation should be completed within approximately 15 hours.

The PDE of seabed disturbance for suction bucket foundations is described in Section 4.2.6. Installation activities will always occur within surveyed areas of the Lease Area.



Suction Bucket Tetrahedron Base

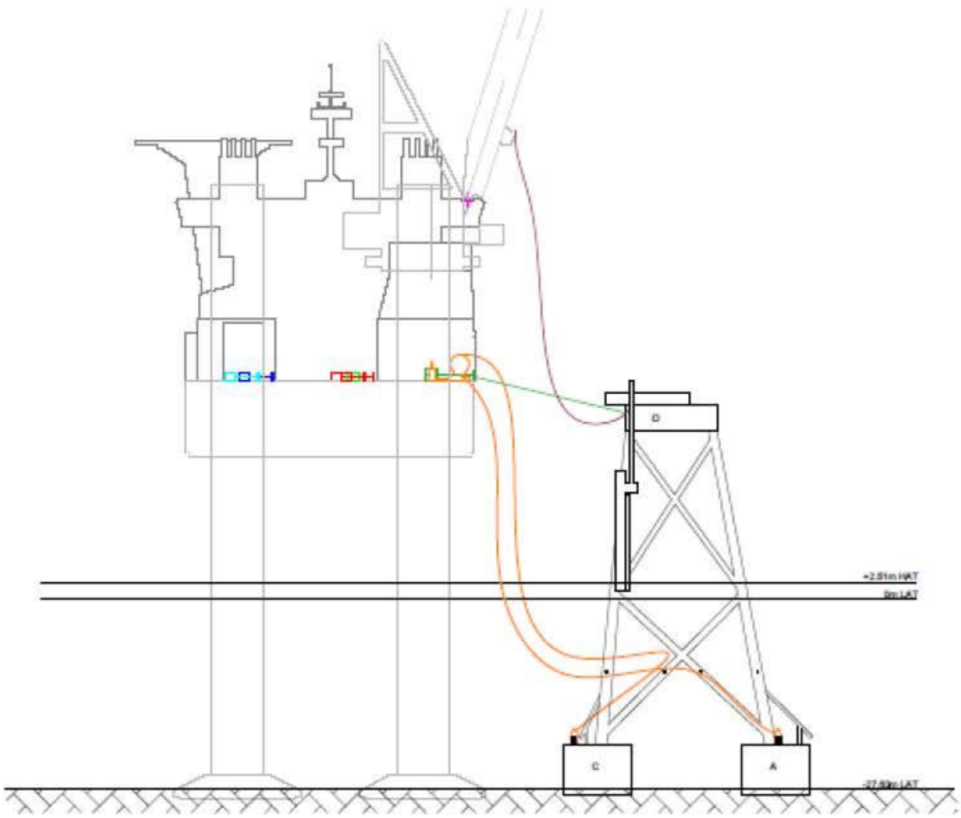


Mono-Bucket

Suction Bucket Jacket

Figure 4.2-3
Suction Bucket Foundations

Lowering of Suction Bucket Foundation using Jack-Up Vessel Crane



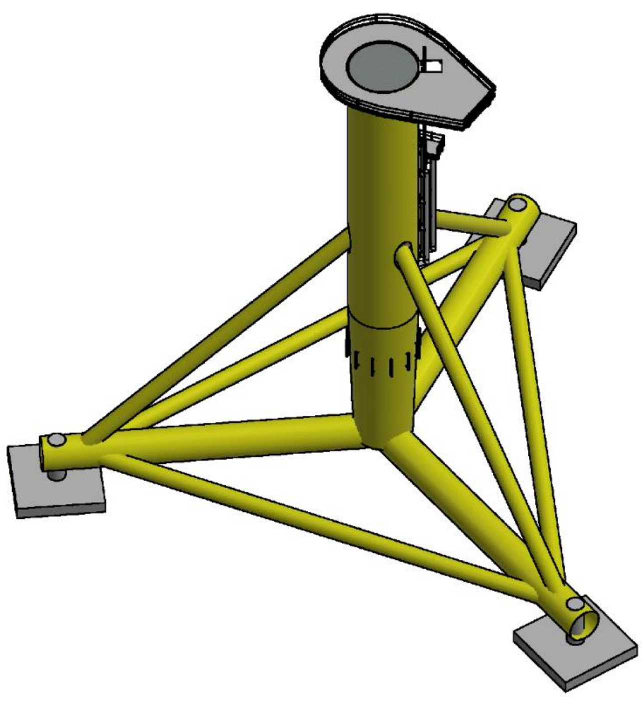
Embedding Suction Buckets by Pumping Out Water

4.2.3 Gravity Foundations

A gravity foundation is stable simply by virtue of its weight and design and requires no piles or suction buckets. Gravity foundations vary in shape and are generally larger at seabed level than piled or suction bucket foundations to provide support and stability for the structure. Two sub-types of gravity foundations are included in the PDE. The PDE for each foundation sub-type is provided in Table 4.2-1 (see Section 4.2.6).

- **Gravity-base structures:** A GBS is a heavy steel-reinforced concrete and/or steel structure that sits on the seabed (see Figure 4.2-5). The GBS foundation's concrete base may be filled with additional ballast material. Ballast material for GBS foundations will likely be sourced from the US, Canada, or Europe and will consist of seawater, sand, gravel, or other crushed minerals or stones. As stated in Section 4.5.3.2, some portion of the dredged sand from sand bedform removal may also be used for ballast in GBS foundations if those foundations are selected for the Project. Above the concrete base, there is a column made of concrete or steel that supports the WTG tower. A transition piece may be mounted on top of the GBS foundation (similar to the monopile foundation type described in Section 4.2.1).
- **Gravity-pad tetrahedron bases:** Gravity-pad tetrahedron bases are similar to the suction bucket tetrahedron bases but are secured in place using high weight pads (i.e., gravity pads) below each leg (see Figure 4.2-5). Similar to piled jacket, suction bucket jacket, and suction bucket tetrahedron base foundations, the top of the foundation contains a flange for connection to the WTG tower as well as secondary structures such as a boat landing, ladders, a work platform, a crane, and other ancillary components.

Gravity-Base Structures (GBS)



Gravity-Pad Tetrahedron Base

Figure 4.2-5
Gravity Foundations

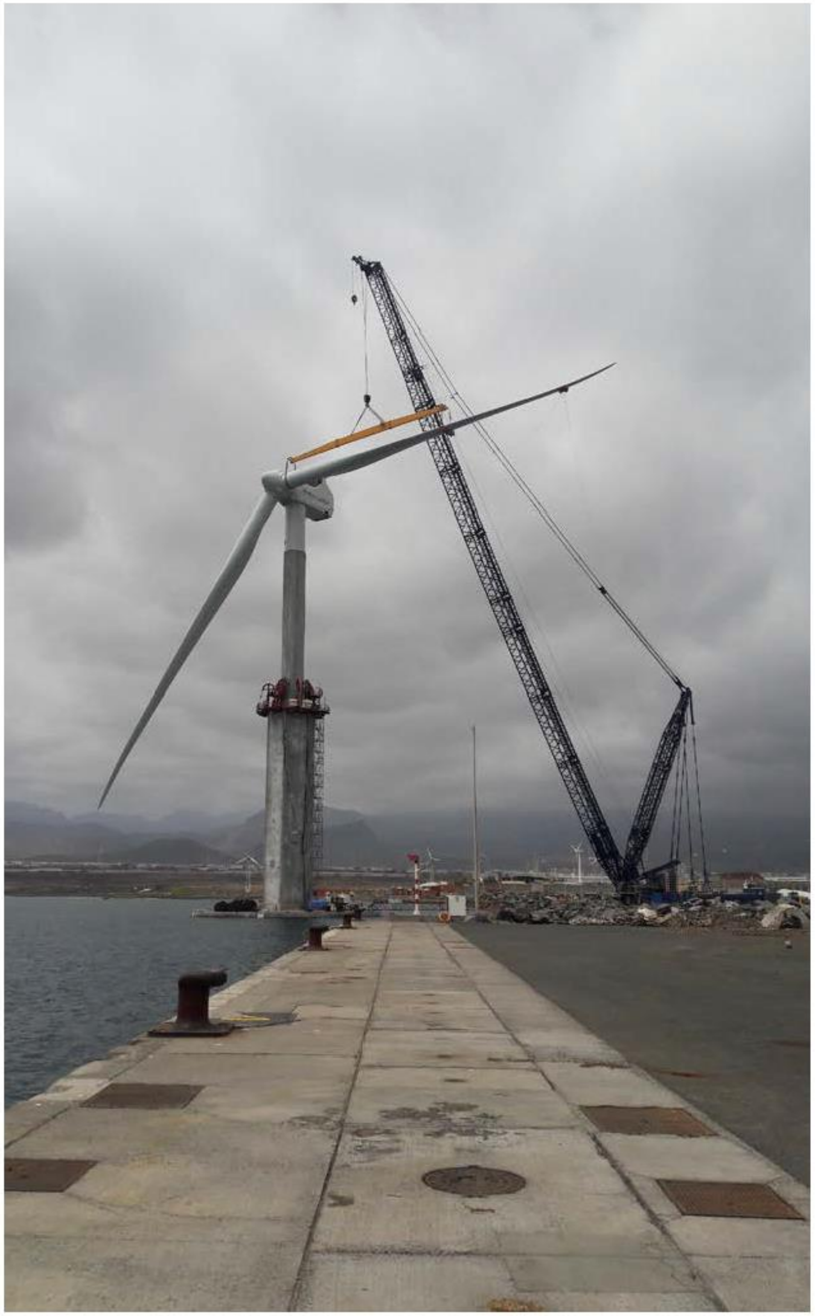
Gravity foundations will be constructed in the United States at an onshore location adjacent to a waterway in proximity to the Lease Area. The gravity foundation may be built entirely onshore or relocated to the adjacent waterway during construction to facilitate subsequent construction activities (see Figure 4.2-6). For example, the vertical foundation sections, transition piece, and secondary components may be installed by quayside cranes while the foundation is temporarily located in the waterway adjacent to the quay. The completed or partially constructed gravity foundation will be transferred to the water through a dry dock, ballasted barge, or other heavy lift methods.

GBS designs may allow for the WTG to be installed on the foundation at port (see Figure 4.2-6). The concrete GBS is built onshore and may be transferred to the water through a dry dock or ballasted barge. The structure is then towed, floating or on barge, to site and sunk or lowered by heavy lift vessel onto a gravel bed pre-laid at the site by rock installation vessels. Certain designs make use of a telescoping tower that is retracted within the foundation column until the GBS is installed at the Lease Area. After the WTG tower is installed onto the foundation, the nacelle and blades will be lifted quayside and attached to the tower section. If the WTG is integrated onto the GBS at the port, a purpose-built installation and transportation aid may be secured to the GBS to stabilize the foundation during the remaining assembly and transport to the Lease Area (see Figure 4.2-7).

Depending on the construction and installation strategy, once the gravity foundations are totally or partially completed, and to release the construction area for subsequent foundation production, the foundations can be temporarily stored onshore or in a designated wet storage area (either adjacent to the quayside or in a designated waterway anchorage area established by the foundation supplier). When a suitable window for installations opens, the units will be refloated and transported to the Lease Area for installation or to the quayside for remaining assembly activities.

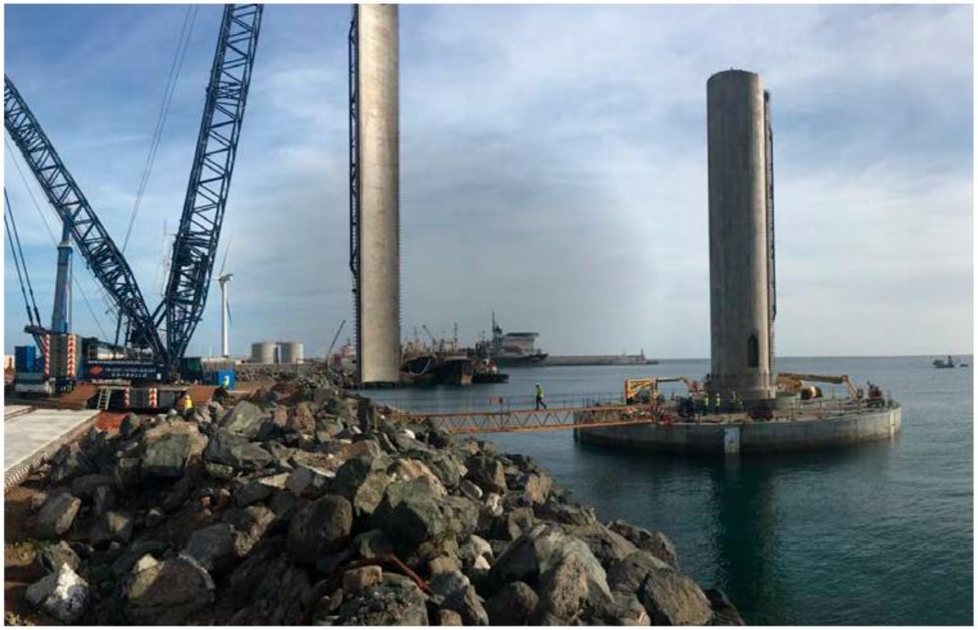
For gravity foundations, seabed preparation in the Lease Area may be needed prior to installation to ensure full contact between the foundation's base and the seafloor so that the foundation remains vertical, and its weight is uniformly distributed. Seabed preparation may be followed by the installation of a gravel pad. Section 4.2.4 provides more details on seabed preparation for gravity foundations. Gravity foundations may also require scour protection (see Section 4.2.5).

Gravity foundations could either be transported to the Lease Area onboard a large-capacity barge or floated to the Lease Area using multiple tugboats. If transported to the Lease Area onboard a large-capacity barge, an HLV's crane will lift the foundation and place it on the seabed. If floated to the Lease Area, the foundation may be transported by tugboats directly to the Lease Area from the supplier's fabrication location or the foundation may first be transported by the supplier on a semisubmersible barge to a sheltered offshore location before being lowered into the water, connected to tugboats, and pulled to the Lease Area. When the floating foundation arrives at the Lease Area, the foundation will be lowered to the seabed by increasing ballast. Once the foundation is at its final position on the seabed, the tugboats are disconnected, and the purpose-built installation and transportation aid (if used) is removed.



WTG Installation onto a Gravity Foundation in Port

Gravity Foundation Transport via Tugboats



Gravity Foundation Construction in Port

ATLANTIC SHORES offshore wind

Figure 4.2-7
Installation and Transportation Aid

After the foundation is in place on the seabed, any additional ballast material (if needed) will be pumped into the foundation's interior by a dedicated vessel to provide additional stability. For concepts that do not involve quayside installation of the transition piece or WTG, the transition piece and WTG will then be installed. If a telescoping gravity foundation design is employed, the telescopic portion of the foundation is jacked up by lifting equipment arranged around the foundation's service platform. After the telescopic portion of the foundation is fully extended and secured, the lifting equipment is removed from the structure.

With a single installation spread, it is anticipated that one gravity foundation will be installed per day. The PDE of seabed disturbance for gravity foundation installation is described in Table 4.2-1.

4.2.4 Seabed Preparation

In general, foundations will be positioned or sized to avoid or reduce seabed preparation where possible.

As described in Sections 4.2.1 through 4.2.3, foundations, particularly gravity foundations, may require some seabed preparation. Seabed preparation involves removing the uppermost sediment layer to establish a level surface, remove any surficial sediments that are too weak to support the planned structure, and enable full contact between the foundation's base and the seafloor. This is necessary to ensure that the foundation remains vertical, and its weight is uniformly distributed. For gravity foundations it may take three to four days to prepare the seabed prior to installation.

Piled and suction bucket foundations are not expected to require seabed preparation unless the seabed is not sufficiently level (e.g., where large sand bedforms are present). Where this occurs, the seabed may need to be prepared prior to pile-driving or suction bucket installation. The maximum dimensions of seabed preparation that could be required for each foundation type is provided in Table 4.2-1.

Seabed preparation could be accomplished the following three ways:

- **Trailing suction hopper dredge (TSHD).** TSHD uses suction pipes to collect sediment in the hopper of the vessel, thus leveling the seabed (see Section 4.5.3.2 for additional details).
- **Jetting/controlled flow excavation.** This method involves directing columns of water at the seabed to excavate sediments and push them aside (see Section 4.5.3.2 for additional details).
- **A backhoe/dipper.** A backhoe/dipper is a mechanical method of removing high points on the seabed to level the sediments in preparation for foundation installation.

For gravity foundations, a gravel pad may be installed after completing seabed preparation. The gravel pad is expected to consist of one or more layer(s) of coarse-grained material. The gravel pads may be comprised of a filter layer (i.e., a layer of finer material) and an armor layer (i.e., a layer of coarser material). Installation of the gravel pad typically consists of the following steps:

1. lowering of a steel frame, if needed, to set the boundaries for the gravel pad

2. leveling the surface of the area within the steel frame
3. filling the volume inside the steel frame with coarse-grained material
4. levelling the gravel pad
5. compacting the gravel pad and possibly injecting the pad with grout.

Seabed preparation and installation of the gravel pad will likely be performed by a DP fallpipe vessel.

4.2.5 Scour Protection

Scour protection may be installed at the base of each foundation to protect it from sediment transport/erosion caused by water currents. The presence of foundations can create locally higher currents around the structures, which scour protection can withstand.

The PDE includes six types of scour protection:

1. Rock placement – up to three layers of rock, with the lower layer(s) consisting of smaller rock and the upper armor layer consisting of larger rock
2. Rock bags – a rock-filled filter unit enclosed by polyester mesh that is non-corrosive, rot-proof, and weather-resistant with proven 30-year durability
3. Grout- or sand-filled bags – bags filled with grout or sand and lowered into place by the installation vessel cranes
4. Concrete mattresses – high-strength concrete blocks cast around a mesh (e.g., ultra-violet stabilized polypropylene rope) that holds the blocks in a flexible covering
5. Ballast-filled mattresses – a folded mattress filled with ballast material (i.e., a sand/water/bentonite mixture or similar) that is lowered to the seabed and unfolded at the base of the foundation
6. Frond mattresses – buoyant fronds approximately 3 ft (1 m) high, which are designed to replicate how natural seaweed reduces water velocity locally, are densely built into a mattress, and are deployed either directly onto the seabed or attached to the structure.

Scour protection consisting of freely laid rock will likely be installed by a DP fallpipe vessel, which uses a pipe that extends to just above the seafloor to deposit rock contained in the vessel's hopper in a controlled manner. Concrete mattresses, rock bags, grout- or sand-filled bags, and frond mattresses will likely be deployed by a vessel's crane.

All scour protection options considered for the Project were screened for technical and economic suitability. The need for and selected type(s) of scour protection will be determined by the final design of the foundations and ongoing agency consultations. The PDE of scour protection dimensions for each foundation type under consideration is defined in Table 4.2-1. Scour protection may occur in any shape and size up to the maximum footprint provided in Table 4.2-1, including the possibility of no scour protection.

4.2.6 Project Design Envelope for the WTG Foundations

The PDE of WTG foundation parameters is provided in Table 4.2-1.

Table 4.2-1 PDE of WTG Foundations Dimensions and Seabed Disturbance

Concept	Piled		Suction Bucket			Gravity	
	Monopile	Piled Jacket	Mono-Bucket	Suction Bucket Jacket	Suction Bucket Tetrahedron Base	Gravity-Pad Tetrahedron Base	GBS
Foundation Structure							
Max. pile, suction bucket, gravity-base, or gravity-pad diameter at seabed	49.2 ft (15.0 m)	16.4 ft (5.0 m)	114.8 ft (35.0 m)	49.2 ft (15.0 m)	52.5 ft (16.0 m)	36.1 ft x 36.1 ft (11.0 m x 11.0 m)	180.5 ft (55.0 m)
Max. # of legs/discrete contact points with seabed	1	4	1	4	3	3	1
Max. depth of penetration below seabed	With scour protection: 196.9 ft (60.0 m) Without: 262.5 ft (80.0 m)	229.7 ft (70.0 m)	114.8 ft (35.0 m)	65.6 ft (20.0 m)	65.6 ft (20.0 m)	9.8 ft (3.0 m)	9.8 ft (3.0 m)
Monopile/jacket pile/bucket length	With scour protection: 344.5 ft (105.0 m) Without: 410.1 ft (125.0 m)	249.3 ft (76.0 m)	147.6 ft (45.0 m)	82.0 ft (25.0 m)	82.0 ft (25.0 m)	N/A	N/A
Max. distance between adjacent legs at seabed	N/A	131.2 ft (40.0 m)	N/A	131.2 ft (40.0 m)	131.2 ft (40.0 m)	246.1 ft (75.0 m)	N/A
Max. foundation diameter/leg spacing at Mean Sea Level (MSL)	39.4 ft (12.0 m)	98.4 ft (30.0 m)	39.4 ft (12.0 m)	98.4 ft (30.0 m)	39.4 ft (12.0 m)	39.4 ft (12.0 m)	39.4 ft (12.0 m)
Max. total foundation footprint contacting seabed per foundation[a]	1,902.0 square feet (ft^2) (176.7 square meters [m^2])	845.0 ft^2 (78.5 m^2)	10,356.0 ft^2 (962.1 m^2)	7,609.0 ft^2 (706.9 m^2)	6,492.8 ft^2 (603.2 m^2)	3,907.3 ft^2 (363.0 m^2)	25,572.9 ft^2 (2,375.8 m^2)
Seabed Disturbance							
Permanent Seabed Disturbance							
Max. representative[b] outer diameter/size of scour protection	269.0 ft (82.0 m) per foundation	98.4 ft (30.0 m) per leg	295.3 ft (90.0 m) per foundation	334.6 ft x 334.6 ft (102.0 m x 102.0 m) per foundation	347.8 ft x 328.1 ft (106.0 m x 100.0 m) per foundation	98.4 ft x 98.4 ft (30.0 m x 30.0 m) per leg	272.3 ft (83.0 m) per foundation
Max. thickness of scour protection	8.2 ft (2.5 m)	6.6 ft (2.0 m)	6.6 ft (2.0 m)	6.6 ft (2.0 m)	6.6 ft (2.0 m)	4.9 ft (1.5 m)	4.6 ft (1.4 m)
Est. volume of scour protection per foundation	314,300.5 ft^3 (8,900.0 m^3)	125,720.2 ft^3 (3,560.0 m^3)	413,181.6 ft^3 (11,700.0 m^3)	600,543.6 ft^3 (17,005.5 m^3)	461,477.9 ft^3 (13,067.6 m^3)	123,795.6 ft^3 (3,505.5 m^3)	151,786.0 ft^3 (4,298.1 m^3)
Max. total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only])	56,844.3 ft^2 (5,281.0 m^2)	30,434.2 ft^2 (2,827.4 m^2)	111,987.6ft^2 (6,361.7 m^2)	111,987.6 ft^2 (10,404.0 m^2)	92,870.9 ft^2 (8,628.0 m^2)	29,062.6 ft^2 (2,700.0 m^2)	58,239.2 ft^2 (5,410.6 m^2)
Seabed Disturbance							
Temporary Seabed Disturbance During Construction							
Max. dimensions of seabed preparation per foundation	269.0 ft x 269.0 ft (82.0 m x 82.0 m)	229.7 ft x 229.7 ft (70.0 m x 70.0 m)	295.3 ft x 295.3 ft (90.0 m x 90.0 m)	334.6 ft x 334.6 ft (102.0 m x 102.0 m)	347.8 ft x 328.1 ft (106.0 m x 100.0 m)	311.7 ft x 344.5 ft (95.0 m x 105.0 m)	272.3 ft x 272.3 ft (83.0 m x 83.0 m)
Max. depth seabed preparation[c]	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)
Max. area of seabed preparation per foundation	72,376.5 ft^2 (6,724.0 m^2)	52,743.2 ft^2 (4,900.0 m^2)	87,187.7 ft^2 (8,100.0 m^2)	111,987.6 ft^2 (10,404.0 m^2)	92,871.0 ft^2 (8,628.0 m^2)	81,133.0 ft^2 (7,537.5 m^2)	74,152.6 ft^2 (6,889.0 m^2)
Avg. volume of seabed preparation per foundation[d]	125,258.1 ft^3 (3,546.9 m^3)	91,279.7 ft^3 (2,584.8 m^3)	150,890.9 ft^3 (4,272.8 m^3)	193,811.0 ft^3 (5,488.1 m^3)	160,726.7 ft^3 (4,551.3 m^3)	141,082.1 ft^3 (3,995.0 m^3)	128,331.9 ft^3 (3,634.0 m^3)

Concept	Piled		Suction Bucket			Gravity	
	Monopile	Piled Jacket	Mono-Bucket	Suction Bucket Jacket	Suction Bucket Tetrahedron Base	Gravity-Pad Tetrahedron Base	GBS
Max. disturbance due to jack-up or anchored vessels per foundation[e]	58,125.1 ft^2 (5,400.0 m^2)	47,361.2 ft^2 (4,400.0 m^2)	58,125.1 ft^2 (5,400.0 m^2)	47,361.2 ft^2 (4,400.0 m^2)	47,361.2 ft^2 (4,400.0 m^2)	0.0 ft^2 (0.0 m^2)	10,763.9 ft^2 (1,000.0 m^2)
Max. total temporary seabed disturbance beyond permanent footprint per foundation	**73,657.2 ft^2 (6,843.0 m^2)**	**69,670.1 ft^2 (6,472.6 m^2)**	**76,835.7 ft^2 (7,138.3 m^2)**	**47,361.2 ft^2 (4,400.0 m^2)**	**47,361.2 ft^2 (4,400.0 m^2)**	**52,070.4 ft^2 (4,837.5 m^2)**	**26,677.2ft^2 (2,478.4 m^2)**
Total Temporary and Permanent Seabed Disturbance During Construction							
Max. total area of seabed disturbance per foundation	**130,501.5 ft^2 (12,124.0 m^2)**	**100,104.3 ft^2 (9,300.0 m^2)**	**145,312.4 ft^2 (13,500.0 m^2)**	**159,348.8 ft^2 (14,804.0 m^2)**	**140,232.1 ft^2 (13,028.0 m^2)**	**81,132.9 ft^2 (7,537.5 m^2)**	**84,916.4 ft^2 (7,889.0 m^2)**
Installation Timeframe							
Approx. max. duration to drive one pile	7-9 hours	3-4 hours	N/A	N/A	N/A	N/A	N/A
Max. # of piles driven per day	**2**	**4**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Notes:

a) The footprint of any mud mats (if used) would overlap with the footprint of scour protection and are included in the “Max. total permanent footprint” rather than the “Total foundation footprint contacting seabed.”

b) Scour protection may occur in any shape and size up to the maximum footprint provided, including the possibility of no scour protection.

c) In the worst-case situation, in a limited number of foundation positions, up to 19.7 ft (6 m) of seabed leveling could be required. Piled and suction bucket foundations are not expected to require seabed preparation unless the seabed is not sufficiently level).

d) The maximum total volume of seabed preparation for the WTG foundations will not exceed the average volume for an individual foundation multiplied by 157 foundations.

e) Foundation installation using jack-up vessels is expected to involve one main installation jack-up vessel with a maximum disturbance of 10,763.9 ft^2 (1,000.0 m^2) (four legs, each disturbing 2,691.0 ft^2 [250.0 m^2]) and one feeder-jack-up vessel with a maximum disturbance of 4,869.5 m^2 (452.4 m^2) (four legs, each disturbing 1,217.4 ft^2 [113.1 m^2]) at each position. Although less likely, if an anchored HLV is used, foundation installation is expected to involve one anchored HLV with a maximum disturbance of 47,361.2 ft^2 (4,400 m^2) (four anchors, each with a disturbance of 1,076.4 ft^2 [100.0 m^2] for the anchor itself plus 10,763.9 ft^2 [1,000.0 m^2] for the mooring system) at each position; the feeder barge(s) would moor to the HLV and cause no additional disturbance. If transition pieces are installed in a separate campaign, another jack-up vessel with a maximum disturbance of 10,763.9 ft^2 (1,000.0 m^2) may be used. The scenario resulting in the greatest seafloor disturbance for each foundation type is assumed in the table above. Additional emergency anchoring or jacking-up may be required.

4.3 Wind Turbine Generators

4.3.1 WTG Design

The Project's WTGs are expected to follow the traditional offshore WTG design comprised of a three-bladed rotor nacelle assembly (RNA) mounted on a tower structure affixed to a foundation. The rotor will drive a variable speed electric generator. Depending on the model of WTG selected, the drivetrain may include a gearbox to increase the rotational speed of the generator. The WTG will sense the direction of the wind using integrated sensors and will automatically turn into the wind by activating the yaw system. The WTG will also adjust the pitch of the blades continuously during operation to maximize power production and maintain safe operating limits. The drivetrain, electric generator, yaw system, control system, and power electronics are enclosed in a nacelle, which provides protection from the weather as well as lightning protection.

The WTG power system (i.e., the power converter, transformers, and switchgear) converts the voltage and frequency of the power produced by the WTG's generator to the inter-array cables' voltage (66 to 150 kilovolts [kV]) and electrical grid's frequency, reduces harmonics, and provides reactive power control. The power converter and transformer may be located in the nacelle or inside the WTG tower. The switchgear and inter-array cable terminations may be located inside the WTG tower or inside the top of the WTG foundation. All power system components are protected according to best practices and industry standards.

The WTG control and protection system monitors environmental and operational parameters to keep equipment within design limits. Heating and cooling systems regulate the temperature of each component and lubrication systems keep components corrosion-free and rotating smoothly. The control and protection system monitors the WTG and protects equipment and personnel by providing automatic shutdown and alarms. The system also includes fire detection, overheating, overpower, and overspeed protection.

All WTGs in the Project will be connected to the central supervisory control and data acquisition (SCADA) system for remote monitoring and control (discussed in greater detail in Section 5.1). The SCADA system allows remote operators to track the operation and performance of all Project assets from a single system, to store long-term data, and to access short-term high-resolution data for fault troubleshooting. It also allows functions such as remote testing, software updates, parameter updates, and WTG shut down for maintenance or at the request of grid operators, regulators, or search and rescue (SAR) teams. Individual WTGs can be controlled manually from within the nacelle or tower base for commissioning and maintenance activities.

The WTG can be accessed for commissioning and maintenance from the platform on the WTG foundation via a locked door in the tower base. WTGs are equipped with an elevator, ladders, and other access routes that enable the movement of maintenance personnel, small equipment, and small spare parts inside the tower and RNA. A helihoist platform on top of the nacelle can be used for technician access and for evacuation. To facilitate maintenance, the WTGs will be equipped with auxiliary cranes in the nacelle and on the external working platform.

An uninterruptible power supply (UPS) will power the control and protection system in case of a grid outage to enable safe shut down of the WTG and saving operational data. Additional back-up power systems (e.g., WTG self-power feature, portable generators, and/or battery systems) may be utilized to provide power for commissioning and for storm protection in the event of a longer-term grid outage.

All WTG components will be designed to comply with relevant HSSE standards and regulations. During construction and operation, the WTGs (and their foundations) will be lighted and marked in accordance with Federal Aviation Administration (FAA), USCG, and BOEM guidelines to aid safe navigation within the Lease Area. Lighting and marking of the WTGs during the operations period is discussed in Section 5.3.

The PDE of WTG dimensions is provided in Table 4.3-1 and illustrated in Figure 4.3-1. The WTG dimensions are indicative of the maximum dimensions of WTGs anticipated to be commercially available within the Project's expected development schedule (see Section 3.5). The PDE of WTG dimensions provides Atlantic Shores with flexibility in WTG choice, which is necessary to ensure that anticipated advancements in available WTG technology can be incorporated into the Project's final design.

Table 4.3-1 PDE of WTG Dimensions

WTG Dimension	Input
Max. Rotor Diameter	967.8 ft (295.0 m)
Max. Tip Height Relative to MLLW Relative to MSL Relative to HAT	 1,048.8 ft (319.7 m) 1,046.6 ft (319.0 m) 1,043.0 ft (317.9 m)
Max. Top of Nacelle Height Relative to MLLW Relative to MSL Relative to HAT	 614.1 ft (187.2 m) 611.9 ft (186.5 m) 608.3 ft (185.4 m)
Max. Hub Height Relative to MLLW Relative to MSL Relative to HAT	 565.0 ft (172.2 m) 574.1 ft (175 m) 5559.1 ft (170.4 m)
Min. Tip Clearance (air gap) Relative to MLLW Relative to MSL Relative to HAT	 78.0 ft (23.8 m) 75.8 ft (23.1 m) 72.2 ft (22.0 m)
Max. Nacelle Dimensions (length x width x height)	150.9 ft x 65.6 ft x 65.6 ft (46.0 m x 20.0 m x 20.0 m)
Max. Blade Length	479.0 ft (146.0 m)
Max. Blade Chord	32.8 ft (10.0 m)
Max. Tower Diameter **Top** **Bottom**	 **27.9 ft (8.5 m)** **32.8 ft (10.0 m)**

Notes: MLLW = Mean Lower Low Water; MSL = Mean Sea Level; HAT = Highest Astronomical Tide

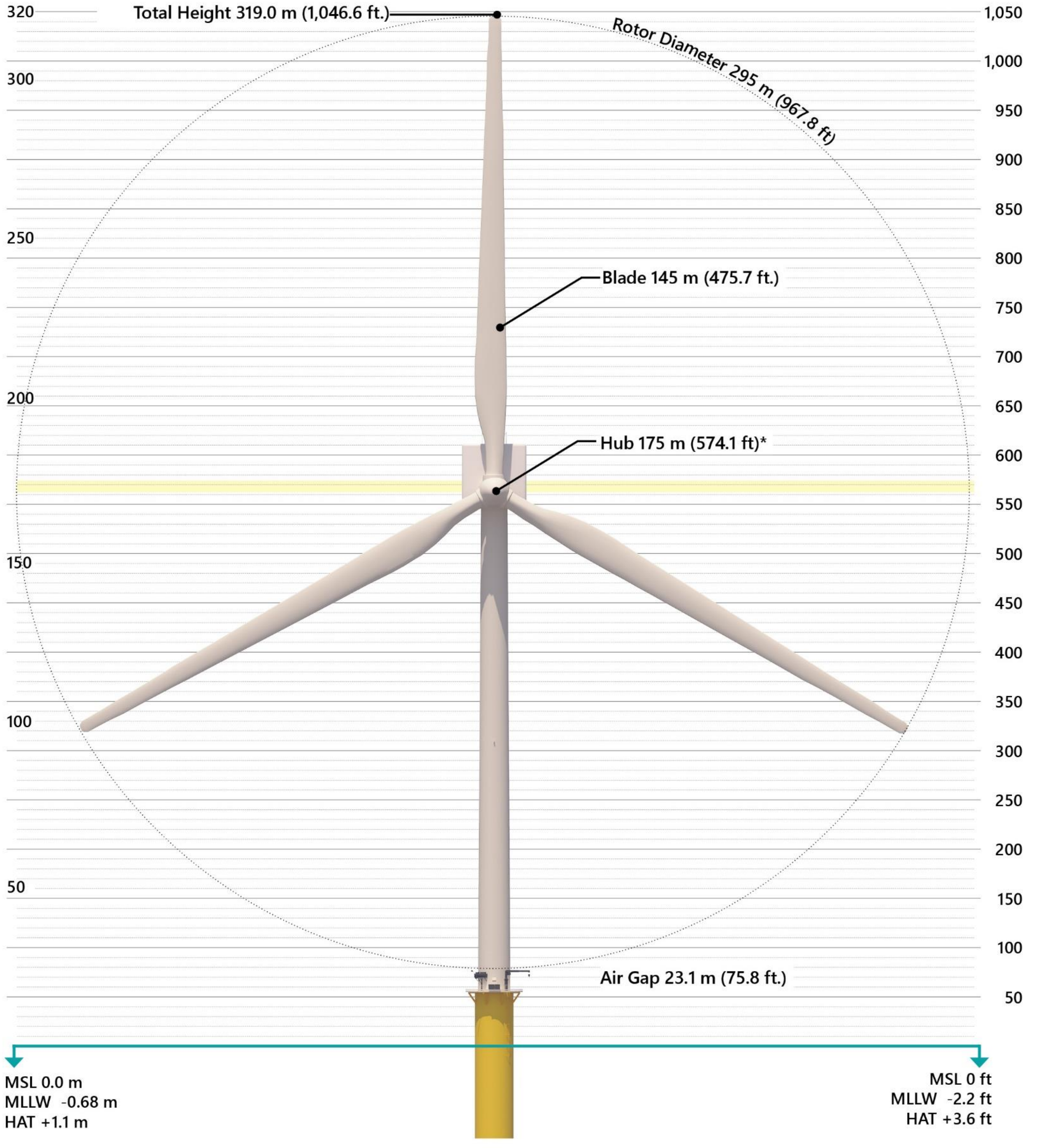


Figure 4.3-1

Wind Turbine Generator PDE

ATLANTIC SHORES offshore wind

- Hub variable 171.5 m to 175.0 m

Notes:
Wind turbine hub Illustrated at 171.5 m to meet the maximum blade tip height. If the hub reaches 175.0 m, the rotor diameter will be reduced. Yellow band illustrates this variable.

This figure depicts the maximum rotor diameter and maximum tip height relative to mean sea level (MSL). The full range of WTG dimensions within the PDE is available in the COP Volume I, Table 4.3-1 PDE of WTG Dimensions.

The WTGs will be designed according to site-specific conditions, including winter storms, hurricanes, and tropical storms, based on industry standards such as American Clean Power Association (ACP), International Electrotechnical Commission (IEC), American Petroleum Institute (API), and International Organization for Standardization (ISO) standards. These site conditions and standards will be detailed in the design basis and verified by the independent CVA as part of the Facility Design Report (FDR) and the Fabrication and Installation Report (FIR). The WTG design is suitable for offshore wind sites with reference wind speeds of 111.8 to 127.5 miles per hour (mph) (50 to 57 meters per second [m/s]) over a 10-minute average and 50-year extreme gusts of 156.6 to178.5 mph (70 to 79.8 m/s) over a 3-second average for type certification.[12] A site-specific assessment of the WTGs will be performed for the Project. The WTGs are expected to produce power at wind speeds between approximately 6.7 and 68.9 mph (ft/s) (3 and 31 m/s), although the WTGs' exact environmental operating conditions will depend on vendor and WTG model. WTGs will automatically shut down in wind speeds above the WTGs' maximum operational limit of 62.6 to 64.9 mph (28 to 29 m/s).

4.3.2 WTG Installation

WTG components are expected to be manufactured in the U.S. or overseas and shipped, if needed, to a U.S. marshalling port. At the marshalling port, WTG components will be offloaded, stored, pre-assembled, and prepared for load-out. The WTG components (i.e., blades, nacelles, and towers) will be delivered in suitable transport and lifting frames to facilitate loading, offloading, storage, and installation. The components will be offloaded using shore-based equipment (e.g., cranes and SPMTs) and will be inspected for damage before being transported from quayside to storage. Storage will ensure a constant supply of WTGs to the assembly location in the Lease Area.

The WTG components may be pre-assembled at the marshaling port. Pre-assembly of WTG tower sections may include assembling the complete tower structure (assuming the port does not have an air draft restriction) or partial tower structure (depending on capabilities of the installation vessel or the feeder barges). To complete this operation, a heavy-lift crane lifts the bottom tower section into a vertical position, and the

Offshore installation of WTGs is expected to involve a jack-up WTG installation vessel and as necessary assisted by feeder barges or jack-up feeder vessels. The jack-up WTG installation vessel will be equipped with a crane to lift WTG components from the feeder barges/vessel onto the foundation (see Figure 4.3-2). Seafloor impacts from jack-up vessels used during WTG installation are provided in Table 4.3-2.

As described in Section 4.2.3, gravity foundations could enable full assembly of the WTG onto the foundation at port with subsequent towing to the Lease Area. With this approach, the gravity foundation is placed on a semisubmersible barge or temporarily set on the bottom at quayside. A shore-based crane lifts the tower sections onto the foundation where they are secured. Towers are

[12] Type certificates are issued by an accredited certification body to independently verify that a WTG (or other renewable energy equipment) is designed and manufactured in accordance with all applicable requirements/standards.

Transport of WTG Components via Jack-Up Vessel

Installation of WTG Component using Jack-Up Vessel Crane

inspected prior to assembly. The RNA is then assembled onto the top tower section, after which blades are assembled onto the hub. The entire assembly is then towed to a wet storage location or to the Lease Area for installation.

Table 4.3-2 Maximum Seabed Disturbance from WTG Installation

Installation Activity	PDE
Max. area of seafloor disturbance per jack-up WTG installation vessel	10,763.9 ft^2 (1000.0 m^2) (four legs, each disturbing 2,691.0 ft^2 [250.0 m^2])
Max. area of seafloor disturbance per jack-up feeder vessel	4,869.5 ft^2 (452.4 m^2) (four legs, each disturbing 1,217.4 ft^2 [113.1 m^2])
Max. # of times vessels jack-up per WTG	1 time for the jack-up WTG installation vessel & 1 time for the jack-up feeder vessel
Max. area of seafloor disturbance from jack-ups per WTG	**15,633.4 ft^2 (1,452.4 m^2)**

4.3.3 WTG Commissioning

Following installation, the WTGs will be energized from the grid through the inter-array cables or with a temporary power supply. Then, the commissioning process will prepare WTGs for operation. The purpose of commissioning is to test electrical connections, safety, and control functions of the WTG (e.g., emergency stop, auto restart, etc.), and the communication between the WTG and the SCADA system. Installed WTGs will likely undergo commissioning and testing while other WTGs are still being installed. Once commissioning is completed, a test run (i.e., trial operation) is carried out (typically for 240 hours) to demonstrate that the WTG performs as expected and is reliable. During commissioning and testing, personnel may be transported to and from WTGs via service operation vessels (SOVs), crew transfer vessels (CTVs), and/or helicopters.

4.4 Offshore Substations

The Project will include one or more OSSs that serve as common collection points for power from the WTGs and also serve as the origin for the export cables that deliver power to shore. Atlantic Shores is considering three sizes of OSS. Depending on the final OSS design, there will be up to eight small OSSs, up to four medium OSSs, or up to three large OSSs in the Project.

OSSs will be generally located along the same east-northeast to west-southwest rows as the WTGs; small OSSs will be located no closer than 12 miles (mi) (19.3 km) from shore whereas medium and large OSSs will be located at least 13.5 mi (21.7 km) from shore. Potential OSS locations for the Project are shown on Figure 3.1-2 and the OSS layout is described further in Section 3.1. OSS foundations are described in Section 4.4.1, while topside structures are described in Section 4.4.2. Scour protection, which may be installed around OSS foundations, and seabed preparation are described in Section 4.4.3.

4.4.1 OSS Foundation Design and Installation

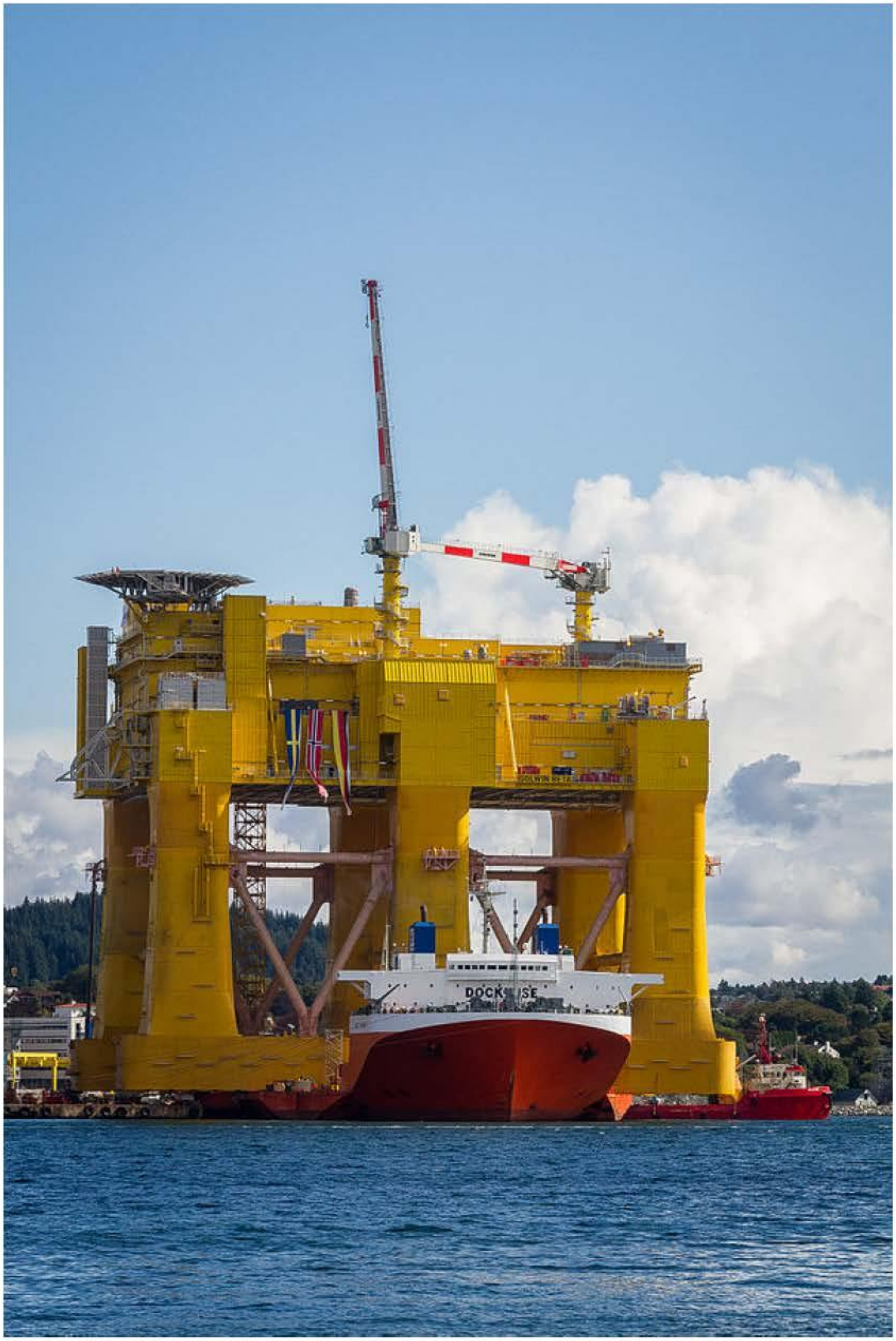
Similar to the WTG foundations, the PDE includes three categories of OSS foundations that may be affixed to the seabed using piles, suction buckets, or gravity. The type of OSS foundation used depends on the size of the OSS itself (see Table 4.4-1).

Table 4.4-1 OSS Foundation Types

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

These foundation types are similar to those under consideration for the WTGs, although tetrahedron base foundations are not included in the OSS foundation PDE. Each foundation type and the various foundation installation methods are described in Section 4.2. For the OSSs, the GBS foundations includes a multi-leg option as shown in Figure 4.4-1.

For small OSSs, the PDE for each foundation type is identical to the PDE for the WTG foundations provided in Table 4.2-1. The PDE of foundation dimensions for the medium and large OSSs is defined in Table 4.4-2.



ATLANTIC SHORES offshore wind

Figure 4.4-1
Multi-Leg Gravity-Base Structure (GBS) Foundation

Table 4.4-2 PDE of OSS Foundation Dimensions and Seabed Disturbance

Foundation Concept	Medium OSS			Large OSS		
	Piled Jacket	Suction Bucket Jacket	GBS	Piled Jacket	Suction Bucket Jacket	GBS
Foundation Structure						
Max. # of foundations	4	4	4	3	3	3
Max. pile, suction bucket, or gravity-base diameter at seabed	Pile diameter: 16.4 ft (5.0 m) Including piling template: 49.2 ft (15.0 m)	49.2 ft (15.0 m)	262.5 x 65.6 ft (80.0 m x 20.0 m)	Pile diameter: 16.4 ft (5.0 m) Including piling template: 65.6 ft (20.0 m)	49.2 ft (15.0 m)	393.7 ft x 98.4 ft (120.0 x 30.0 m)
Max. # of legs/discrete contact points with seabed	6 legs (up to two pin piles per leg)	6	2	8 legs (up to 3 pin piles per leg)	8	2
Max. depth of penetration below seabed	229.7 ft (70.0 m)	82.0 ft (25.0 m)	9.8 ft (3.0 m)	229.7 ft (70.0 m)	82.0 ft (25.0 m)	9.8 ft (3.0 m)
Max. jacket pile/bucket length	295.3 ft (90.0 m)	98.4 ft (30.0 m)	N/A	295.3 ft (90.0 m)	98.4 ft (30.0 m)	N/A
Max. distance between adjacent legs at seabed	196.9 ft (60.0 m)	196.9 ft (60.0 m)	180.4 ft (55.0 m)	164.0 ft (50.0 m)	164.0 ft (50.0 m)	229.7 ft (70.0 m)
Max. foundation size/leg spacing at MSL	393.7 ft x 196.9 ft (120.0 m x 60.0 m)	393.7 ft x 196.9 ft (120.0 m x 60.0 m)	262.5 ft x 246.1 ft (80.0 m x 75.0 m)	492.1 ft x 328.1 ft (150.0 x 100.0 m)	492.1 ft x 328.1 ft (150.0 m x 100.0 m)	393.7 ft x 328.1 ft (120.0 m x 100.0 m)
Max. total foundation footprint contacting seabed per foundation[a]	11,413.0 ft^2 (1,060.3 m^2)	11,413.0 ft^2 (1,060.3 m^2)	34,444.5 ft^2 (3,200.0 m^2)	27,052.9 ft^2 (2,513.3 m^2)	15,216.9 ft^2 (1,413.7 m^2)	77,500.2 ft^2 (7,200.0 m^2)
Seabed Disturbance						
Permanent Seabed Disturbance						
Max. representative[b] outer diameter/size of scour protection	131.2 ft (40.0 m) per leg	196.9 ft (60.0 m) per leg	393.7 ft x 377.3 ft (120.0 m x 115.0 m) per foundation	147.6 ft (45.0 m) per leg	695.5 ft x 203.4 ft (212.0 m x 62.0 m) per row of four legs	524.9 ft x 459.3 ft (160.0 m x 140.0 m) per foundation
Max. thickness of scour protection	6.6 ft (2.0 m)	6.6 ft (2.0 m)	5 ft (1.5 m)	6.6 ft (2.0 m)	6.6 ft (2.0 m)	5 ft (1.5 m)
Est. volume of scour protection per foundation	380,427.2 ft^3 (10,772.5 m^3)	885,903.7 ft^3 (25,086.0 m^3)	731,013.6 ft^3 (20,700.0 m^3)	666,998.7 ft^3 (18,887.3 m^3)	1,485,370.2 ft^3 (42,061.0 m^3)	1,186,572.8 ft^3 (33,600.0 m^3)
Max. total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only])	81,157.9 ft^2 (7,539.8 m^2)	182,605.3 ft^2 (16,964.6 m^2)	148,541.8 ft^2 (13,800.0 m^2)	136,953.9 ft^2 (12,723.5 m^2)	282,961.4 ft^2 (26,288.0 m^2)	241,111.4 ft^2 (22,400.0 m^2)
Seabed Disturbance						
Temporary Seabed Disturbance During Construction						
Max. dimensions of seabed preparation per foundation	524.9 ft x 328.1 ft (160.0 m x 100.0 m)	590.6 ft x 393.7 ft (180.0 m x 120.0 m)	442.9 ft x 393.7 ft (135.0 m x 120.0 m)	639.8 ft x 475.7 ft (195.0 m x 145.0 m)	695.5 ft x 531.5 ft (212.0 m x 162.0 m)	557.7 ft x 524.9 ft (170.0 m x 160.0 m)
Max. depth of seabed preparation[c]	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)	19.7 ft (6.0 m)
Max. area of seabed preparation per foundation	172,222.6 ft^2 (16,000.0 m^2)	232,500.5 ft^2 (21,600.0 m^2)	174,375.4 ft^2 (16,200.0 m^2)	304,349.6 ft^2 (28,275.0 m^2)	369,675.7 ft^2 (34,344.0 m^2)	292,778.4 ft^2 (27,200.0 m^2)
Avg. volume of seabed preparation per foundation[d]	565,034.7 ft^3 (16,000.0 m^3)	762,796.8 ft^3 (21,600.0 m^3)	572,097.6 ft^3 (16,200.0 m^3)	998,522.2 ft^3 (28,275.0 m^3)	1,212,846.9 ft^3 (34,344.0 m^3)	960,558.9 ft^3 (27,200.0 m^3)
Max. area of disturbance due to jack-up or anchored vessels per foundation[e]	47,361.2 ft^2 (4,400 m^2)	47,361.2 ft^2 (4,400 m^2)	0.0 ft^2 (0.0 m^2)	47,361.2 ft^2 (4,400 m^2)	47,361.2 ft^2 (4,400 m^2)	0.0 ft^2 (0.0 m^2)
Max. total temporary seabed disturbance beyond permanent footprint per foundation	138,425.7 ft^2 (12,860.2 m^2)	97,256.1 ft^2 (9,035.4 m^2)	25,833.4 ft^2 (2,400.0 m^2)	214,756.5 ft^2 (19,951.5 m^2)	134,075.1 ft^2 (12,456.0 m^2)	51,666.7 ft^2 (4,800.0 m^2)
Total Temporary and Permanent Seabed Disturbance During Construction						

Foundation Concept	Medium OSS			Large OSS		
	Piled Jacket	Suction Bucket Jacket	GBS	Piled Jacket	Suction Bucket Jacket	GBS
Max. total area of seabed disturbance per foundation	219,583.6 ft² (20,400.0 m²)	279,861.4 ft² (26,000.0 m²)	174,375.2 ft² (16,200.0 m²)	351,710.4 ft² (32,675.0 m²)	417,036.5 ft² (38,744.0 m²)	292,778.1 ft² (27,200.0 m²)
Installation Timeframe						
Approx. max. duration to drive one pile	3-4 hours	N/A	N/A	3-4 hours	N/A	N/A
Max. # of piles driven per day	4	N/A	N/A	4	N/A	N/A

Notes:

a) The footprint of any mud mats (if used) is included in the "Max. total permanent footprint" rather than the "Total foundation footprint contacting seabed."

b) Scour protection may occur in any shape and size up to the maximum footprint provided above, including the possibility of no scour protection.

c) In the worst-case situation, in a limited number of foundation positions, up to 19.7 ft (6 m) of seabed leveling could be required. Piled and suction bucket foundations are not expected to require seabed preparation unless the seabed is not sufficiently level.

d) The maximum total volume of seabed preparation for the OSS foundations will not exceed the average volume for an individual foundation multiplied by the maximum number of foundations.

e) OSS foundation installation using jack-up vessels is expected to involve one main installation jack-up vessel with a maximum disturbance of 10,763.9 ft² (1000.0 m²) (four legs, each disturbing 2,691.0 ft² [250.0 m²]) and one feeder-jack-up vessel with a maximum disturbance of 4,869.5 m² (452.4 m²) (four legs, each disturbing 1,217.4 ft² [113.1 m²]) at each position. If an anchored HLV is used, foundation installation is expected to involve one anchored HLV with a maximum disturbance of 47,361.2 ft² (4,400 m²) (four anchors, each with a disturbance of 1,076.4 ft² [100.0 m²] for the anchor itself plus 10,763.9 ft² [1,000.0 m²] for the mooring system) at each position. Any feeder barge(s) would moor to the HLV and cause no additional disturbance. The scenario resulting in the greatest seafloor disturbance for each OSS type is assumed in the table above. Additional emergency anchoring or jacking-up may be required.

4.4.2 Topside Design, Installation, and Commissioning

Power generated by the WTGs will be transmitted to the OSSs via 66 to 150 kV inter-array cables, which will connect to switchgear, transformers, and converter equipment (if HVDC) located within the OSS topsides. These transformers will increase the voltage level to the export cable voltage (230 to 525 kV). From the OSSs, the export cables will transmit electricity to shore. Additional information about the offshore cables is included in Section 4.5.

The PDE of OSS topside parameters is provided in Table 4.4-3.

Table 4.4-3 PDE of OSS Topside Dimensions

Topside Parameter	Small OSS	Medium OSS	Large OSS
Max. # of OSSs	8	4	3
Max. Width	114.8 ft (35.0 m)	147.6 ft (45.0 m)	164.0 ft (50.0 m)
Max. Length	131.2 ft (40.0 m)	213.3 ft (65.0 m)	295.3 ft (90.0 m)
Max. Height above Foundation Interface	98.4 ft (30.0 m)	114.8 ft (35.0 m)	131.2 ft (40.0 m)
Max. Height of Topside above MLLW	174.8 ft (53.3 m)	191.2 ft (58.3 m)	207.6 ft (63.3 m)

Notes: MLLW = Mean Lower Low Water

The OSSs will be designed according to site-specific conditions, including winter storms, hurricanes, and tropical storms, based on industry standards such as ACP, IEC, API, and ISO standards.
Although the precise electrical equipment contained in the OSS topsides will be determined as the engineering design advances, each OSS will contain power transformers, which will vary in size depending on the type of OSS (HVAC or HVAC/HVDC) and electrical capacity. The OSS topsides are also expected to include the following:

- switchgear
- transformers
- control and communications equipment
- shunt reactors
- fire detection and firefighting equipment (e.g., inert gas and/or water/foam systems)
- cranes
- safety equipment (e.g., life rafts or boats, lifejackets)
- freshwater storage
- clean water wash system
- UPS system and associated batteries
- backup diesel generator

- diesel fuel storage
- utility pumps for systems such as freshwater, diesel fuel, and cooling.
- oil containment.

Seawater may be used in a once-through (open loop) system to provide cooling to an offshore HVDC OSS. This only applies to HVDC offshore substations. HVAC OSSs will be air cooled per industry standard. Seawater intake for HVDC equipment cooling would typically be supplied by one or more seawater pumps submerged below sea level in pump caissons attached to the offshore substation foundation structure (either electric submersible pumps or shaft-driven pumps). Seawater entering the bottom of the pump caisson would pass through an appropriately sized inlet port and screen to prevent impingement (through-screen intake water superficial velocity less than 0.5 ft/s). This seawater would be pumped to the offshore substation topsides where it would typically pass through a coarse seawater strainer (to protect the downstream heat exchangers from particles and debris) then typically it would be treated with hypochlorite for the prevention of biofouling in the close-tolerance heat exchange equipment downstream. This treatment can be achieved either by dosing the seawater with a concentrated sodium hypochlorite liquid or by using a seawater electrolyzer to generate hypochlorite in-situ by passing an electric current through a small portion of the seawater flow (in a controlled electrolyzer cell) then blending this with the seawater inlet seawater. A concentration of 50 to 200 parts per million (ppm) hypochlorite is expected based on typical industry practice.

This treated seawater would then pass through one or more heat exchangers where this seawater would remove heat from the closed-loop circulation system (typically consisting of deionized water), thus cooling the closed circulation system water so that it can in turn recycle to cool the offshore substation's electrical equipment. This seawater, after picking up the rejected heat from the topside equipment, would then be discharged to the water column via one or more dedicated caissons attached to the offshore substation foundation structure, with discharge ports numbered, spaced, and sized appropriately to meet dispersion or other regulatory requirements. Volume II, Appendix II-W provides effluent discharge modeling and hydraulic zone of influence intake calculations. Additionally, an evaluation of potential impingement / entrainment of fish and ikthyoplankton associated with the seawater intake is currently underway with results and analysis to be provided upon completion.

Lightning masts or air terminals will be installed on OSS topsides to protect electrical equipment and personnel. Heating, ventilation, and air conditioning systems will be installed in the OSS to regulate equipment temperatures.

During construction and operation, the OSSs will be lighted and marked in accordance with FAA, USCG, and BOEM guidelines to aid safe navigation within the Lease Area. Lighting and marking of the OSSs during the operations period are discussed in Section 5.3. Atlantic Shores does not currently anticipate installing helicopter pads on the OSSs, though this feature may be added depending on the O&M strategy employed (see Section 5.6). If a helicopter pad is included, it will be designed to support a USCG helicopter and appropriate lighting, and marking will be included as required.

The OSS topsides are expected to be fabricated outside of the U.S. and transported directly to the Lease Area on the installation vessel, a HTV, or ocean-going barge. Although unlikely, if an OSS is staged at a U.S. port prior to installation, shore-based equipment such as crawler cranes and SPMTs would unload the OSS topside and transport it to port storage. Then, the OSS topside would be loaded onto a vessel to be transported to the Lease Area for installation. Once at the Lease Area, the OSS topsides are expected to be lifted from the transport vessel onto the OSS foundation using a crane on a jack-up vessel or HLV using either DP or anchors (see Figure 4.4-2).

Alternatively, the OSS topsides may be pulled by tugboats and floated to the Lease Area, after which the topsides would be ballasted down over an installed OSS foundation or jack-up legs integrated into the topside would lower to the seabed and raise the topside to its target elevation.

After the OSS topside is secured to its foundation, the OSS will be commissioned. During commissioning, the electrical and safety systems on the OSS will be tested and the OSS will be energized. A jack-up vessel or floating vessel may be used to provide accommodations for the personnel commissioning the OSSs. Any seabed disturbance from vessels used during installation and commissioning of the OSS topsides will occur within surveyed areas of the Lease Area. The PDE of seabed disturbance for OSS topside installation and commissioning is described in Table 4.4-4.

Lifting of Offshore Substation Topside Using Vessel Crane

Figure 4.4-2
Offshore Substation Installation

Table 4.4-4 Maximum Seabed Disturbance from OSS Topside Installation and Commissioning

Installation Activity	PDE
Max. area of seafloor disturbance for OSS topside installation	47,361.2 ft^2 (4,400.0 m^2) per OSS (assumes one HLV with four anchors, each with a disturbance of 11,840.3 ft^2 [1,100.0 m^2] for the anchor and mooring system)[a]
Max. area of seafloor disturbance for OSS commissioning	10,763.9 ft^2 (1,000.0 m^2) per OSS (assumes one jack-up vessel with four legs, each with a disturbance of 2,691.0 ft^2 [250.0 m^2])
Max. Total Seabed Disturbance from Anchors/Jack-Up Vessels During OSS Topside Installation and Commissioning	**58,125.1 ft^2 (5,400.0 m^2) per OSS**

Note:

a) Alternatively, the topsides could be installed by a HLV operating on DP (i.e., with no seafloor disturbance) or a jack-up vessel with a maximum seafloor disturbance of 10,763.9 ft^2 (1,000.0 m^2).

4.4.3 Seabed Preparation and Scour Protection

As with WTG foundations, OSS foundations (particularly gravity foundations), may require seabed preparation (i.e., removing the uppermost sediment layer beneath the foundation). Gravity foundations are also expected to require gravity pads. Methods to complete seabed preparation are described in Section 4.2.4. The maximum dimensions of seabed preparation that could be required for each OSS foundation type is provided in Table 4.4-2.

Scour protection may be installed at the base of each OSS foundation to protect it from sediment transport/erosion caused by water currents. The different types of scour protection that could be placed around OSS foundations are the same as for WTG foundations and are described in Section 4.2.5. Dimensions of OSS foundation scour protection is included in Table 4.4-2.

4.5 Offshore Cables

The Project will include offshore export, inter-array, and possibly inter-link cables (the "offshore cables"). The export cables will deliver electricity from the Project OSSs to the landfall sites. Up to a total of 5 export cables will be installed per ECC to deliver electricity from the OSSs to the landfall sites. The Project also includes inter-array cables to connect strings of WTGs to an OSS and may include inter-link cables to connect OSSs to each other.

4.5.1 Offshore Cable Design

4.5.1.1 Export Cables

The Monmouth ECC will have the capacity to contain up to five export cables including up to four HVAC export cables and one HVDC export cable, or up to four HVDC cables. The Monmouth ECC for Atlantic Shores North is inclusive of the five export cables included as the Monmouth ECC for Atlantic Shores South OCS-A 0499. The Northern ECC, from the interconnection with the Lease Area to the

Asbury Branch will have the capacity to contain up to five export cables in one of three configurations: (1) four HVAC export cables and one HVDC export cable; (2) three HVAC export cables and two HVDC export cable; or (3) four HVDC export cables. The Asbury Branch of the Northern ECC will have the capacity to contain four HVAC export cables or two HVDC export cables. North of the Asbury Branch of the Northern ECC to its terminus in New York, the Northern ECC will have the capacity to contain up to two HVDC export cables. If HVAC cables are used, the voltage will be between 230 and 275 kV; if HVDC cables are used, a higher voltage between 320 and 525 kV will be used.

HVAC cables are expected to contain three stranded-core conductors made of aluminum or copper that are encapsulated in a cross-linked polyethylene (XLPE) insulation system, a metallic screen, and a core jacket. The three power cores are bundled together and protected by an armor layer. All cables will contain or be bundled with fiber optic cables for communication, protection and monitoring purposes. See Figure 4.5-1 for a schematic of a typical HVAC export cable. The HVAC export cables will have a maximum outer diameter of approximately 12.6 inches (in) (320 millimeters [mm]).

HVDC cables are expected to have single-core stranded conductors made of aluminum or copper each encapsulated in either an XLPE (cross-linked polyethylene) or mass impregnated insulation system, a metallic screen, a core jacket, and protected by an armor layer (see Figure 4.5-2). Each HVDC cable bundle is composed of two or three HVDC cables bundled with external fiber optic cables and possibly a metallic return cable and installed simultaneously within the same trench. The HVDC export cable bundle will have a maximum width of approximately 14.2 in (360 mm).

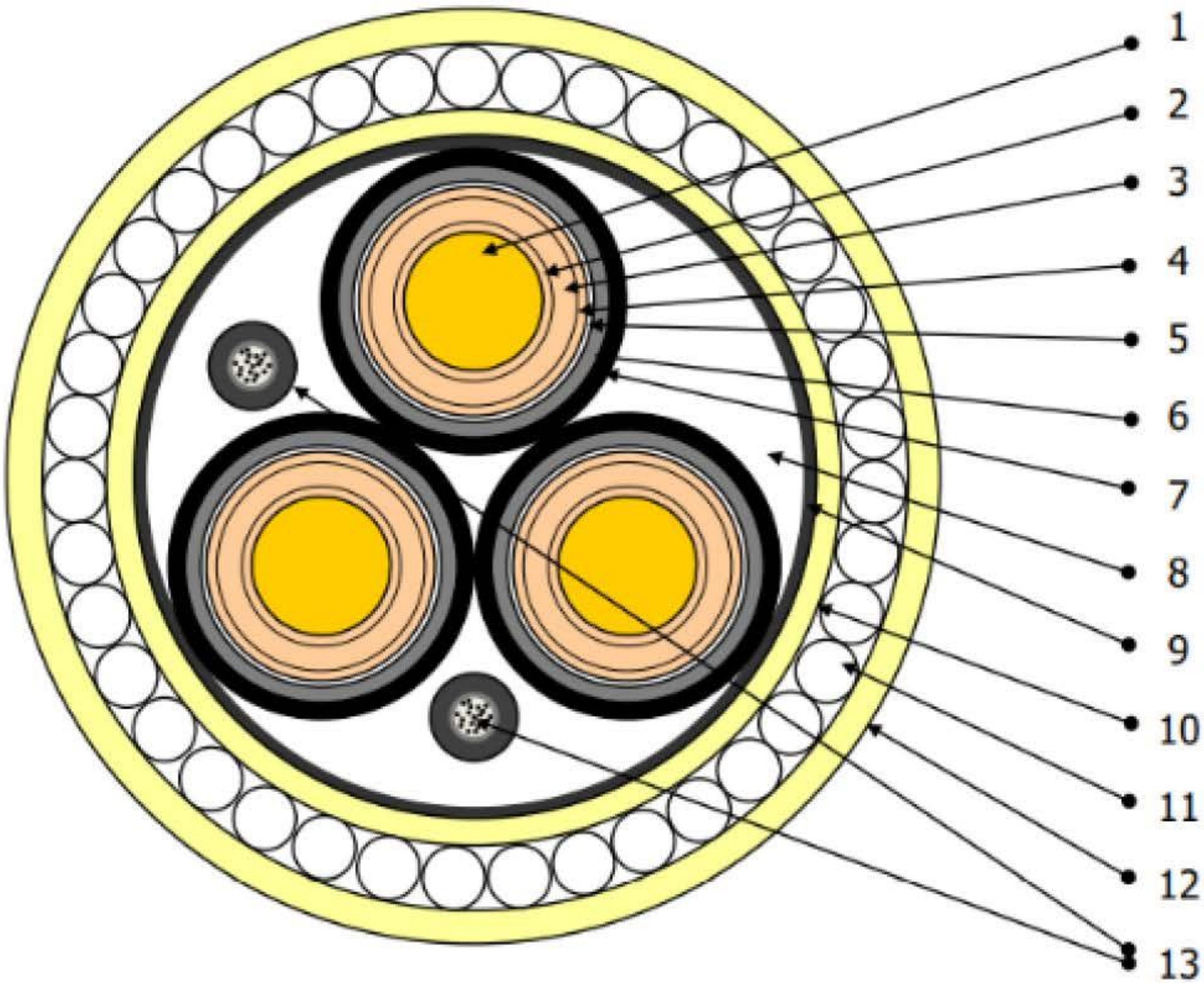
The export cable design will include a monitoring system, such as a distributed temperature system (DTS), distributed acoustic sensing (DAS) system, or online partial discharge (OLPD) monitoring, to continuously assess the status of offshore cables and detect anomalous conditions, insufficient or excess cable depth, or potential cable damage (see Section 5.1 for additional details). The target burial depth of the export cables will be 5 to 6.6 ft (1.5 to 2 m). Section 4.5.4 contains a description of offshore cable installation techniques. The total maximum seafloor impacts for the Project are presented in Section 4.5.10.

4.5.1.2 Inter-Array and Inter-Link Cables

HVAC inter-array cables will have a voltage between 66 and 150 kV and a maximum outer diameter of 8.5 in (215 mm). The HVAC inter-link cables, if used, will have a voltage between 66 and 275 kV and a maximum outer diameter of 12.6 in (320 mm).

Each inter-array and inter-link cable is expected to have three stranded-core conductors made of aluminum or copper, each encapsulated in an XLPE insulation system, a metallic screen, and a core jacket (see Figure 4.5-3). The three power cores are bundled together and protected by an armor layer. All cables will contain optical fibers embedded between the cores for communication and monitoring purposes. The cable design will limit water propagation along the cable core in case of cable damage. The inter-array and inter-link cables may include monitoring systems such as DAS, DTS, or OLPD.

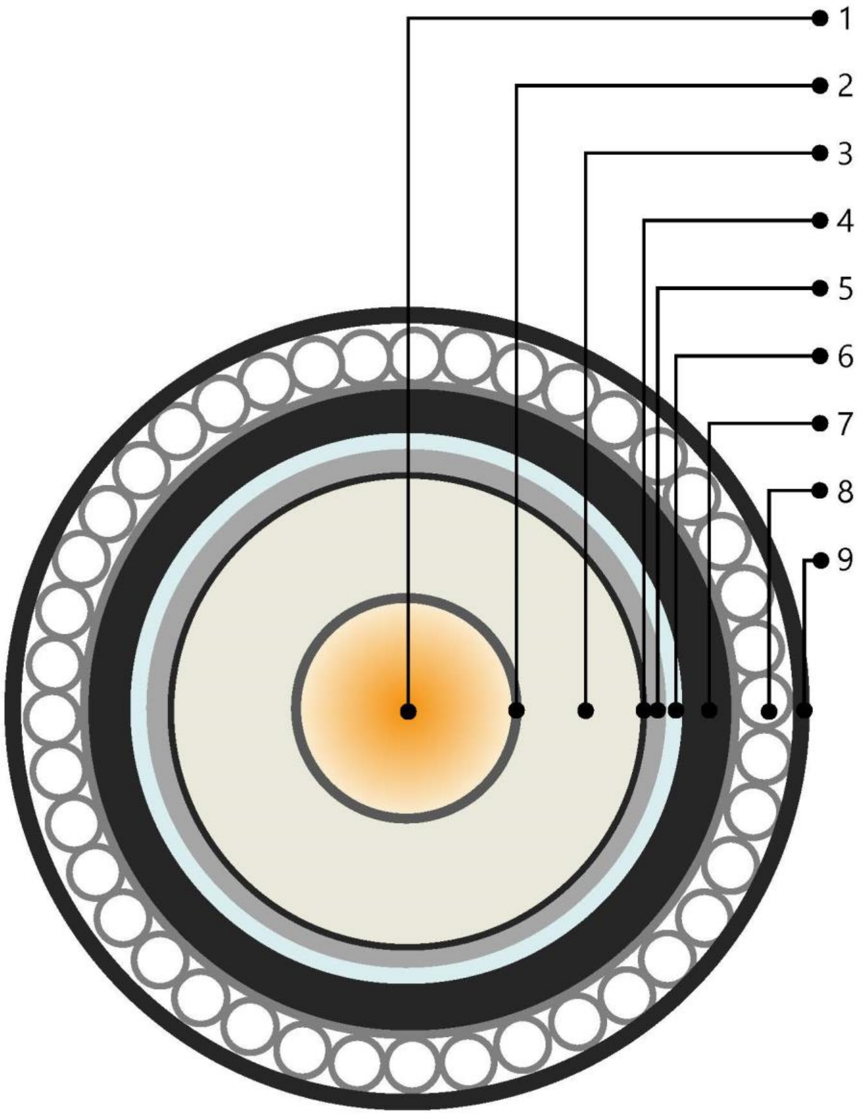
The target burial depth of the inter-array and inter-link cables will be 5 to 6.6 ft (1.5 to 2 m). Section 4.5.4 contains a description of offshore cable installation techniques. The total maximum seafloor impacts for the Project are presented in Section 4.5.10.



Label	Description
1	Conductor
2	Conductor screen
3	Insulation
4	Insulation screen
5	Water blocking layer
6	Metallic sheath
7	Anti-corrosion sheath
8	Filler
9	Binder tape
10	Armor bedding
11	Wire armor
12	Serving
13	Fiber Optic Cables

Figure 4.5-1
High Voltage Alternating Current (HVAC) Export Cable Schematic

Individual HVDC Cable



Label	Description	Material
1	Conductor	Copper or Aluminum
2	Conductor screen	Extruded semi conductive compound
3	Insulation	XLPE and/or mass impregnated paper
4	Insulation screen	Extruded semi conductive compound
5	Metallic sheath	Lead alloy / Semi conducting swelling tape to prevent longitudinal water penetration
6	Core sheath	Semi conducting polyethylene
7	Armor bedding	Non-conductive tapes
8	Armor	Galvanized steel wires
9	Outer serving	Polypropylene yarns

Bundled HVDC Cables

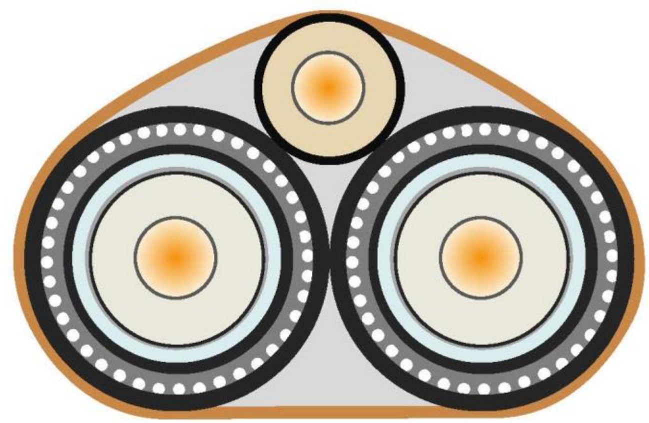
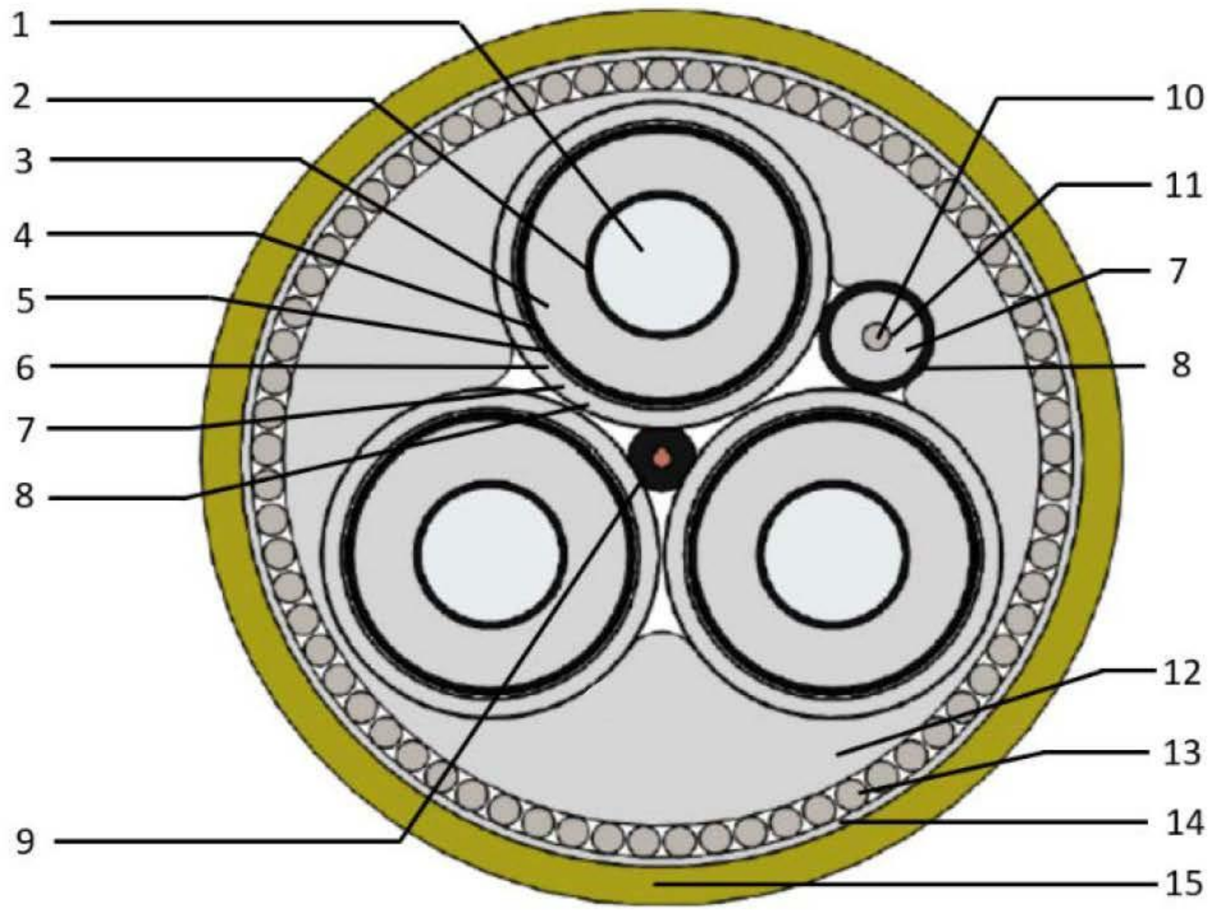


Figure 4.5-2
High Voltage Direct Current (HVDC) Export Cable Schematic



Label	Description
1	Conductor
2	Conductor screen
3	XLPE insulation
4	Insulation screen
5	Water blocking tape
6	Aluminum tube
7	HDPE Sheath
8	Semi-conducting skin
9	Drain wire & semi-conducting sheath
10	Optical fibers in gel
11	Stainless steel tube
12	Filling
13	Steel wire armor
14	Binding tape
15	PE outer sheath

Figure 4.5-3

Inter-Array and Inter-Link Cable Schematic

4.5.2 Offshore Cable Routes

4.5.2.1 Export Cable Corridors

The export cables will be installed within the Monmouth and Northern ECCs (see Figure 4.5-4 and 4.5-5, respectively). The Monmouth ECC originates at Lease Area OCS-A 0499 and extends to the north along the eastern border of Lease Area OCS-A 0549. The Northern ECC originates to the east of the Monmouth ECC at the southeast corner of Lease Area OCS-A 0549. Both ECCs extend in a general north / northwest direction to the point where the Monmouth ECC turns to the west and extends to the Monmouth Landfall. The Northern ECC continues to the north toward New York. The Asbury Branch of the Northern ECC extends west to the New Jersey coast at the Asbury Landfall. The Northern ECC continues to the north into New York State waters to the coast at the potential Lemon Creek, Wolfe's Pond, and Fort Hamilton Landfalls. The width of each ECC corresponds to the width of the marine survey corridors and ranges up to 3,300 feet (1 km) for all of the Monmouth ECC and the Northern ECC to the point where it enters New York State waters. The Northern ECC then narrows as it extends toward the potential New York landfalls. Table 4.5-1 provides additional information on each of the Project ECCs including associated lengths and seabed effects.

The width of each ECC is needed to accommodate the export cables as well as the associated cable installation vessel activities and also allows for avoidance of resources such as shipwrecks and sensitive habitats (see Section 3.3). Variations in width at the landfall sites are needed to accommodate the construction vessel activities necessary to support the landfall of each export cable via horizontal directional drilling (HDD).

The export cables installed within each ECC will typically be separated by approximately 492 ft (150 m), though this separation distance may range from approximately 328 to 820 ft (100 to 250 m), depending on route constraints and water depths. Additionally, the minimum spacing may be further decreased as required in site-specific locations (e.g., cable crossings, shallow waters, at the HDD exit). This typical separation distance, which provides flexibility for routing and installation as well as for future potential cable repairs, may be modified if required based on ongoing evaluation of site conditions.

The Northern ECC is located to the east of both the Lease Area and the Monmouth ECC. To enable the export cables from the Lease Area to reach the Northern ECC, they will need to cross the Monmouth ECC. A conceptual example of this export cable crossing schematic is shown in Figure 4.5-12. Atlantic Shores is currently evaluating the potential crossing locations, methods and cable protection measures that will be implemented to facilitate the cable crossing. This additional information will be provided within a future COP Supplement.

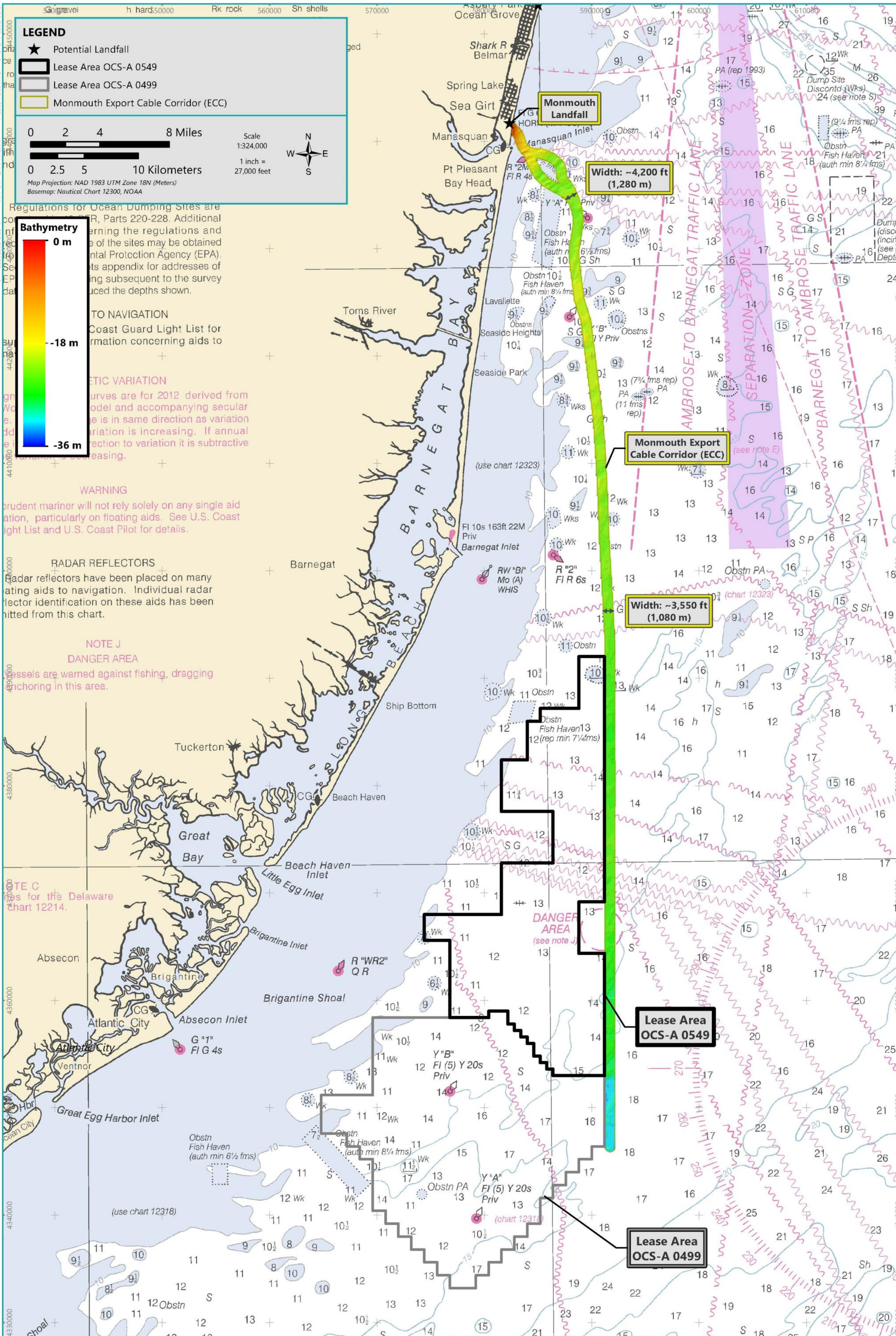
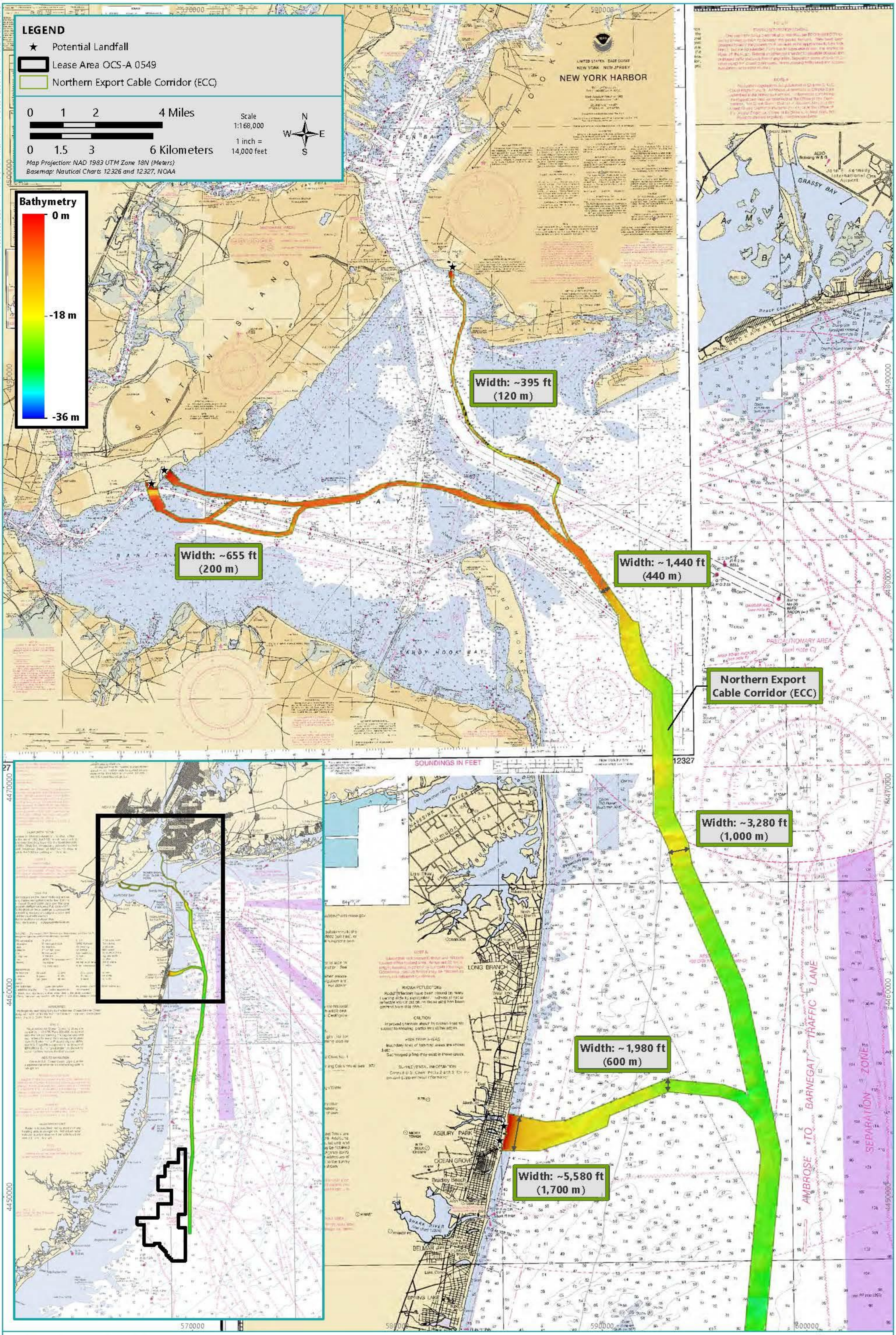


Figure 4.5-4
Monmouth Export Cable Corridor (ECC)



ATLANTIC SHORES offshore wind

Figure 4.5-5
Northern Export Cable Corridor (ECC)

4.5.2.2 Inter-Array and Inter-Link Cable Routes

The electrically distinct inter-array cables and inter-link cables (if used) will be installed within surveyed corridors in the Lease Area where full archaeological and geological assessments will have been completed. Atlantic Shores will engineer potential inter-array and inter-link cable layouts based on the results of surveys conducted in 2022. Atlantic Shores anticipates that up to 466 mi (750 km) of inter-array cables and up to approximately 62 mi (100 km) of inter-link cables may be needed. Depending upon the detailed electrical engineering outputs, a distributed temperature system may be installed within the inter-link and inter-array cables. A representative inter-array cable layout is provided in Figure 4.5-6.

4.5.3 Pre-Installation Activities

Activities that may be conducted prior to cable installation include sand bedform clearing, relocation of boulders, a pre-lay grapnel run, and a pre-lay survey. Descriptions of these potential cable pre-installation activities are provided in the following sections.

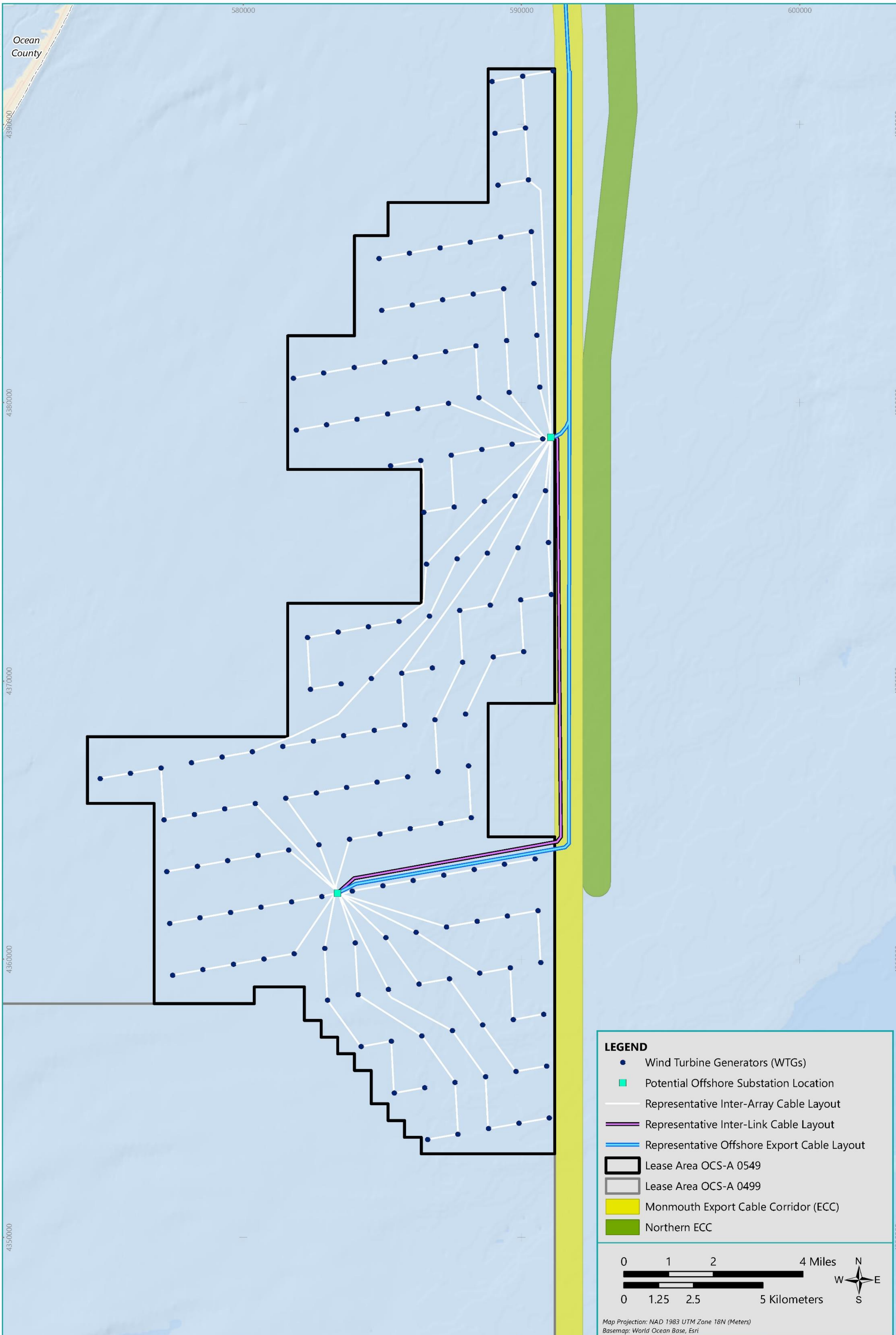
4.5.3.1 Boulder Relocation

Boulder relocation may be required prior to cable installation in limited areas along the final export cable alignments within the ECCs. If required, this will likely be executed by subsea grab, since the presence of boulders is expected to be minimal, and this method minimizes seabed impact (impact will be limited to a boulder's original footprint and its final, relocated footprint). Previous experience of boulder sizes that would be required to be relocated range from 0.3m – 4.0m approximate diameter.

If more boulders than expected are encountered, a displacement plow could be used for clearing the area. This plow is anticipated to clear an approximately 33-ft-wide (10-m-wide) corridor for up to 10% of each export cable. A displacement plow has a simple and robust Y-shaped design configured with a boulder board attached. This plow, which is towed along the seabed by a vessel, displaces boulders along a clearance path as it passes along the seabed surface. The plow will normally be ballasted to only clear boulders (to a depth of up 31 inches [800 mm]) to avoid creating a significant depression in the seabed. The maximum area of seabed disturbance from boulder relocation is provided in Section 4.5.10.

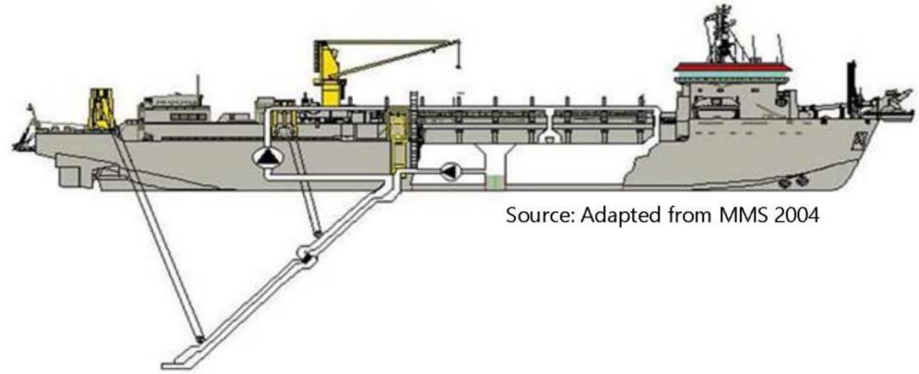
4.5.3.2 Sand Bedform Removal

The expected presence of mobile sand bedforms (i.e., ripples, megaripples, and sand waves) within the ECCs and Lease Area may necessitate the removal of the tops of some sand bedforms prior to offshore cable installation to ensure the cables can be installed within stable seabed. Sand bedform removal will be limited only to the extent required to achieve adequate cable burial depth. Atlantic Shores anticipates that up to 10% of the export cable routes, 10% of the inter-array cable routes, and 10% of the inter-link cable routes may require sand bedform removal. The maximum dredge areas and volumes are provided in Section 4.5.10.



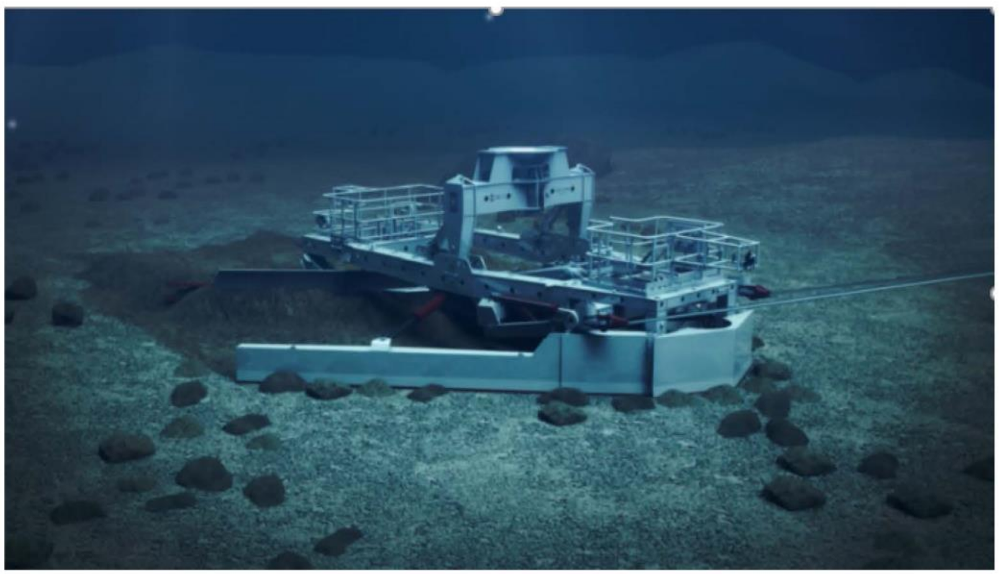
ATLANTIC SHORES offshore wind

Figure 4.5-6
Representative Inter-Array and Inter-Link Cable Layout



Source: Adapted from MMS 2004

Trailing Suction Hopper Dredge



Route Clearance Plow

Controlled Flow Excavation

Figure 4.5-7
Sand Bedform Removal Methodologies

Sand bedform removal is expected to be completed with one or more of the following typical methodologies (see Figure 4.5-7):

- **Trailing suction hopper dredge (TSHD):** In this dredging method, one or two suction pipes, each equipped with a trailing drag head, descend from the side of the dredging vessel to the seabed. Each drag head is fitted with nozzles that direct high-pressure water at the seabed to loosen seabed material. Due to lower pressure in the pipe, the loosened material is sucked up and discharged into the vessel's hopper. Once collected, dredged materials can be discharged via the bottom doors of the vessel or a pipe that releases dredged material lower in the water column. The collected material will be disposed of within surveyed areas exhibiting sand bedforms, avoiding hard-bottom areas and allowing the volume to be winnowed away by normal currents and tidal actions. Some portion of the dredged sand may also be used for ballast in GBS foundations if those foundations are selected for the Project. Alternatively, if required, the removed material could be transported a short distance to an agreed-upon disposal site outside the Lease Area.
- **Controlled flow excavation:** Controlled flow excavators are equipped with rotating propellers capable of producing high-volume water columns which, when directed at the seabed, rapidly excavate sediments. The tool can be gyroscopically stabilized and deployed either from a crane or A-frame on the cable installation vessel. Controlled flow excavation may also be used for repairs or removal of cables in soft soils such as silt or loose/medium sand.
- **Route clearance plow:** A route clearance plow pushes sand aside, clearing the way for cable installation. Similar to the use of controlled flow excavation, use of a route clearance plow does not involve collecting sand from the seabed; rather, removed sand is cast aside adjacent to the cable alignments.

In addition to these typical methodologies, two additional specialty methods may be used in limited areas:

- **Cutterhead dredging:** This type of dredging is similar to TSHD but is used in hard or rocky seabed conditions. The method employs a cutterhead, which is similar to a large drill, that breaks up the seabed and loosens it for suction dredging. Given the harder substrate, the rate of production is slower than with a TSHD. Cutterhead dredging is not expected within the Lease Area but could be required if rocky seabed is encountered along the ECCs.
- **Backhoe dredging:** This type of dredging is more likely to be used in shallow, nearshore areas where only a small amount of material may need to be removed. The backhoe dredging equipment operates in a similar manner as an onshore backhoe excavator but is mounted on a small barge either with or without stabilizing spud legs. Underwater works are typically monitored using either multibeam or blue-view cameras attached to the vessel. Material extracted in the backhoe may be sidecast or it could be deposited in either a hopper on the barge or on a separate hopper vessel before proper disposal.

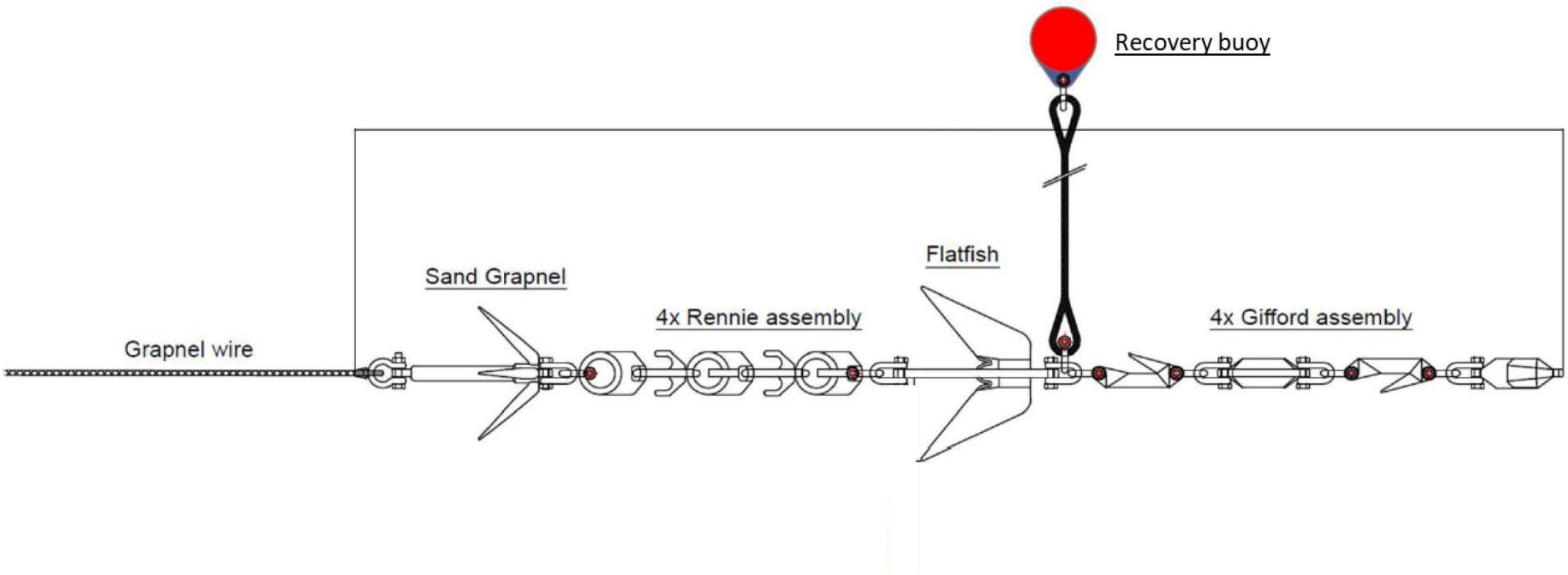


Figure 4.5-8
Representative Pre-Lay Grapnel Train Schematic

4.5.3.3 Pre-lay Grapnel Run

Approximately two months prior to cable installation, Atlantic Shores will perform a pre-lay grapnel run to clear the final cable alignments of human-made obstructions/debris such as discarded fishing wires, nets, or ropes. To complete the pre-lay grapnel run, a vessel will tow an approximately 3.3 ft-wide (1 m-wide) grapnel train consisting of a series of hooks designed to snag debris (see Figure 4.5-8). Measuring tension on the grapnel train towing rope will indicate whether debris is caught on the hooks. Atlantic Shores expects to make three passes with the grapnel train along each cable alignment. The first pass will likely be placed on the centerline of the cable alignment and the remaining two passes will occur parallel to and slightly offset from the centerline (within approximately 25 ft [7.5 m] to each side). The pre-lay grapnel runs will impact the seafloor to a maximum depth of 1.6 ft (0.5 m), subject to prevailing sediment conditions. During the prelay grapnel run, debris encountered would be recovered to deck, taken ashore and recycled and or disposed of according to the material classification. Should a MEC be encountered, it will be handled in accordance with the Project specific SMS (Appendix I-E). The total area of seabed disturbance from the pre-lay grapnel runs is provided in Section 4.5.10.

4.5.3.4 Pre-lay Surveys

Atlantic Shores will perform pre-lay surveys along the final planned cable alignments shortly before cable installation to confirm seabed morphology and bathymetry before the start of cable-laying operations and to detect any objects that may affect the future infrastructure. These surveys will consist of multibeam echo-sounder surveys in a corridor at least 65 ft (20 m) wide centered on the cable alignments, with the total width of the survey encompassing the entire area of seabed to be disturbed by cable installation activities.

4.5.4 Cable Installation

The export cables, the inter-array cables, and any inter-link cables will be transported to the Lease Area or ECCs via one of two methods: direct or marshalled. Since the cables will likely be manufactured outside the U.S., the direct method of delivery is expected to involve a cable installation vessel being loaded at the factory or port and sailing to the Offshore Project Area to complete the cable installation. In this scenario, it is possible that the same vessel will sail back to its origin, obtain the next load of cable, and return to the Lease Area or ECC to complete the installation; alternatively, a second cable installation vessel could sail from the origin.

- The marshalled method would have a similar first step consisting of a cable installation vessel sailing from its origin to the Offshore Project Area to install the first batch of cable. Meanwhile, a subsequent batch of cable would be loaded onto a freighter that would sail to a U.S. port where the cable would be spooled onto a carousel located onshore and stored quayside. Alternatively, the cables can be transported on pre-wound drums that are unloaded and transported into quayside storage using heavy lift cranes or SPMTs. After the first batch of cable is installed, the installation vessel would load the remaining batches from the U.S. port and install them in the Offshore Project Area. Inter-array and inter-link cables are lighter and easier to handle than the export cables, making staging at a U.S. port prior to installation more likely.

Three common methods may be used to lay and bury the export cables, inter-array cables, and/or inter-link cables:

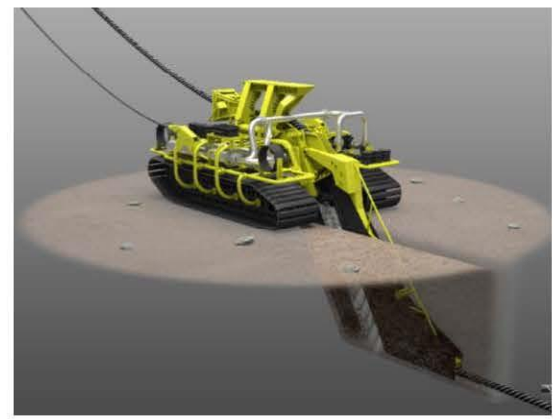
- **Simultaneous lay and burial:** This is a combined process where the cable will be directly guided from the cable installation vessel through the burial tool and laid into the seabed. This approach will provide immediate protection of the cable following installation but is slower than laying cable with other methods depending on the tool employed (see the description of each tool below for installation speeds). Atlantic Shores expects to use simultaneous lay and burial to install the export cables**.**
- **Post-lay burial:** This process involves temporarily laying the cable onto the seabed followed by a subsequent, separate burial operation. With post-lay burial, the cables lie unprotected on the seabed between the laying and post-lay burial campaigns. Post-lay burial is especially appropriate for inter-array cables where the cables are buried close to WTG or OSS foundations and are relatively short lengths. Cable-laying without simultaneous burial could proceed at a rate of 985 to 1,970 ft per hour (300 to 600 m per hour). Post-lay burial can proceed at a faster burial rate than simultaneous lay and burial (see the description of each tool below for installation speeds) and is appropriate for the sediment types in the Lease Area. In particular, post-lay burial is expected to be used for the inter-array and inter-link cables because it allows them to be buried to their target depth closer to the foundations and facilitates performing multiple passes with the burial tool (where needed), hence minimizing the need for cable protection. Post-lay burial also results in a shorter duration of burial, thus minimizing the duration of cable installation impacts. Post-lay burial is not proposed as a primary installation technique for the export cables due to the longer lengths of export cables compared to the inter-array cables that would remain exposed, which would temporarily preclude other marine uses from the ECCs.
- **Pre-lay trenching:** This process involves excavating a trench prior to cable installation. The trench must remain clear before the cable is laid into the trench. Once the cable is laid, the trench is backfilled with spoils from the previous excavation. For the offshore cables, this technique is only expected to be used in limited circumstances where deeper cable burial (greater than the target depth of 5 to 6.6 ft [1.5 to 2 m]) may be required or firmer ground (such as clays or dense sands) is encountered.

Atlantic Shores is carefully evaluating available cable installation tools to select techniques that are appropriate for the Project and that maximize the likelihood of achieving the target cable burial depth of 5 to 6.6 ft (1.5 to 2 m). The selection of equipment best suited for the task is an iterative process that involves reviewing seabed conditions, cable properties, laying and burying combinations, burial tool systems, and anticipated performance. As shown on Figure 4.5-9, the three primary cable installation tools proposed are:

Representative Cable Laying Vessels

Jet Plow

Jet Trencher



Mechanical Trencher

- **Jet trenching:** Water jetting systems can be used for simultaneous lay and burial or post-lay burial in soft soils such as silt or loose/medium sand. The tool's jetting legs contain numerous nozzles that produce water jets that create a fluidized channel of seabed sediment into which the cable sinks. The tool may be towed by the installation vessel, or it may be a "free-flying" ROV (i.e., neutrally buoyant and self-propelled on a tether). Jet trenching creates a trench approximately 1.3 to 3.3 ft (0.4 to 1.0 m) wide and operates at a burial rate of approximately 820 to 1,150 ft per hour (250 to 350 m per hour).
- **Plowing/jet plowing:** Typically used for simultaneous lay and burial, a plow's share cuts into the seabed, opening a trench to the required burial depth and holding it open with the side walls of the share. As the plow advances, the cable passes through the tool and falls into the open trench at the desired burial depth. Some plows are equipped with jetting nozzles in the share to increase performance. Plowing creates a trench approximately 1.6 ft (0.5 m) wide and operates at a burial rate of approximately 330 to 650 ft per hour (100 to 200 m per hour).
- **Mechanical trenching:** Mechanical cutting trenchers can be used for pre-lay trenching, simultaneous lay and bury, and post-lay burial operations in firmer ground such as clays or dense sands. This type of tool can be equipped with a jetting sword (using water jets) or excavation chain (with mechanical teeth) that cuts a narrow trench into the seabed. For simultaneous lay and bury operations, the cable passes through or over the tool, and as the trench is formed, a depressor directs the cable (within tolerances) into the trench. Mechanical cutting creates a trench approximately 2.1 ft (0.6 m) wide and operates at a burial rate of approximately 490 to 820 ft per hour (150 to 250 m per hour).

Cable installation is anticipated to create a trench with a typical depth of approximately 10 ft (3 m) and a maximum width of up to approximately 3.3 ft (1 m). The burial depth may be deeper in specific locations such as Federal channels that are dredged to ensure that the cables maintain a sufficient depth of cover. In addition to the direct trench impact, the installation tool's two skids or tracks (each approximately 6.6 ft [2 m] wide) could result in surficial seabed impacts. An anchored cable laying vessel may be used in shallow portions of the ECCs; no anchoring is expected in the Lease Area (see Section 4.5.10).

Most of the export, inter-array, and inter-link cables are expected to be installed using jet trenching (either simultaneous lay and burial or post-lay burial) or jet plowing, with limited areas of mechanical trenching. Atlantic Shores estimates that 80-90% of the offshore cables could be installed with a single pass of the cable installation tool. However, in limited areas expected to be more challenging for cable burial (along up to 10-20% of the export, inter-array, and inter-link cable routes), an additional one to three passes of the cable installation tool may be required to further lower the cable to its target burial depth.

Additionally, for the export cables, an additional pass of the cable installation tool prior to installing the cable (known as pre-pass jetting) may be performed along up to 5% of the cable alignments to loosen sediments and increase the probability of successful burial. Geophysical and geotechnical surveys performed in 2022 will confirm the most likely locations where pre-pass jetting may be performed for the offshore cables. Finally, for export cable installation in shallow water, a shallow-water barge with tensioners to tow a plow may be used for simultaneous lay-and-bury.

To install an inter-array cable, a cable-laying vessel will first pull the end of an inter-array cable into a WTG or OSS foundation, then lay the cable along the route to the next WTG, where the second cable end will be pulled into the WTG or OSS foundation. The vessel will repeat the process until all WTGs in a string are connected to a single OSS. If post-lay burial is used, a cable burial vessel will then progress along the laid strings of inter-array cables, burying them to target depth. If simultaneous lay and burial is used, the cables will be installed to the target depth in a single operation. If inter-link cables are included in the final design of the Project, the same process will apply to inter-link cables, except these cables will connect OSSs to one another rather than to strings of WTGs.

4.5.5 Export Cable Jointing

Given the length of the export cables, Atlantic Shores expects that they will be installed in one or more segments and that cable jointing offshore will be required. For either HVAC and/or HVDC export cables, joints will be installed approximately every 25 mi (40 km). Field joints may also be required at each end to facilitate the pull-in and tie-in processes.

After the installation of each export cable segment and prior to jointing, the end of the cable segment will be left on the seabed and held in temporary wet storage. In this case, temporary cable protection (e.g., concrete mattresses) may be placed over the cable end to avoid damage prior to splicing. To complete a joint, the end of a previously laid cable will be brought onboard a jointing vessel (this could be a cable-laying vessel, jack-up vessel, or other specialized vessel) and into a jointing room. The end of the next cable to be installed will also be brought into the jointing room. There, the two ends will be joined together in a process that can take multiple days. Since jointing is a delicate operation, and because it occurs with the end of one cable extending up from the seabed and onboard the vessel, the operation requires several consecutive days of favorable weather. After a joint is complete, the vessel lowers the joint to the seabed, either in an omega shape or aligned with the previously laid cable (i.e., an in-line joint), and the joint will be buried. If the joint is not too wide, it could be buried with a jet trencher; alternatively, controlled flow excavation could be used to cover the joint. If burial is not possible or practical due to sediment conditions, cable protection could be placed on top of the joint (see Section 4.5.7).

4.5.6 Cable Pull-In and Commissioning

As described in Section 4.5.4, the inter-array cables and any inter-link cables will be pulled into the WTG and OSS foundations as they are installed. Depending on the final construction schedule, the ends of each export cable may be temporarily wet-stored (during which the cable ends are expected to be covered with cable protection) or directly pulled into the OSS.

Cable pull-in to a WTG or OSS foundation will be initiated by recovering a messenger wire from the foundation and bringing it to the cable laying vessel where the messenger wire will be connected to the end of the offshore cable. A winch on the foundation will then pull the cable (via the messenger wire) through the foundation's steel or composite j-shaped tube (j-tube), which is used to guide the cable into the foundation, and into the OSS topside or WTG tower/transition piece.

Where each cable approaches a foundation, the cable will likely be protected by a cable entry protection system intended to reduce fatigue and mechanical loads as the cables transition above the seabed and into the foundation (see Figure 4.5-10). This system may consist of different composite materials and/or cast-iron half-shells with suitable corrosion protection. The cable entry protection system will likely be attached to the cable prior to its placement on the seabed. If scour protection is used, the cable entry protection system would largely lie above the scour protection and may extend up to 19.7 ft (6.0 m) beyond the scour protection before transitioning beneath the seabed.

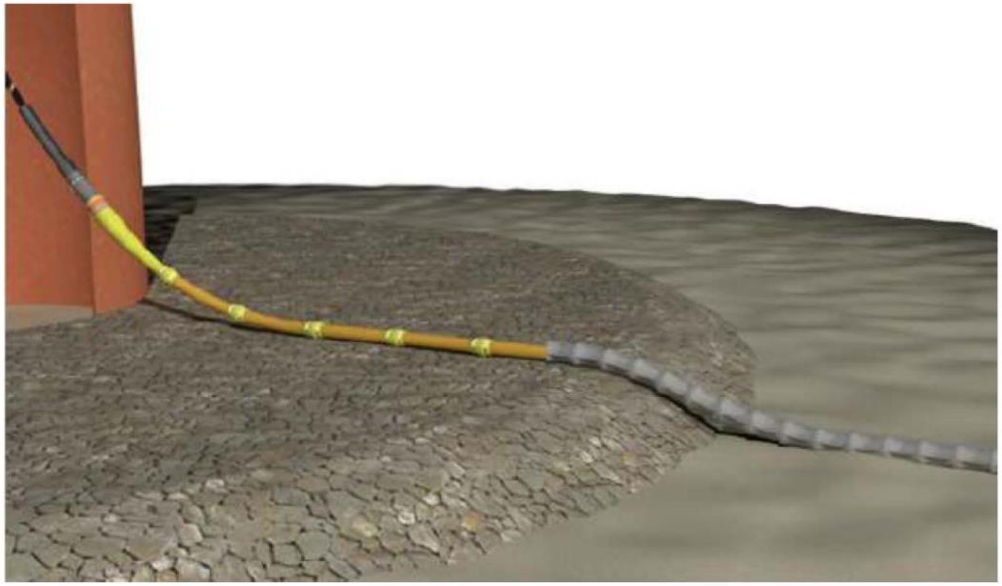
Once inside the foundation, the cable will be stripped to expose power cores and fiber optic cables in preparation for termination at the OSS or WTG. After termination is complete, the cables will be tested and commissioned prior to being energized.

4.5.7 Cable Protection

Cable protection may be necessary if sufficient burial depth cannot be achieved (e.g., due to sediment properties or a cable joint). Cable protection may also be required to support the crossing of existing marine infrastructure such as submarine cables or pipelines (see Section 4.5.8). While the extent of cable protection required will be minimized to the extent practicable, Atlantic Shores conservatively assumes that up to 10% of the export cables, inter-array cables, and inter-link cables may require cable protection where sufficient burial depth is not achieved. The maximum dimensions of cable protection and area of seabed disturbance are provided in Section 4.5.10.

Atlantic Shores is considering the use of five types of cable protection:

1. **Rock placement:** up to three layers of rock, with the lower layer(s) consisting of smaller rock and the upper armor layer consisting of larger rock;
2. **Concrete mattresses:** high-strength concrete blocks cast around a mesh (e.g., ultra-violet stabilized polypropylene rope) that holds the blocks in a flexible covering that settles over the contours of a cable;
3. **Rock bags:** a rock-filled filter unit enclosed by polyester mesh that is non-corrosive, rot-proof, and weather-resistant with proven 30-year durability;
4. **Grout-filled bags:** woven fabric filled with grout that is placed under the cables to provide support or over the cables to provide protection; and
5. **Half-shell pipes:** composite materials or cast iron fixed around a cable to provide mechanical protection.



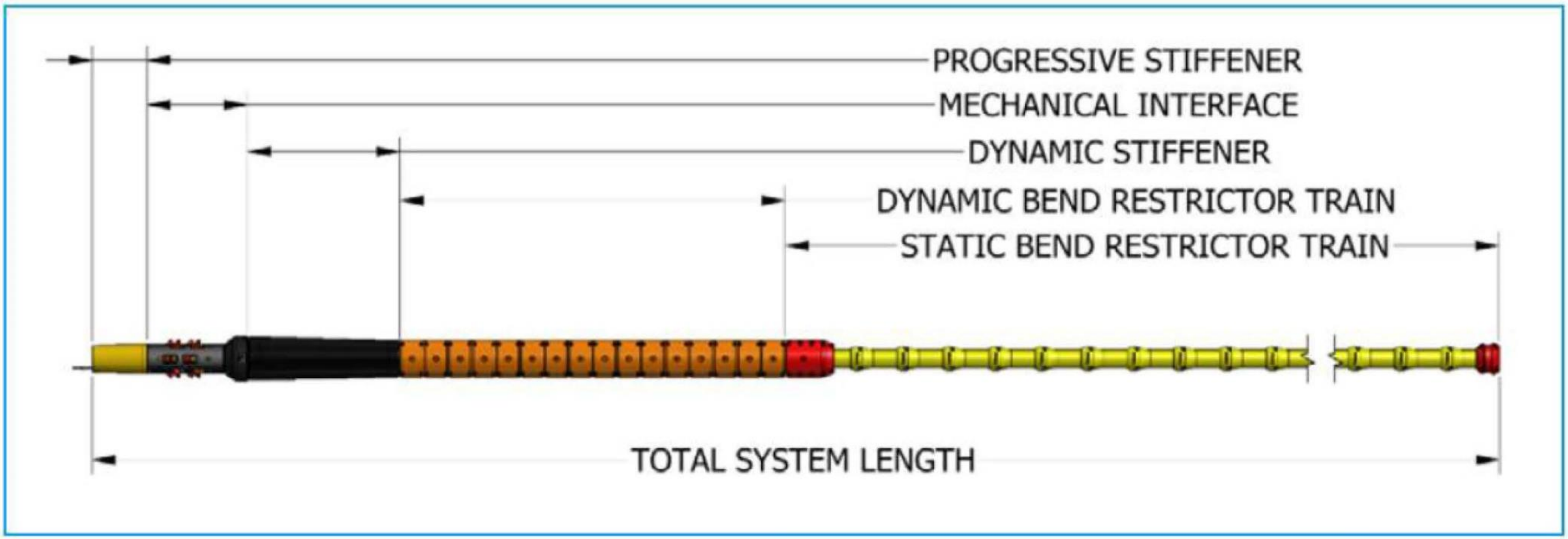


Figure 4.5-10
Representative Cable Entry Protection System

6. One or more of these types of cable protection may be used. Cable protection consisting of freely laid rock can be installed by a DP fallpipe vessel, a vessel's crane, or side dumping from a vessel. If freely laid rock is used, the fallpipe installation method, the most accurate technique, will be used wherever possible. Concrete mattresses, rock bags, and grout-filled bags will likely be deployed by a vessel's crane. Half-shell pipes are expected to be installed around the cable on board the cable laying vessel prior to installing the cable.

4.5.8 Cable Crossings

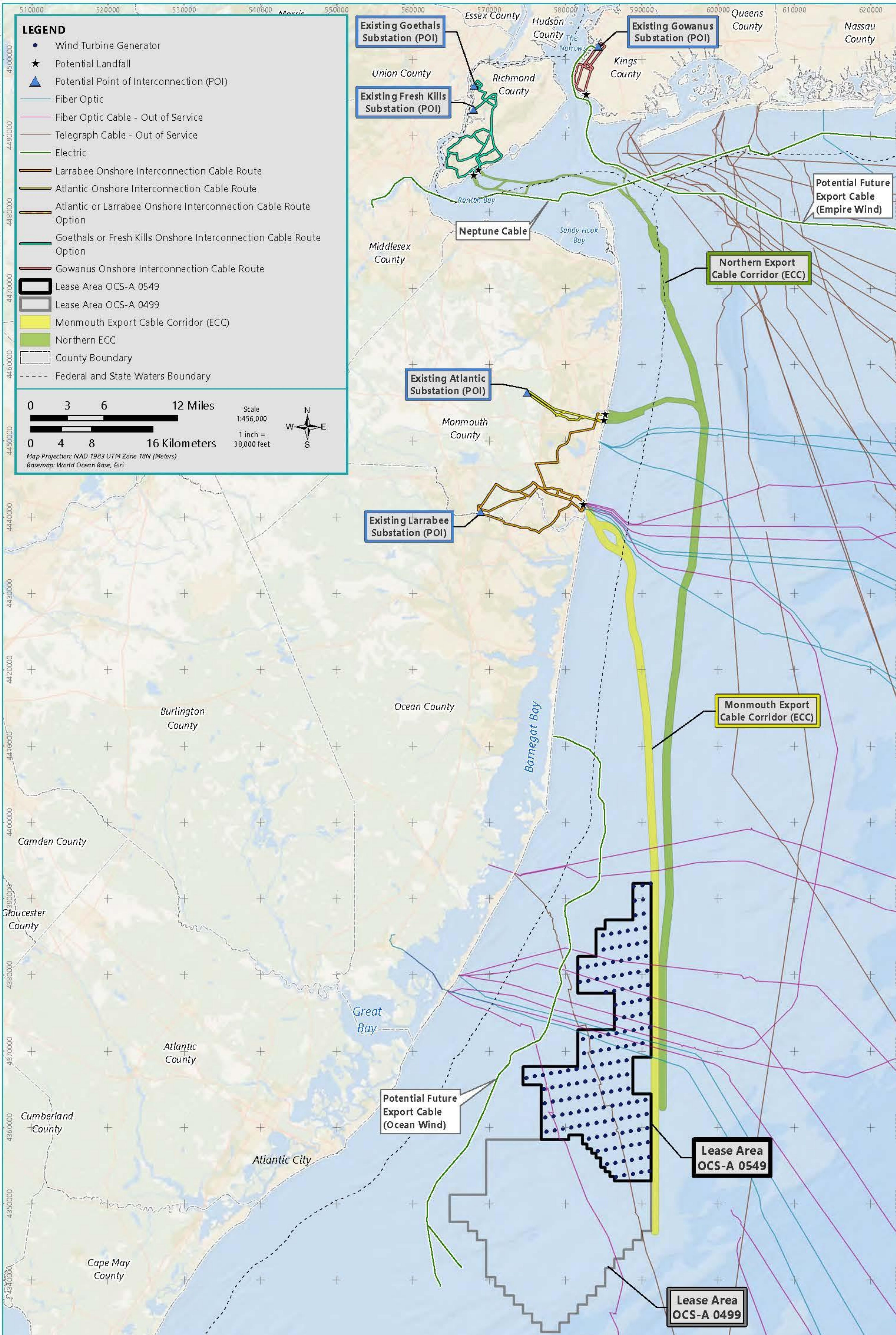
The ECCs will cross existing marine infrastructure, including submarine cables (see Figure 4.5-11). The two ECCs in combination may cross approximately 121 cables or pipelines between the Lease Area and the Landfall Sites.[13] The Northern ECC is located to the east of both the Lease Area and the Monmouth ECC and does not have direct connectivity to the Lease Area. To enable the export cables to reach the Northern ECC from the Lease Area, they will need to cross the Monmouth ECC. A conceptual example of this export cable crossing schematic is shown in Figure 4.5-12. The total number of cable crossings is inclusive of those required to cross the Monmouth ECC. Atlantic Shores also estimates that up to 10 inter-array cable crossings and up to two inter-link cable crossings may be required.

Any cable crossing will be carefully surveyed and, if the cable is still active, Atlantic Shores will develop a crossing agreement with its owner prior to cable installation. At each crossing, before installing the Atlantic Shores cable, the area around the crossing will be cleared of any marine debris. Depending on the status of the existing cable and its location, such as burial depth and substrate characteristics, cable protection may be placed between the existing cable and Atlantic Shores' overlying cable. However, if sufficient vertical distance exists, such protection may be avoided. It is likely that the presence of an existing cable will prevent Atlantic Shores' cable from being buried to its target burial depth. In this case, cable protection may be required on top of the proposed cable at the crossing location. Following installation of the proposed cables, the cable crossing will be surveyed again.

Atlantic Shores is considering the same five types of cable protection at infrastructure crossings as described in Section 4.5.7. The dimensions of cable protection at infrastructure crossings are provided in Section 4.5.10.

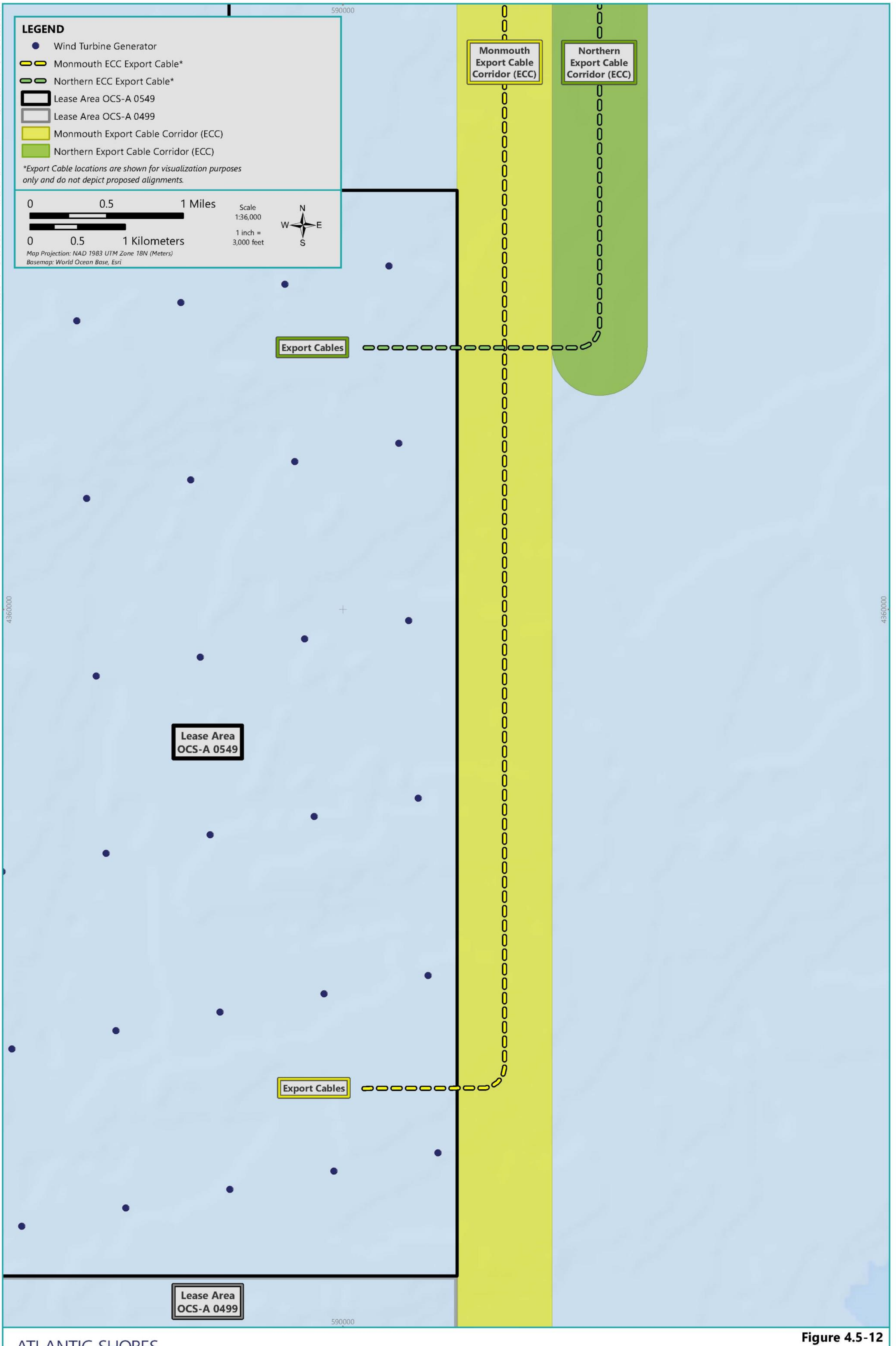
If an existing cable is inactive, it will be cut and removed prior to installing Atlantic Shore's cables. Removal of the inactive cables will enable burial of Atlantic Shores' cables and avoid the need for cable protection. Where removal is not feasible, standard cable crossing techniques will be employed, which may require cable protection.

13 The maximum number of cable crossings for each ECC accounts for the possibility that other offshore cables may be installed prior to the start of Project construction.



ATLANTIC SHORES offshore wind

Figure 4.5-11
Cable Crossings



ATLANTIC SHORES offshore wind

Figure 4.5-12

Conceptual Export Cable Crossing Schematic

4.5.9 Post-Construction Surveys

The precise location and burial depth of each cable will be monitored in real-time during installation activities. As-built plans will be provided to the National Oceanic and Atmospheric Administration (NOAA) so the cables can be included on nautical charts; this will enable mariners to access information on the cable locations. Following installation, Atlantic Shores will perform a post-construction survey along the cables. Monitoring of the offshore cables during O&M is further described in Section 5.1.

4.5.10 Summary of Area of Potential Seabed Disturbance

4.5.10.1 Export Cables

The maximum potential seabed disturbance from export cable installation is provided in Table 4.5-1. Given that a portion of the export cables will be installed within the Lease Area (from the Lease Area boundary to OSSs), Table 4.5-1 provides the maximum area of potential seabed disturbance for the export cables within the Lease Area as well as the ECCs.

Table 4.5-1 Maximum Seabed Disturbance from Export Cable Installation

Installation Activity Characteristics (Maximum)	Monmouth Landfall Site to OSS	Northern Landfall Site to OSS
Max. length per export cable	66.9 mi (107.6 km)	90.4 mi (145.5 km)
Max. total length of export cables	334.4 mi (538.1 km)	416.7 mi (670.6 km)
Maximum Temporary Disturbance from Export Cable Installation		
Cable Installation Trench and Skid/Track		
Max. depth of cable trench	9.8 ft (3.0 m)	9.8 ft (3.0 m)
Max. width of cable trench	3.3 ft (1.0 m)	3.3 ft (1.0 m)
Max. width of additional skid/track disturbance	13.1 ft (4.0 m)	13.1 ft (4.0 m)
Cable Installation Trench and Skid/Track		
Max. area of cable trench and skid/track disturbance	1.04 square mile (mi^2) (2.69 square kilometer [km^2])	1.29 mi^2 (3.35 km^2)
Pre-Pass Jetting and Multiple Burial Passes (along limited length of the cable routes)		
Max. total length of cable requiring pre-pass jetting	16.7 mi (26.9 km)	20.8 mi (33.5 km)
Max. total length of cable requiring multiple burial passes	66.9 mi (107.6 km)	41.6 mi (67.0 km)
Max. area of additional disturbance from pre-pass jetting and subsequent passes of the cable installation tool	None	None
Pre-Lay Grapnel Run (along entire cable routes)		
Max. depth of pre-lay grapnel run (PLGR)	1.6 ft (0.5 m)	1.6 ft (0.5 m)
Max. width of PLGR (total for 3 passes)	9.8 ft (3.0 m)	9.8 ft (3.0 m)
Max. area of additional disturbance from PLGR (for 2 passes beyond cable trench and skids/tracks)	0.42 mi^2 (1.08 km^2)	0.52 mi^2 (1.34 km^2)

Installation Activity Characteristics (Maximum)	Monmouth Landfall Site to OSS	Northern Landfall Site to OSS
Boulder Relocation (along limited length of the cable routes)		
Max. total length of boulder relocation	33.4 mi (53.8 km)	41.6 mi (67.0 km)
Max. width of displacement plow	32.8 ft (10.0 m)	32.8 ft (10.0 m)
Max. depth of displacement plow	2.6 ft (0.8 m)	2.6 ft (0.8 m)
Max. area of additional disturbance from boulder relocation (beyond cable trench, skids/tracks, and PLGR)	0.06 mi^2 (0.16 km^2)	0.08 mi^2 (0.20 km^2)
Sand Bedform Removal (along limited length of the cable routes)		
Max. total length of cables requiring sand bedform removal	66.9 mi (107.6 km)	83.3 mi (134.1 km)
Max. width of sand bedform removal Top of trench Bottom of trench	 98.4 ft (30.0 m) 49.2 ft (15.0 m)	 98.4 ft (30.0 m) 49.2 ft (15 m)
Typical depth of sand bedform removal	3.3 ft (1.0 m)	3.3 ft (1.0 m)
Max. depth of sand bedform removal	19.7 ft (6.0 m)	19.7 ft (6.0 m)
Max. volume of sand bedforms removed[a]	3,167042.3 cubic yards (yd^3) (2,421,378.7 m^3)	3,955,904.3 yd^3 (3,016095.7 m^3)
Max. area of additional disturbance from sand bedform removal (beyond cable trench, skids/tracks, and PLGR)	0.96 mi^2 (2.48 km^2)	1.19 mi^2 (3.08 km^2)
Anchoring/Jacking-Up		
Max. total length of cables requiring anchoring	5.0 mi (8.0 km)	14.9 mi (24.0 km)
Max. area of disturbance from anchoring during cable installation[b]	0.14 mi^2 (0.35 km^2)	0.41 mi^2 (1.06 km^2)
Max. area of disturbance from jacking-up during cable splicing and HDD at the landfall sites[c]	0.0017 mi^2 (0.0008 km^2)	0.0008 mi^2 (0.008 km^2)
Maximum Temporary Disturbance from Export Cable Installation		
Total Temporary Disturbance from Export Cable Installation		
Total max. area of temporary seafloor disturbance due to export cable installation[d]	2.46 mi^2 (6.38 km^2)	3.31 mi^2 (8.56 km^2)
Portion of temporary disturbance within the Lease Area[e]	0.22 mi^2 (0.56 km^2)	0.30 mi^2 (0.77 km^2)
Portion of temporary disturbance within ECC[f]	2.21 mi^2 (5.73 km^2)	3.00 mi^2 (7.76 km^2)
Maximum Permanent Disturbance from Export Cable Installation		
Cable Entry Projection System		
Max. # of export cable approaches to OSS	5	5
Max. length of cable entry protection system beyond scour protection[g]	19.7 ft (6.0 m)	19.7 ft (6.0 m)
Max. diameter of cable entry protection system	2.0 ft (0.6 m)	2.0 ft (0.6 m)
Cable Protection for Infrastructure Crossings		
Max. # of cable crossings	84	84
Max. area of cable protection per crossing	43,055.6 ft^2 (4,000.0 m^2)	43,055.6 ft^2 (4,000.0 m^2)
Max. thickness of cable protection at crossings	5.6 ft (1.7 m)	5.6 ft (1.7 m)
Cable Protection for Insufficient Burial Depth (along limited length of the cables)		
Max. length of cable protection	33.4 mi (53.8 km)	41.6 mi (67.0 km)

Installation Activity Characteristics (Maximum)	Monmouth Landfall Site to OSS	Northern Landfall Site to OSS
Max. width of cable protection	41.0 ft (12.5 m)	41.0 ft (12.5 m)
Max. thickness of cable protection	4.6 ft (1.4 m)	4.6 ft (1.4 m)
Total Permanent Disturbance from Export Cable Installation		
Total max. area of permanent seafloor disturbance for export cables	0.39 mi^2 ($1.01 km^2$)	0.45 mi^2 ($1.17 km^2$)
Portion of permanent disturbance within Lease Area	0.04 mi^2 (0.11 km^2)	0.05 mi^2 (0.13 km^2)
Portion of permanent disturbance within ECC	0.35 mi^2 (0.90 km^2)	0.40 mi^2 (1.04 km^2)
Total Temporary and Permanent Seafloor Disturbance		
Total max. area of temporary and permanent seafloor disturbance from export cable installation	**2.85 mi^2 (7.39 km^2)**	**3.76 mi^2 (9.74 km^2)**
Portion of total seafloor disturbance within Lease Area	**0.29 mi^2 (0.76 km^2)**	**0.36 mi^2 (0.93 km^2)**
Portion of total seafloor disturbance within ECC	**2.56 mi^2 (6.63 km^2)**	**3.40 mi^2 (8.80 km^2)**

Notes:

a) Maximum sand bedform removal volumes are calculated based on the typical depth of sand bedform removal.

b) Assumes an eight-point anchor spread with each anchor disturbing 11,840 ft^2 (1,100 m^2) (i.e., 1,076 ft^2 [100 m^2] for the anchor itself plus 10,764 ft^2 [1,000.0 m^2] for the mooring system), giving a total disturbance area of 94,722.3 ft^2 (8,800.0 m^2) each time the vessel repositions its anchors (assumed every 656.2 ft [200.0 m]).

c) Assumes one jack-up vessel disturbing 845.4 ft^2 (78.5 m^2) (based on a four-legged jack-up with each leg disturbing 211.3 ft^2 [19.6 m^2]) per cable joint plus one jack-up for HDD operations per HDD conduit.

d) To avoid double counting impacts, excludes the area of temporary disturbance that would be covered by cable protection.

e) Based on an estimated 11% of the individual export cable length within the Lease Area. No boulder relocation or anchoring is anticipated to occur within the Lease Area.

f) Based on an estimated 89% of the individual export cable length within the ECC. All potential disturbance from boulder relocation and anchoring is assumed to occur in the ECCs.

g) The area of disturbance from the cable entry protection system where it lays above the scour protection is accounted for in the PDE of OSS foundation parameters (see Table 4.4-2 in Section 4.4).

4.5.10.2 Inter-Array and Inter-Link Cables

Atlantic Shores anticipates that up to 466 mi (750 km) of inter-array cables may be required, while up to approximately 62 mi (100 km) of inter-link cables may be needed. The maximum potential seabed disturbance from installation of inter-array and inter-link cables is provided in Table 4.5-2.

Table 4.5-2 Maximum Seabed Disturbance from Inter-Array and Inter-Link Cable Installation

Installation Activity Characteristics (Maximum)	Inter-Array Cables	Inter-Link Cables
Max. total length of cable	466 mi (750.0 km)	62 mi (100.0 km)
Maximum Temporary Disturbance from Cable Installation		
Cable Installation Trench and Skid/Track		
Max. depth of cable trench	9.8 ft (3.0 m)	9.8 ft (3.0 m)
Max. width of cable trench	3.3 ft (1.0 m)	3.3 ft (1.0 m)
Max. width of additional skid/track disturbance	13.1 ft (4.0 m)	13.1 ft (4.0 m)
Max. area of cable trench and skid/track disturbance	1.45 mi^2 (3.75 km^2)	0.19 mi^2 (0.50 km^2)
Multiple Burial Passes (along limited length of the cables)		
Max. total length of cable requiring multiple burial passes	93.2 mi (150.0 km)	12.4 mi (20.0 km)
Max. area of additional disturbance from subsequent passes of the cable installation tool	None	None
Pre-Lay Grapnel Run (along entire cable)		
Max. depth of PLGR	1.6 ft (0.5 m)	1.6 ft (0.5 m)
Max. width of PLGR (total for 3 passes)	9.8 ft (3.0 m)	9.8 ft (3.0 m)
Max. area of additional disturbance from PLGR (for 2 passes beyond cable trench and skids/tracks)	0.58 mi^2 (1.50 km^2)	0.08 mi^2 (0.20 km^2)
Sand Bedform Removal (along limited length of the cables)		
Max. total length of cables requiring sand bedform removal	46.6 mi (75.0 km)	12.4 mi (20.0 km)
Max. width of sand bedform removal Top of trench Bottom of trench	 98.4 ft (30.0 m) 49.2 ft (15.0 m)	 98.4 ft (30.0 m) 49.2 ft (15 m)
Typical depth of sand bedform removal	3.3 ft (1.0 m)	3.3 ft (1.0 m)
Max. depth of sand bedform removal	19.7 ft (6.0 m)	19.7 ft (6.0 m)
Sand Bedform Removal (along limited length of the cables)		
Max. volume of sand bedforms removed[a]	2,207,166.7 yd^3 (1,687,500.0 m^3)	588,577.8 yd^3 (450,000.0 m^3)
Max. area of additional disturbance from sand bedform removal (beyond cable trench, skids/tracks, and PLGR)	0.67 mi^2 (1.73 km^2)	0.18 mi^2 (0.46 km^2)
Total *Temporary* Disturbance from Cable Installation		
Total max. area of temporary seafloor disturbance due to cable installation[b]	2.49 mi^2 (6.45 km^2)	0.42 mi^2 (1.09 km^2)
Cable Entry Projection System		
Max. # of cable approaches to WTGs and OSSs	330	4
Max. length of cable entry protection system beyond scour protection[c]	19.7 ft (6.0 m)	19.7 ft (6.0 m)
Max. diameter of cable entry protection system	2.0 ft (0.6 m)	2.0 ft (0.6 m)
Cable Protection for Infrastructure Crossings		
Max. # of cable crossings	30	8
Max. area of cable protection per crossing	43,055.6 ft^2 (4,000.0 m^2)	43,055.6 ft^2 (4,000.0 m^2)
Max. thickness of cable protection at crossings	5.6 ft (1.7 m)	5.6 ft (1.7 m)
Cable Protection for Insufficient Burial Depth (along limited length of the cables)		
Max. length of cable protection	46.6 mi (75.0 km)	6.2 mi (10.0 km)
Max. width of cable protection	41.0 ft (12.5 m)	41.0 ft (12.5 m)
Max. thickness of cable protection	4.6 ft (1.4 m)	4.6 ft (1.4 m)

Installation Activity Characteristics (Maximum)	Inter-Array Cables	Inter-Link Cables
Total Permanent Disturbance from Cable Installation		
Total max. area of permanent seafloor disturbance for inter-array and inter-link cables	0.41 mi^2 (1.06 km^2)	0.06 mi^2 (0.16 km^2)
Total Temporary and Permanent Seafloor Disturbance		
Total max. area of temporary and permanent seafloor disturbance from inter-array and inter-link cable installation	**2.90 mi^2 (7.51 km^2)**	**0.48 mi^2 (1.25 km^2)**

Notes:

a) Maximum sand bedform removal volumes are calculated based on the typical depth of sand bedform removal.

b) To avoid double counting impacts, excludes the area of temporary disturbance that would be covered by cable protection.

c) The area of disturbance from the cable entry protection system where it lays above the scour protection is accounted for in the PDE of WTG and OSS foundation parameters (see Table 4.2-1 in Section 4.2 and Table 4.4-2 in Section 4.4).

4.6 Meteorological Tower and Metocean Buoys

4.6.1 Permanent Meteorological Tower

A single permanent meteorological (met) tower may be installed within the Lease Area during construction. One location for the met tower is currently under consideration (see Figure 4.6-1). The foundation options for the met tower include all options under consideration for WTG foundations and the construction methodologies are assumed to be the same as those for WTG foundations (see Section 4.2). There is sufficient conservatism in the total estimates of seafloor disturbance from WTG foundation installation to account for the impacts from the met tower's installation (see Section 4.11). The maximum height of the met tower will not exceed 16.5 ft (5 m) above the hub height of the largest WTG installed. Therefore, it is conservative to assume the maximum height of the met tower will be 590.6 ft (180 m) above MSL. The met tower itself is expected to be composed of square lattice consisting of tubular steel. It will be equipped with a deck estimated to be approximately 50 ft by 50 ft (15 m by 15 m) mounted at approximately the same elevation as the interface between the WTGs and their foundations. A schematic of a representative met tower is provided as Figure 4.6-2.

4.6.2 Temporary Metocean Buoys

In addition to the met tower, up to two temporary meteorological and oceanographic (metocean) buoys may be installed and kept in place during construction to monitor weather and sea state conditions. The metocean buoys are expected to be anchored to the seafloor using a steel chain connected to a steel chain weight on the seafloor. An additional bottom weight associated with a water level sensor may also be connected to the buoys' mooring system. The maximum area of temporary seafloor disturbance from each buoy's anchor (including anchor sweep) is anticipated to be approximately 0.005 mi^2 (0.013 km^2), with a maximum depth of disturbance of 3.3 ft (1.0 m). The potential locations for the metocean buoys are shown on Figure 4.6-1 and an indicative schematic of a metocean buoy is provided as Figure 4.6-3. The buoys will be decommissioned in accordance with 30 CFR Part 585, Subpart I at the end of construction.

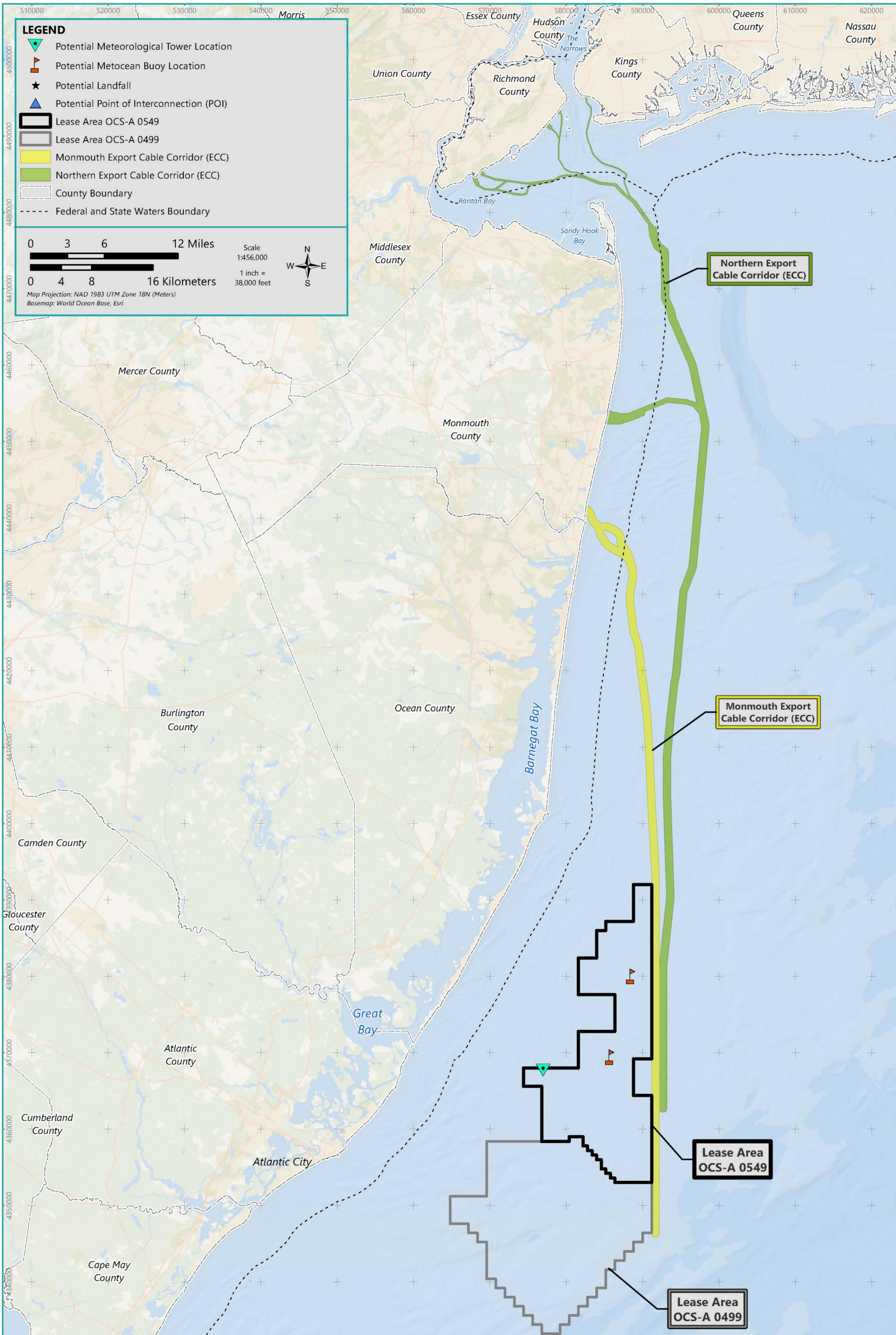


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Figure 4.6-1

Potential Met Tower and Metocean Buoy Locations

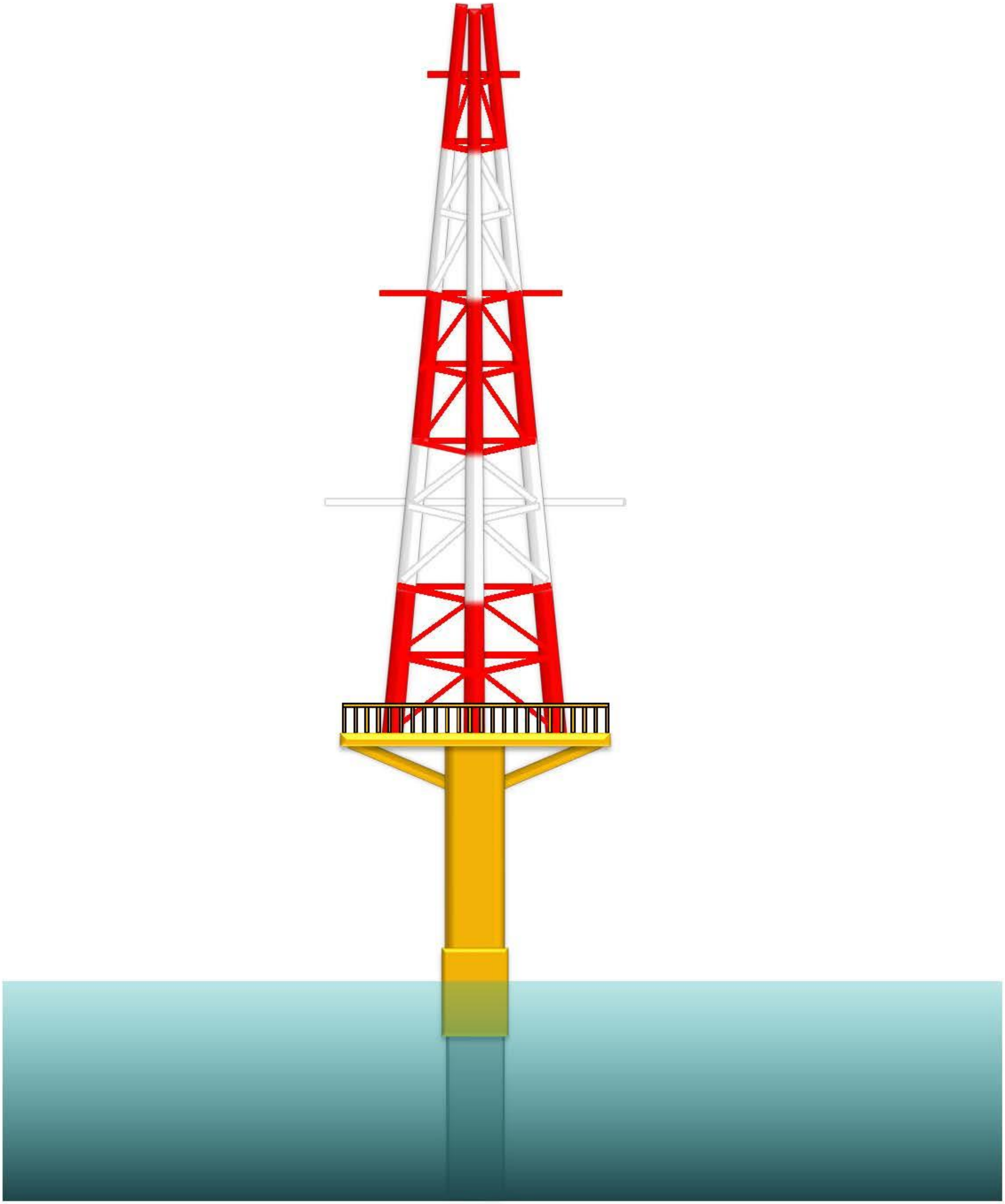

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Figure 4.6-2
Representative Met Tower Schematic

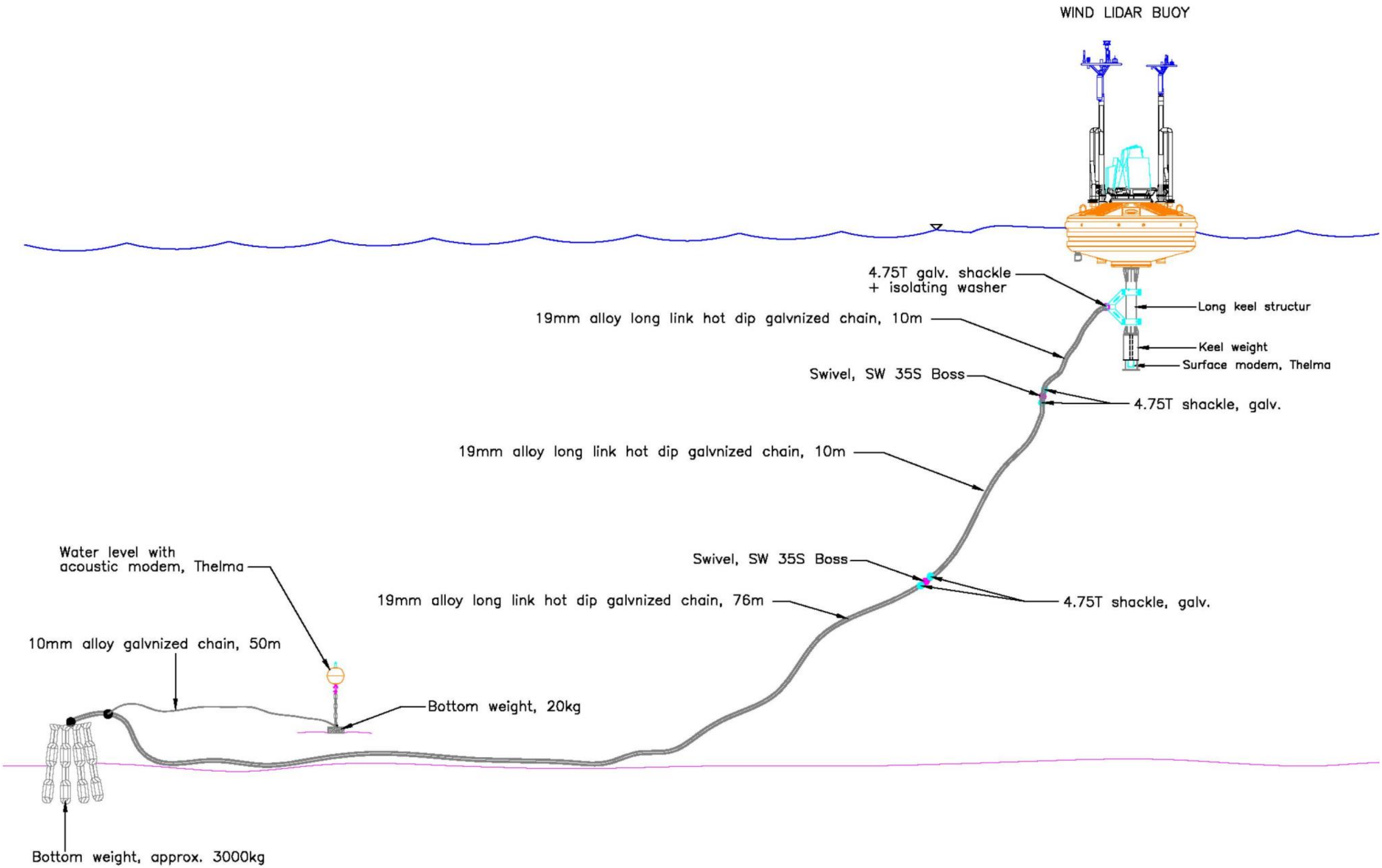

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Figure 4.6-3
Representative Metocean Buoy Schematic

4.7 Landfall Sites

Landfall site options have been identified at the terminus of the ECCs in both New Jersey and New York to accommodate the offshore-to-onshore transition between the export cables and the onshore interconnection cables (see Figure 1.1-2). Please refer to Table 3.2-2 in Section 3.2 for additional information regarding potential landfalls and Figures 4.8-1, 4.8-1a, 4.8-1b, 4.8-2, 4.8-2a and 4.8-2b for detailed location information regarding the landfall site options.

4.7.1 New Jersey Landfall Options

As shown on Figure 1.1-2, the Monmouth ECC extends from the Lease Area to the Monmouth Landfall Site, from which onshore interconnection cables will connect to the Larrabee point of interconnection (POI), and the Northern ECC extends from the Lease Area to the two (2) Asbury Landfall Sites, from which onshore interconnection cables will connect to the Atlantic POI and/or Larrabee POI.

The Monmouth Landfall Site will be located on a parcel of land that is currently owned and operated by the U.S. Army National Guard Training Center (NGTC) and New Jersey Department of Military and Veteran Affairs (DMAVA) in the Borough of Sea Girt, Monmouth County, New Jersey (see Figure 4.8-1a). This landfall site will include underground transition vaults associated with the Larrabee export cables (one per export cable).

The Asbury Landfall Sites include the Asbury Landfall and Kingsley Landfall, both of which would be located on previously disturbed parcels of land within existing parking lots, in the City of Asbury Park, Monmouth County, New Jersey (see Figure 4.8-1b). These landfall sites include underground transition vaults associated with the Atlantic export cables (one per export cable)

Detailed descriptions of the Larrabee Onshore Interconnection Cable Routes from the Monmouth Landfall Site to the POI and the Atlantic Onshore Interconnection Cable Routes from the Asbury Landfall Site options to the POI are provided in Section 4.8.

4.7.2 New York Landfall Options

As shown on Figure 1.1.-2, the Northern ECC extends from the Lease Area to the two (2) landfall sites on Staten Island from which onshore interconnection cables will interconnect to the Fresh Kills and/or Goethals POIs, and one (1) landfall site in Brooklyn, New York from which onshore interconnection cables will interconnect to the Gowanus POI.

The two landfall sites on Staten Island are referred to as the Lemon Creek and Wolfe's Pond Landfalls, respectively, both of which will be located on previously disturbed parcels of land within existing parking lots, on Staten Island, Richmond County, New York (see Figures 4.8-2a and 4.8-2b). The Lemon Creek and Wolfe's Pond landfall sites include underground transition vaults associated with the Northern Export cables (one vault per export cable).

The landfall site in Brooklyn, referred to as the Fort Hamilton Landfall Site, will be located on a previously disturbed parcel of land that includes parkland and is currently owned and operated by the U.S. Army in Brooklyn, Kings County, New York (see Figure 4.8-2b). This landfall site will also include underground transition vaults associated with the Northern Export cables (one vault per export cable).

4.7.3 Landfall Construction Activities

The offshore-to-onshore transition is proposed to be accomplished using HDD, a trenchless installation method that will avoid nearshore impacts as well as impacts directly along the shoreline. HDD, in comparison to trenching, also results in a deeper burial depth for cables in the nearshore environment, facilitating sufficient burial over the life of the Project and decreasing the likelihood that cables will become exposed over time. Each of the export cables coming ashore will be installed via HDD in separate conduits. Up to six HDD conduits may be installed to accommodate the HVAC and/or HVDC cable options. To support HDD activities, Atlantic Shores will establish an onshore staging area at each landfall.

Engineering for the HDD trajectories for landfall sites is currently underway. Final design of the landfall site HDDs will be provided as part of the Project's Facility Design Report (FDR) and Fabrication and Installation Report (FIR). The HDDs will either be initiated or exit landward of the beach to avoid impacts to the beach. At each of the landfall site options, the HDD trajectory for each of the cables is expected to be approximately 2,625 to 3,280 ft (800 to 1,000 m) long to extend beyond the toe-of-slope of the beach and avoid near-shore habitat and obstructions. The estimated average depth of the HDDs is approximately 16 to 131 ft (5 to 40 m) below the seabed.

The landfall site HDDs will consist of the following steps:

- **Excavation of entrance pit and exit pit:** Onshore, each HDD alignment will originate or terminate in an excavated pit that is approximately 10 ft by 13 ft (3 m by 4 m) located at the landfall site's onshore staging area. The excavated pit will also serve to contain drilling fluid. This fluid is a slurry of bentonite (an inert, non-toxic clay) and water that lubricates the drill head and extracts excavated material from the bore hole. Offshore, each HDD entrance/exit location will require an excavated area of up to approximately 66 ft by 33 ft (20 m by 10 m). A backhoe dredge may be required to complete the excavation and a cofferdam (or similar method) of approximately the same size as the excavated pit may be utilized. The need for a cofferdam (or similar) will depend on the results of marine surveys conducted near the landfall sites, the depth of burial, and the direction of HDD. A temporary offshore platform (i.e., jack-up barge) may be needed to support the HDD drilling rig; the seabed disturbance from jacking-up during HDD activities is included in Table 4.5-1.

  Drilling of pilot hole: An approximately 12.4-in (315-mm) pilot hole will be drilled between the pit at the onshore staging area and the offshore HDD exit/entrance pit in an arcing fashion beneath the shoreline and nearshore zone. If HDD is initiated onshore, when the pilot hole exits the seabed, the contractor may use water to carry drill cuttings back to the approach pit rather than drilling fluids in order to avoid release of clay to the water column (even though bentonite is a natural substance that poses little to no risk to the marine environment).

- **Reaming and conduit insertion:** The drill will be equipped with a larger cutter head that will enlarge the pilot hole in preparation for insertion of a high-density polyethylene (HDPE) or polyvinyl chloride (PVC) conduit. The same drill head can pull the plastic HDD conduit through the enlarged bore hole.

- **Cable insertion:** Following installation of the conduit, the export cable will be inserted into the opening at the seabed and pulled through the conduit towards shore. A cofferdam (or similar method) may be used during insertion of the cable. If used, Atlantic Shores anticipates that the cofferdam will be approximately 98.4 ft by 26.2 ft (30 m by 8 m). Once the export cables are installed into the HDD conduit, the end of the conduit exposed on the seabed will then be fully buried, possibly by divers using hand-jets.
- **Disposal of drill cuttings:** Drilling the HDD trajectory will produce a mixture of drill cuttings from the bore hole, water, and bentonite clay (used to lubricate and cool the drill bit). This mixture will be collected on-site and filtered to separate solids from fluids, which will enable reuse of the drilling fluid. Drill cuttings and excess drill fluids are typically classified as clean fill material, and it is anticipated they will be disposed of at an appropriate upland facility such as a local landfill, a gravel pit, or other facility permitted to take such material.
- **Pull-back to transition vaults:** Cables installed through the HDD conduit will be pulled into onshore transition vaults, where they will be split into separate onshore cables. The transition vaults at the landfall site will be approximately 11.5 ft wide by 46 ft long by 14.8 ft deep (3.5 m wide by 14 m long by 4.5 m deep). It is anticipated that the transition vaults will also include fiber optic splice boxes.
- **Site restoration:** The onshore HDD staging areas will be restored to be consistent with existing conditions, while the transition vaults will be entirely underground except for at-grade manhole covers.

Based on local permit requirements, Atlantic Shores expects that onshore construction may be seasonally restricted to occur outside of the period from Memorial Day to Labor Day. The HDD construction schedules will be developed in accordance with municipal noise ordinances. Certain activities, such as conduit pull-in, cannot stop once they are started, so work may need to continue into the night or occur on the weekend. Atlantic Shores will coordinate with municipal officials to finalize the onshore construction schedule and hours.

4.8 Onshore Interconnection Cables and Points of Interconnection

From the landfall site options, onshore interconnection cables will be installed underground primarily along existing roadways and/or electric transmission ROWs to the proposed onshore substation and/or converter station site options as described in Section 4.9. Easements and ROW for private parcels will be acquired where necessary. From the proposed onshore substations and/or converter stations (which are to be determined), the onshore interconnection cables will continue to the proposed POI substations for interconnection to the electrical grid.

As described in Section 4.5, Atlantic Shores is currently considering the following transmission options: (1) four HVAC export cables and one HVDC export cable; (2) three HVAC export cables and two HVDC export cables; or (3) four HVDC export cables. Atlantic Shores is continuing to evaluate the transmission options for the Project. Therefore, depending on the transmission option selected, the Project could use any of the proposed onshore interconnection cable route options (see Figures 4.8-1, 4.8-1a, 4.8-1b, 4.8-2, 4.8-2a and 4.8-2b).

To support construction of the onshore interconnection cable route, Atlantic Shores will develop a Traffic Management Plan (TMP) to avoid and minimize traffic impacts and will adhere to seasonal construction restrictions near the shoreline (see Section 4.8.3). The use of specialty trenchless installation techniques, most likely HDD, jack-and-bore, or pipe jacking (see Section 4.8.3), will also be used to avoid and minimize traffic and environmental resource impacts, particularly at locations such as major roads, railroads, wetlands and waterway crossings. HDD, jack-and-bore, and pipe jacking methodologies are described in Section 4.8.3.

4.8.1 New Jersey Onshore Interconnection Cable Route Options

Onshore interconnection cable route options from the landfall site options to the existing Larrabee and Atlantic Substation POIs range from approximately 7 to 17 mi (11.2 to 27.4 km) (see Table 1.1-1). These options largely utilize existing linear infrastructure corridors (i.e., roadways, transmission line rights-of-way and recreational trails) (See Figures 4.8-1, 4.8-1a and 4.8-1b). The areas adjacent to the routes consist mostly of developed space, including residential, commercial, and utility land uses, interspersed with small, forested parcels and other open space. The onshore interconnection cable route options will terminate at the existing POIs, which are located on previously disturbed parcels.

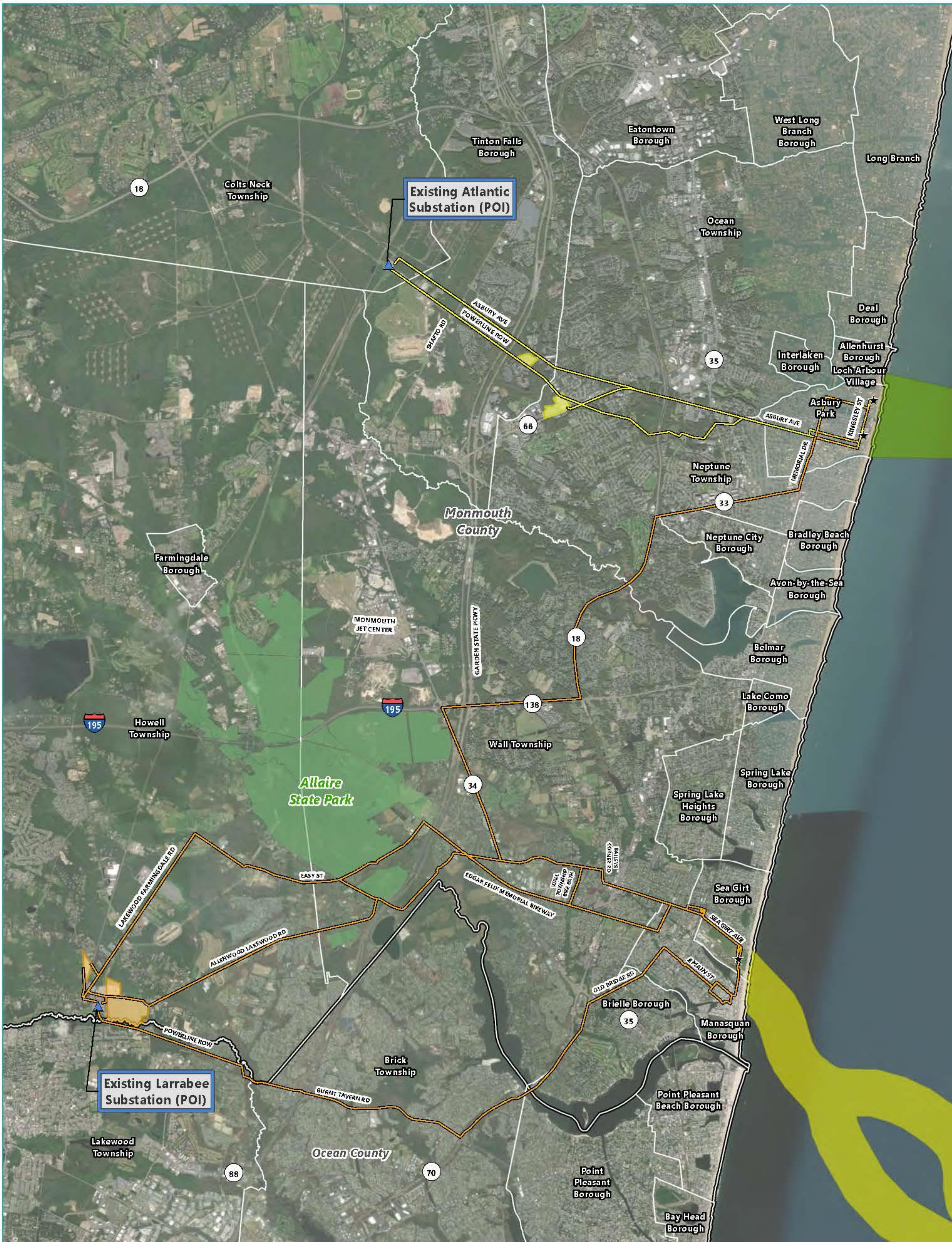
4.8.2 New York Onshore Interconnection Cable Route Options

Onshore interconnection cable route options from the landfall site options to the Fresh Kills, Goethals and Gowanus Substation POIs range in length from approximately 5 to 15 mi (8 to 24.1 km). These options largely utilize existing linear infrastructure corridors (i.e., urban roadways) (See Figures 4.8-2, 4.8-2a and 4.8-2b) The areas adjacent to the routes consists mostly of developed space, including residential, commercial, industrial, and utility land uses. There are also small parcels of open space located along some of the route options. The cable route options will terminate at the existing POIs, which are located on previously disturbed parcels.

4.8.3 Cable Design and Construction Activities

HVAC and/or HVDC technology will be used for the Project's onshore transmission. HVAC cables will involve three single-core cables per circuit, with cables having a water-tight design suitable for installation within a duct bank. If HVAC technology is utilized, each route could contain up to four circuits, for a total of up to 12 onshore interconnection cables and four fiber optic cables. The voltage of these onshore HVAC cables will be between 230 to 345 kV. HVDC cables will involve two or three single-core cables per cable circuit. If HVDC technology is utilized, one circuit consisting of two 320 to 525 kV onshore interconnection cables and up to two fiber optic cables will be used.

Regardless of the type of cable, the onshore interconnection cables will be contained within a buried concrete duct bank, with individual cables residing in conduits composed of HDPE or PVC. Onshore interconnection cables will typically require splices every 1,640 to 3,280 ft (500 to 1,000 m). At each splice location, a concrete splice vault will be installed. Typical dimensions of a splice vault will be up to 8 ft (2.5 m) wide, 26 ft (8 m) long, and 5 ft (1.5 m) deep.



ATLANTIC SHORES offshore wind

Figure 4.8-1

Monmouth and Asbury Landfalls, Onshore Interconnection Routes, and Points of Interconnection (POI) Monmouth and Ocean County, New Jersey

0 0.375 0.75 1.5 Mile

0 1 2 Kilometer

Scale 1:78,000

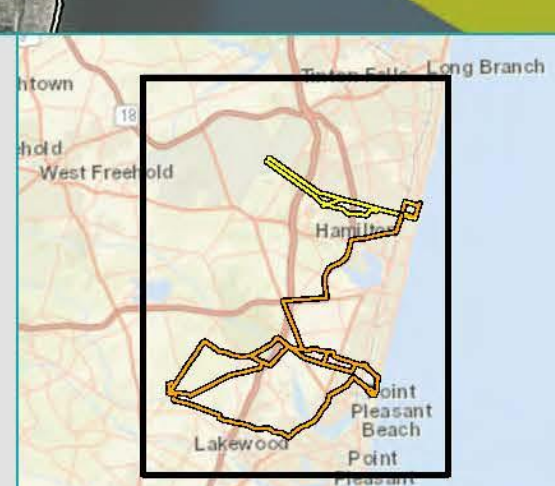
1 inch = 6,200 feet

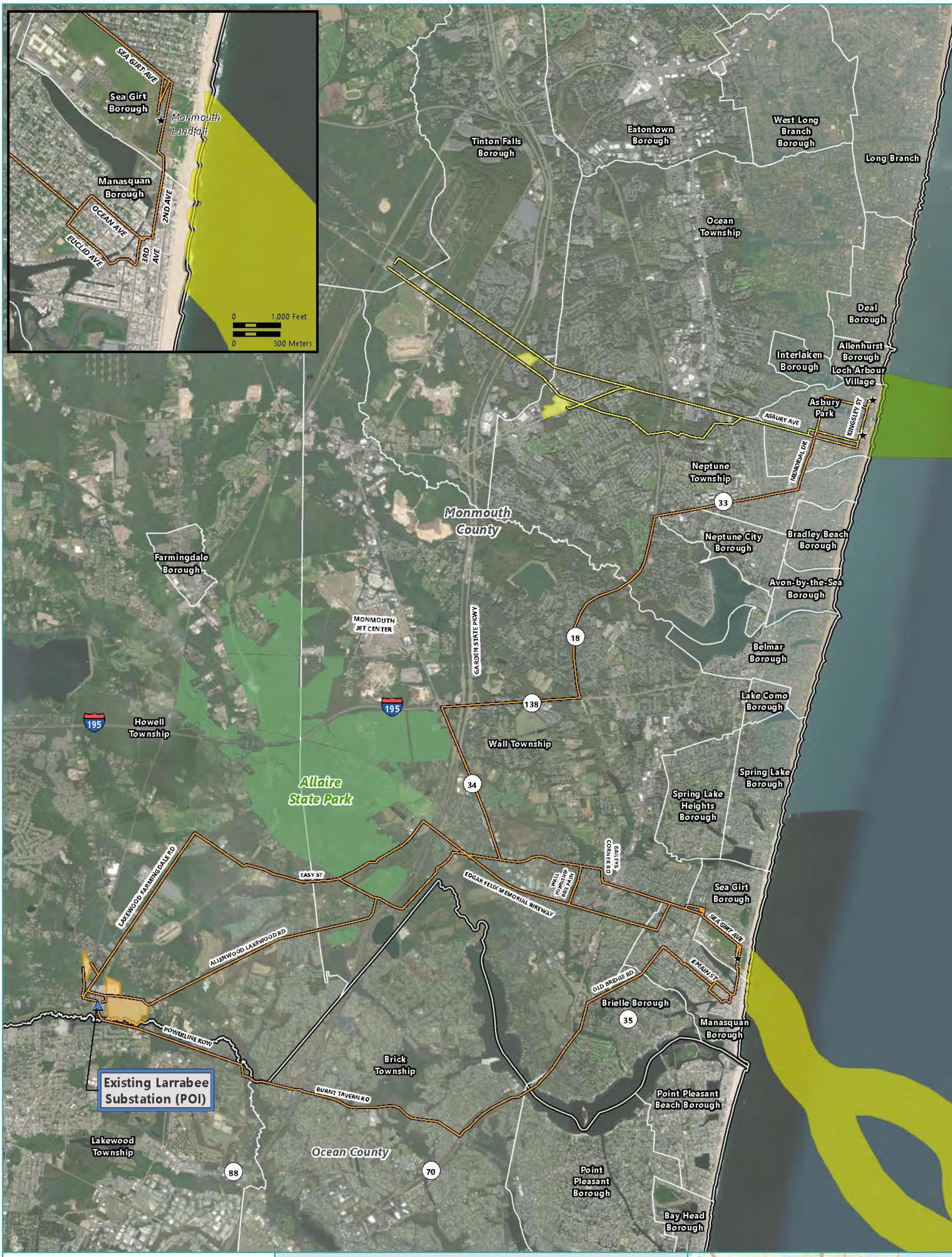
N E S W

LEGEND

- Potential Point of Interconnection
- Larrabee Onshore Interconnection Cable Route Option
- Atlantic Onshore Interconnection Cable Route Option
- Atlantic or Larrabee Onshore Interconnection Cable Route Option
- Potential Atlantic Substation and/or Converter Station
- Potential Larrabee Substation and/or Converter Station
- Potential Landfall
- Monmouth Export Cable Corridor (ECC)
- Northern ECC
- Municipal Boundaries
- County Boundaries

Map Projection: NAD 1983 UTM Zone 18N
Basemap: World Imagery (Clarity), Esri





ATLANTIC SHORES offshore wind

Figure 4.8-1a

Monmouth Landfall, Onshore Interconnection Routes, and Points of Interconnection (POI) Monmouth and Ocean County, New Jersey

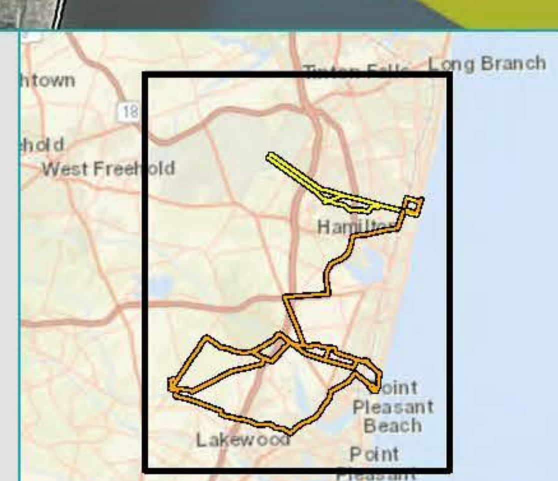
0 0.375 0.75 1.5 Mile
0 1 2 Kilometer

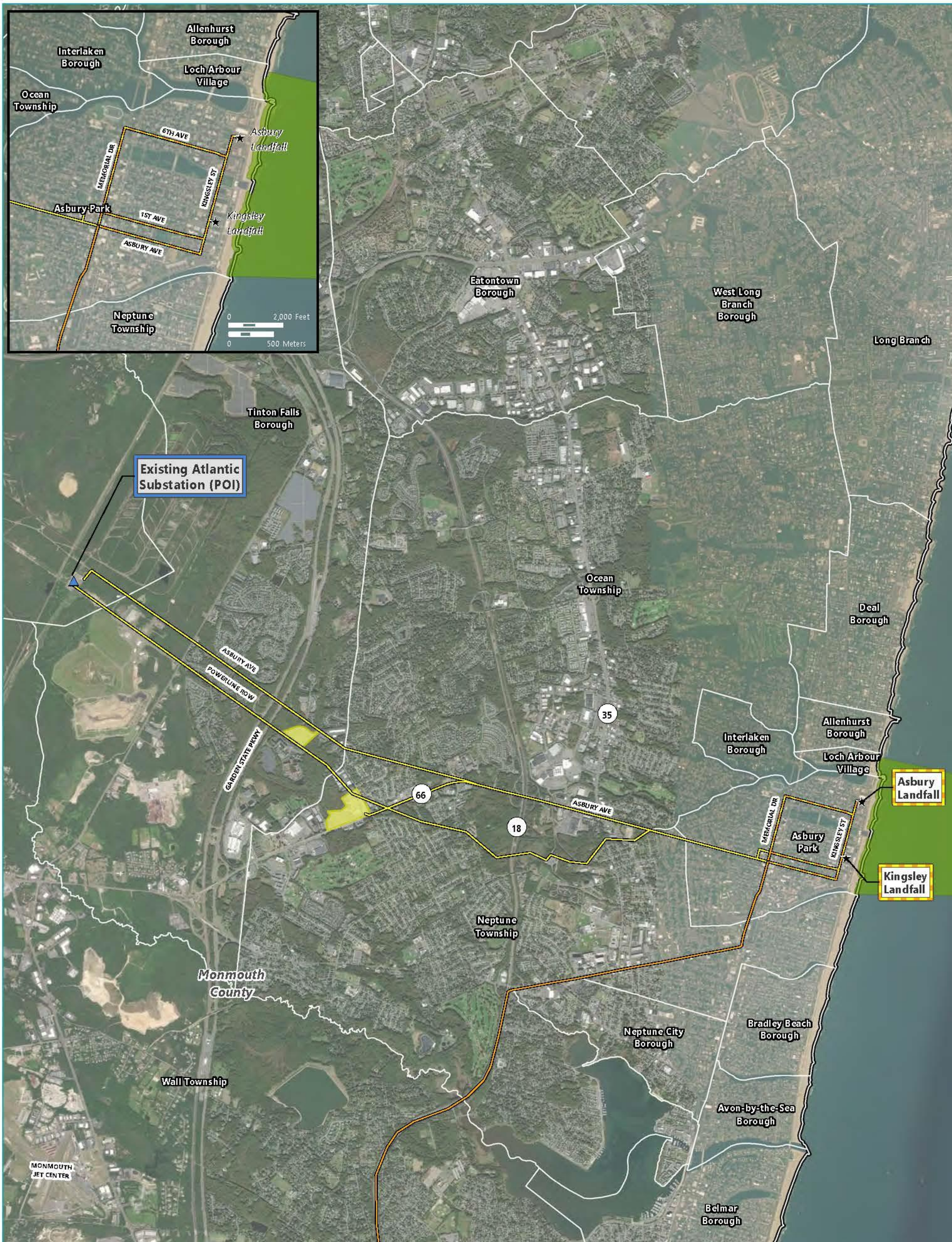
Scale 1:78,000
1 inch = 6,200 feet

LEGEND

- Potential Point of Interconnection
- Larrabee Onshore Interconnection Cable Route Option
- Atlantic Onshore Interconnection Cable Route Option
- Atlantic or Larrabee Onshore Interconnection Cable Route Option
- Potential Atlantic Substation and/or Converter Station
- Potential Larrabee Substation and/or Converter Station
- Potential Landfall
- Monmouth Export Cable Corridor (ECC)
- Northern ECC
- Municipal Boundaries
- County Boundaries

Map Projection: NAD 1983 UTM Zone 18N
Basemap: World Imagery (Clarity), Esri





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ATLANTIC SHORES offshore wind

Figure 4.8-1b

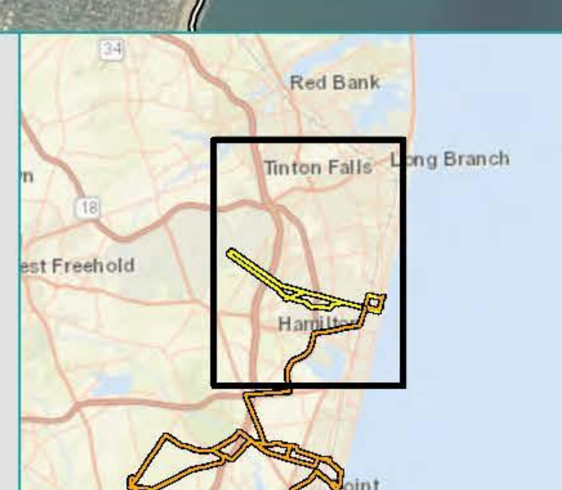
Asbury Landfalls, Onshore Interconnection Routes, and Points of Interconnection (POI) Monmouth County, New Jersey

0 0.25 0.5 1 Mile
0 0.5 1 Kilometer
Scale 1:48,000
1 inch = 4,000 feet
N S E W

LEGEND

- Potential Point of Interconnection (POI)
- Larrabee Onshore Interconnection Cable Route Option
- Atlantic Onshore Interconnection Cable Route Option
- Atlantic or Larrabee Onshore Interconnection Cable Route Option
- Potential Atlantic Substation and/or Converter Station
- Potential Landfall
- Northern Export Cable Corridor (ECC)
- Municipal Boundaries
- County Boundaries

Map Projection: NAD 1983 UTM Zone 18N
Basemap: World Imagery (Clarity), Esri



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ATLANTIC SHORES offshore wind

Figure 4.8-2

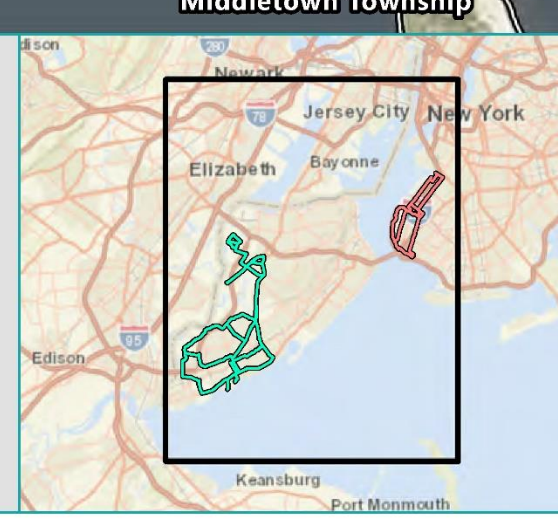
New York Landfalls, Onshore Interconnection Routes, and Points of Interconnection (POI) Richmond and Kings County, New York

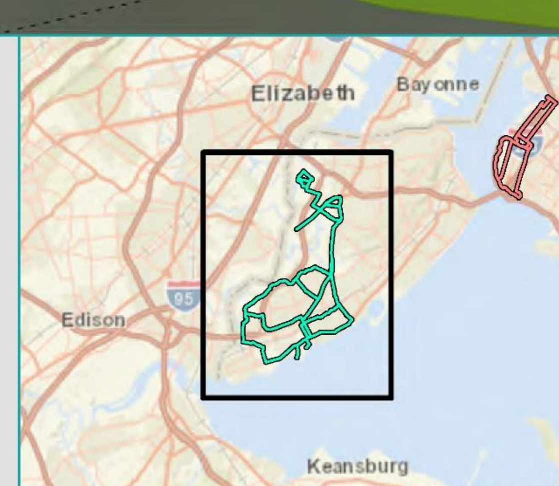
0 0.5 1 2 Mile
0 1 2 Kilometer
Scale 1:90,000
1 inch = 7,500 feet

LEGEND

- Potential Point of Interconnection (POI)
- Goethals or Fresh Kills Onshore Interconnection Cable Route Option
- Gowanus Onshore Interconnection Cable Route Option
- Potential Fresh Kills/Goethals Substation and/or Converter Station
- Potential Gowanus Substation and/or Converter Station
- Potential Landfall
- Northern Export Cable Corridor (ECC)
- New York Department of Environmental Conservation Land
- Municipal
- County Boundary
- State Waters Boundary

Map Projection: NAD 1983 UTM Zone 18N
Basemap: World Imagery (Clarity), Esri





ATLANTIC SHORES offshore wind

Figure 4.8-2a

Raritan Landfalls,
Onshore Interconnection Routes, and
Points of Interconnection (POI)
Richmond County, New York

0 0.25 0.5 1 Mile

0 0.5 1 Kilometer

Scale 1:48,000

1 inch = 4,000 feet

N W E S

LEGEND

- ▲ Potential Point of Interconnection (POI)
- Goethals or Fresh Kills Onshore Interconnection Cable Route Option
- Potential Fresh Kills/Goethals Substation and/or Converter Station
- ★ Potential Landfall
- Northern Export Cable Corridor (ECC)
- New York Department of Environmental Conservation Land
- Municipal Boundary
- County Boundary
- State Waters

Map Projection: NAD 1983 UTM Zone 18N
Basemap: World Imagery (Clarity), Esri

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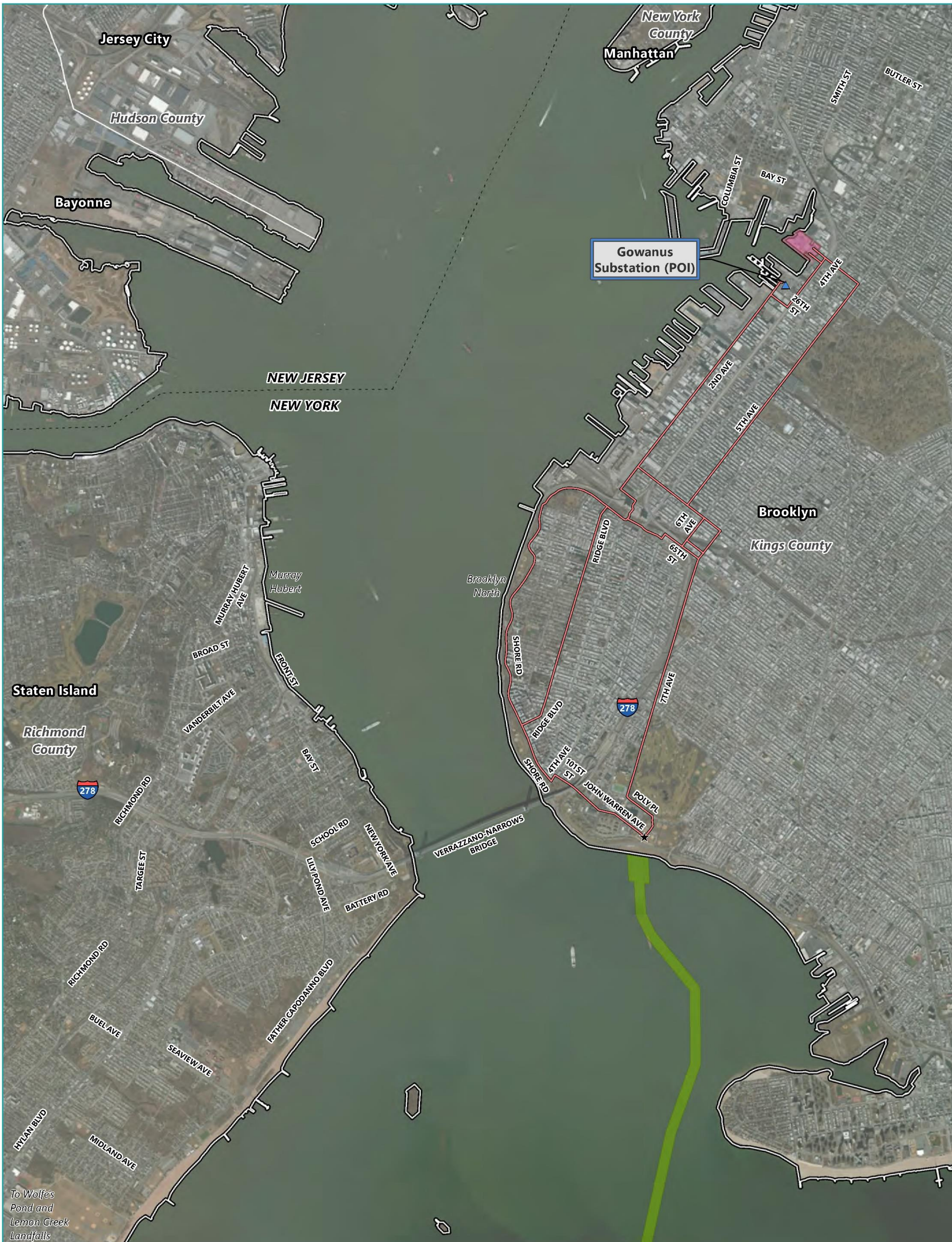


ATLANTIC SHORES offshore wind

Figure 4.8-2b

Narrows Landfalls, Onshore Interconnection Routes, and Points of Interconnection (POI) Richmond and Kings County, New York

0 0.25 0.5 1 Mile

0 0.5 1 Kilometer

Scale 1:42,000

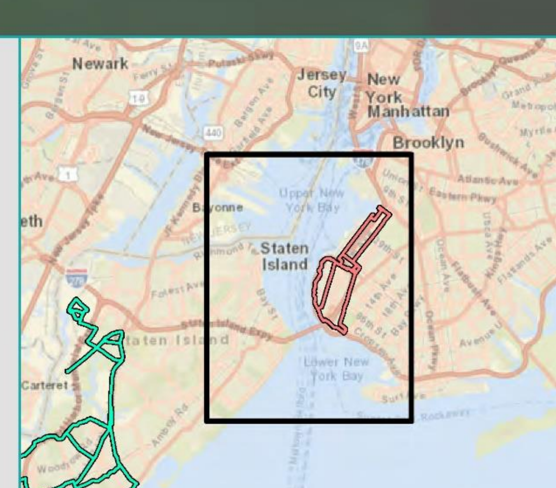
1 inch = 3,500 feet

N E S W

LEGEND

- Potential Point of Interconnection (POI)
- Goethals or Fresh Kills Onshore Interconnection Cable Route Option
- Gowanus Onshore Interconnection Cable Route Option
- Potential Gowanus Substation and/or Converter Station
- Potential Landfall
- Northern Export Cable Corridor (ECC)
- Municipal Boundary
- County Boundary
- State Waters Boundary

Map Projection: NAD 1983 UTM Zone 18N
Basemap: World Imagery (Clarity), Esri



Installation of the concrete duct banks for onshore interconnection cables will typically be accomplished via open trenching, although specialized construction techniques are anticipated at unique features such as road crossings, wetlands, and waterbodies. Depending on the types of cables used and the existing conditions along the cable alignments, the cables may be installed in a single duct bank or a dual duct bank.

During typical installation of the onshore interconnection cable duct banks or splice vaults, the associated trench will be up to 15 ft (4.5 m) in width and 12 ft (3.5 m) in depth. These dimensions are required to meet minimum standards for safe installation of the duct bank while maintaining a required 3 to 6 ft (0.9 m to 1.8 m) depth of cover over the top of the duct bank. Where dual duct banks are used, there will be a minimum separation of 5 ft (1.5 m) between the duct banks. The final duct bank size, layout and depth of cover will be determined during the detailed design (engineering) phase of the Project.

Typical construction results in the use of mechanical excavation to remove the concrete or asphalt road surface (for roadways), topsoil, and sub-grade material to the desired depth. Once a portion of the trench is opened, PVC conduit is assembled and lowered into the trench. Spacers are utilized to maintain the desired spacing of the conduits. The area around the conduit is filled with a high strength thermal concrete. The concrete is not formed but fills the entire trench width. After the concrete is installed, the trench is backfilled, and the site restored.

In areas where the onshore transmission cables cross busy roadways, wetlands, waterbodies, existing developments or features, specialty installation techniques may be implemented. These specialty installation methods would include trenchless techniques that help to avoid direct surface disturbance to reduce and/or avoid impacts to sensitive areas. These specialty techniques primarily include:

- **Horizontal directional drilling:** HDD is typically used to cross beneath relatively wide features such as interstate highways and waterbodies. As described in the context of the offshore-to-onshore transition (see Section 4.7.1), HDD commonly involves drilling a hole in an arc under the surface feature, then enlarging that hole and pulling either a large PVC or HDPE casing or several smaller PVC or HDPE conduits (in a bundle) back through the bore hole.
- **Pipe jacking:** In this method, a casing pipe originating in a jacking shaft is driven through the soil by powerful hydraulic jacks to excavate a tunnel that leads to a receiving shaft on the opposite side of the obstacle being avoided on the surface. This method results in a flexible, structural, watertight, and finished conduit for the installation of cables.
- **Jack-and-bore:** This trenchless crossing technique is used to install a casing beneath the surface feature being avoided. Relative to HDD, jack-and-bore is typically used for shorter crossings (less than approximately 200 ft [61 m]), such as those under streams or highways. A jack-and-bore is performed by excavating a bore pit and a receiving pit, located on opposite sides of the obstacle. Drilling and jacking activities are initiated from the bore pit, while the steel or concrete casing is driven into the receiving pit. As a borehole is drilled, the casing is pushed into the borehole. After the casing is in place, it is cleaned, and then smaller HDPE or PVC conduits are installed inside the casing.

Onshore construction hours will adhere to local noise ordinances. While Atlantic Shores is not anticipating significant nighttime work, any nighttime work deemed necessary will be coordinated with the local authorities. Atlantic Shores will develop a Traffic Management Plan to avoid and minimize traffic- and transportation-related impacts during construction. The TMP will be reviewed and approved by the NJDOT or NYSDOT for State highways and will also pertain to County and local roads. The TMPs will also be reviewed and approved by applicable city, town, and/or county officials for local roads. Best management practices (BMPs) for the TMP are expected to include traffic control measures such as signage, police details, lane closures, and detours, among others.

Atlantic Shores is proposing to adhere to seasonal construction restrictions for certain portions of the onshore interconnection cable route options in New Jersey and New York to avoid impacts during peak usage. Onshore construction will avoid, as practicable, the summer (generally from Memorial Day to Labor Day), subject to ongoing coordination with local authorities. Aside from busy summer traffic, these roads may also function as a coastal evacuation route so this seasonal restriction will avoid any interference with that important function.

Prior to the initiation of construction, appropriate agencies and municipalities will be contacted in order to develop a construction schedule that will minimize traffic impacts to the extent practicable. Such a schedule may include alternate traffic routes and nighttime work to minimize traffic disruption. The Project's construction and restoration activities may occur primarily at night and at other off-hours times (i.e., other than the weekday hours when vehicular traffic is highest) when practicable.

Construction laydown areas have not yet been identified, but Atlantic Shores will preferentially select workspaces that are paved or utilized for industrial uses to minimize new ground disturbance to the extent practicable.

4.9 Onshore Substations and/or Converter Stations

The Project will require the use of onshore substations (if HVAC export cables are used) and/or converter stations (if HVDC export cables are used) in both New Jersey and New York. Atlantic Shores has identified five (5) potential options for HVAC onshore substations and/or HVDC converter stations in New Jersey and three (3) potential options for HVAC onshore substations and/or HVDC converter stations in New York (see Figures 4.8-1, 4.8-1a, 4.8-1b, 4.8-2, 4.8-2a, and 4.8-2b). The feasibility of each site is being evaluated and additional information will be provided when site options have been selected.

At each onshore substation and/or converter station, transmission voltage will be stepped up or stepped down in preparation for interconnection to the electrical grid at either the existing Larrabee Substation, Atlantic Substation, Fresh Kills Substation Goethals Substation or Gowanus Substation POIs. At each onshore HVDC converter station, the current will be converted from DC to AC and the voltage will be stepped up or stepped down to match the electrical grid voltage.

4.9.1 New Jersey Onshore Substations and/or Converter Station Site Options

Atlantic Shores has identified five (5) potential locations for an HVAC onshore substation and/or HVDC converter station in New Jersey, three (3) of which have been identified for the Larrabee Onshore Interconnection Cable Route Options (see Figures 4.9-1, 4.9-2 and 4.9-3) and two (2) of which have been identified for the Atlantic Onshore Interconnection Cable Route Options (See Figures 4.9-4 and 4.9-5). All five (5) options are located on parcels that have experienced previous development and/or disturbance. None of the potential options are located within a designated floodplain. The Larrabee site options are located in areas zoned for special economic development and agricultural real estate, and the Atlantic options are located in areas zoned for commercial development.

Atlantic Shores has identified five (5) potential locations for an HVAC onshore substation and/or HVDC converter station in New Jersey. Three of the potential site options are in Howell Township, New Jersey (Lanes Pond Road Site, Randolph Road Site, and Brook Road Site) that could be utilized for a substation and/or converter station along the Larrabee interconnection cable route. One of the sites (Brook Road Site) is expected to be prepared and developed as part of the State of New Jersey Board of Public Utility (BPU) State Agreement Approach (SAA) to support multiple offshore wind generation projects that the State will procure as part of New Jersey BPU's Third Offshore Wind Solicitation (Solicitation). As part of the Solicitation, the BPU will require bidders to utilize the SAA infrastructure. Given this requirement by the BPU, all siting, permitting, and other site preparation activities associated with the substation and/or converter station at the Brook Road Site will be the responsibility of the BPU's SAA-awardee and therefore, have not been considered as part of the PDE for the Projects.

The remaining two (2) potential site options are in Tinton Falls, New Jersey (Asbury Avenue Site) and Neptune Township, New Jersey (Route 66 Site) that could be utilized for a substation and/or converter station along the Atlantic interconnection cable route.

4.9.2 New York Onshore Substations and/or Converter Station Site Options

Atlantic Shores has identified three (3) potential locations for an HVAC onshore substation and/or HVDC converter station in New York, two (2) of which (Arthur Kill Road Site and River Road Site) have been identified for the Fresh Kills/Goethals Onshore Interconnection Cable Route options and one (1) which (Sunset Industrial Park Site) has been identified for the Gowanus Onshore Interconnection Cable Route options (see Figures 4.9-6, 4.9-7 and 4.9-8). All site options are located on land parcels that have experienced significant development and/or disturbance. . All site options are located in manufacturing districts which are zoned for heavy industries that generate noise, traffic, and/or pollutants (Zone M3-1).

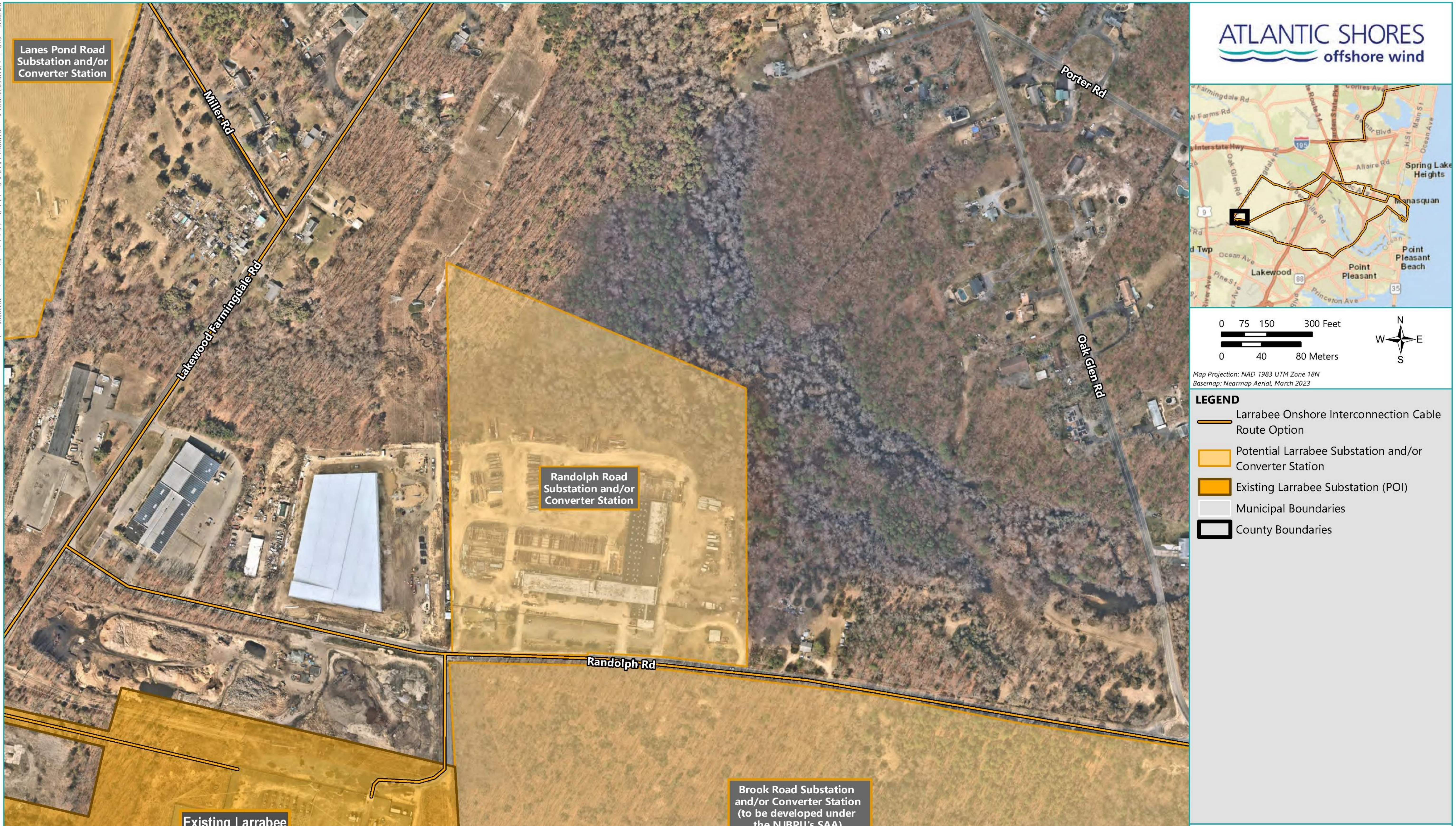
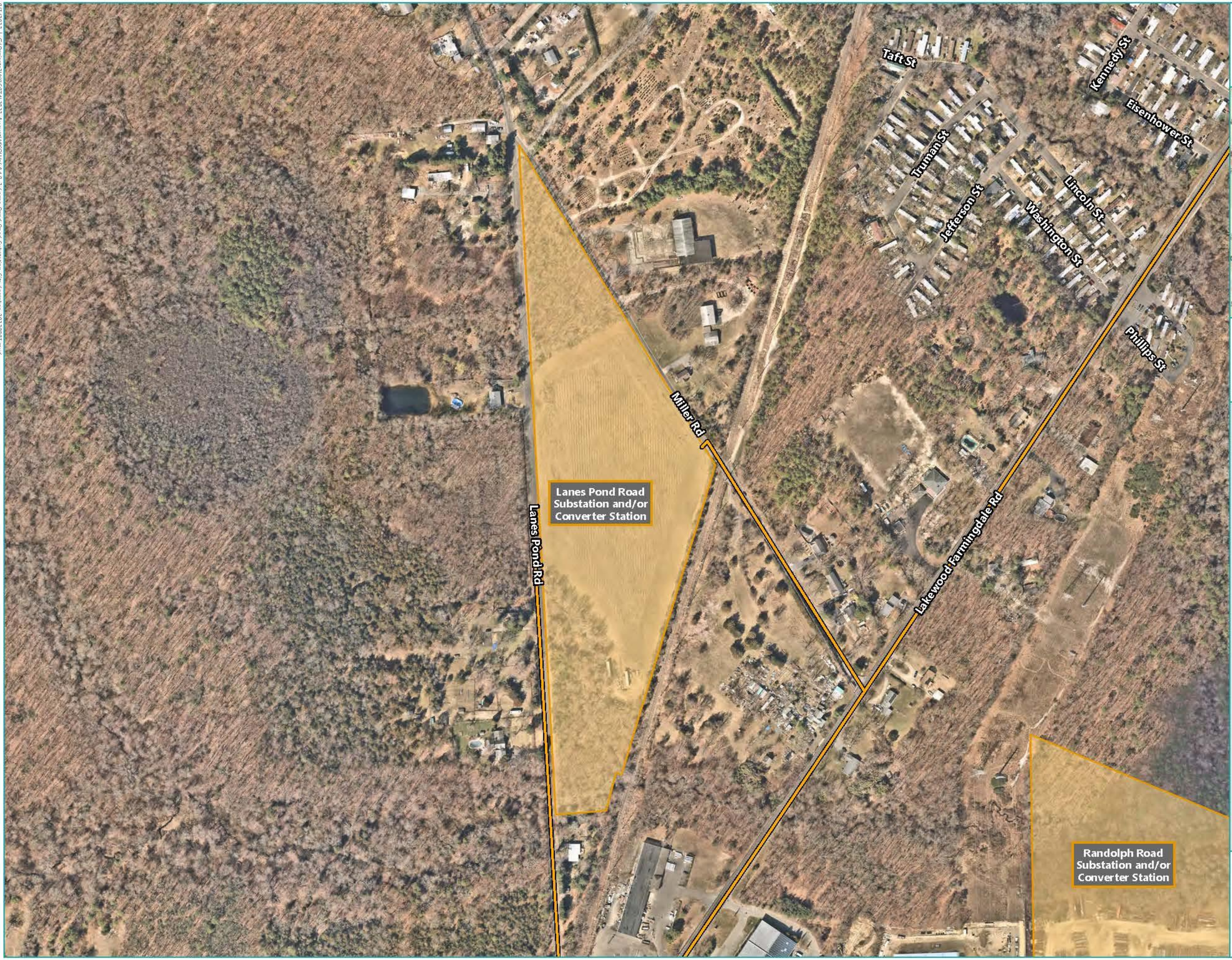
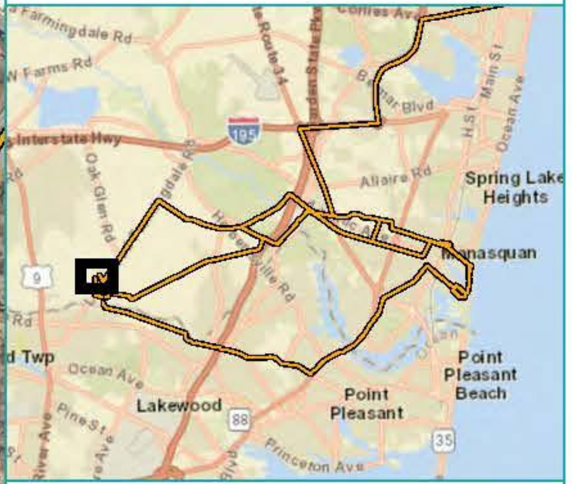


Figure 4.9-1

Randolph Road Substation and/or Converter Station Site



ATLANTIC SHORES
offshore wind



0 75 150 300 Feet
0 40 80 Meters

Map Projection: NAD 1983 UTM Zone 18N
Basemap: Nearmap Aerial, March 2023

LEGEND

- Larrabee Onshore Interconnection Cable Route Option
- Potential Larrabee Substation and/or Converter Station
- Municipal Boundaries
- County Boundaries

Figure 4.9-2

Lanes Pond Road Substation and/or Converter Station Site

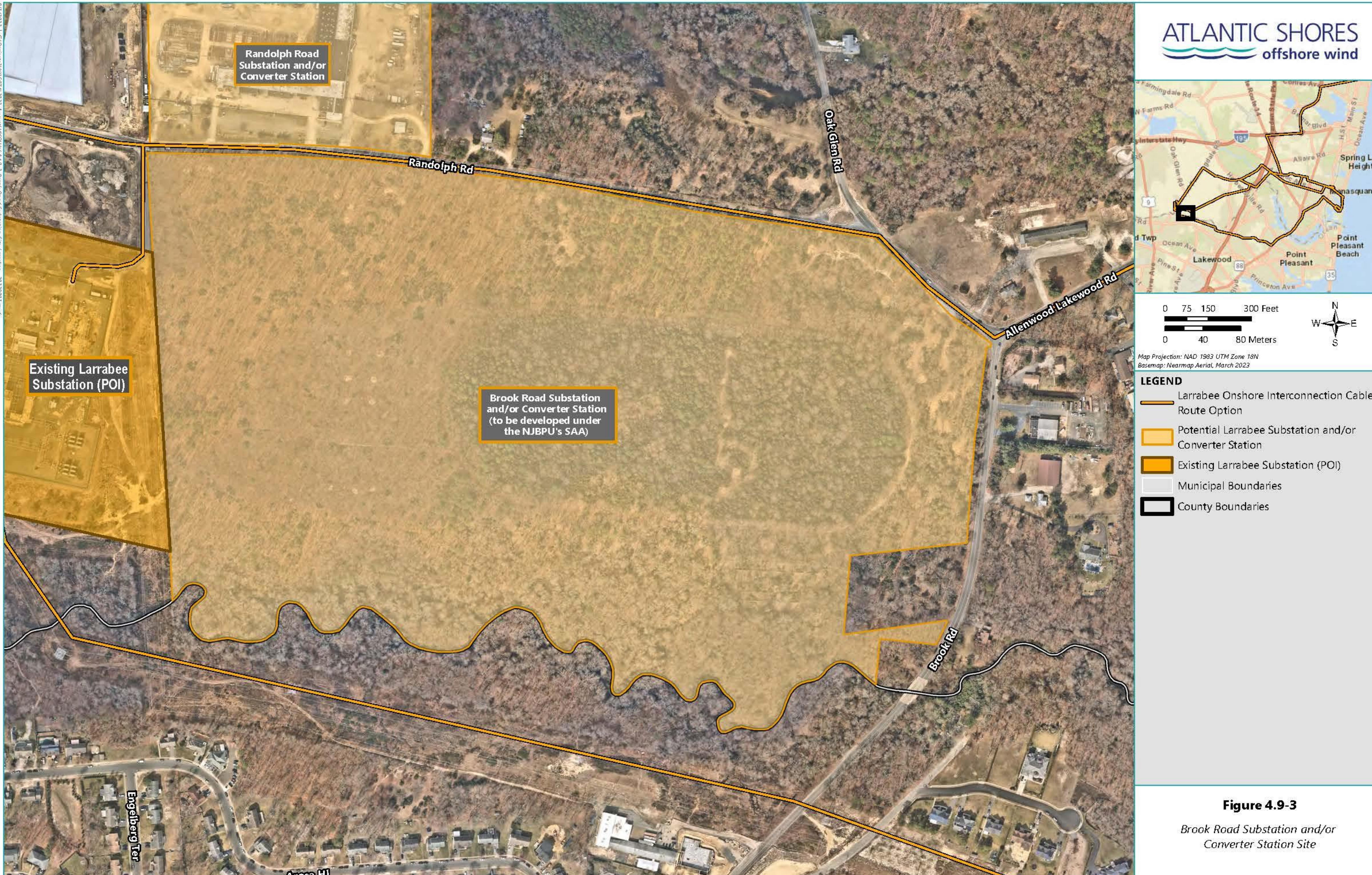


Figure 4.9-3

Brook Road Substation and/or Converter Station Site

Figure 4.9-4

Asbury Road Substation and/or Converter Station Site

ATLANTIC SHORES offshore wind

Figure 4.9-5

Route 66 Substation and/or Converter Station Site

Figure 4.9-6

Arthur Kill Substation and/or Converter Station Site

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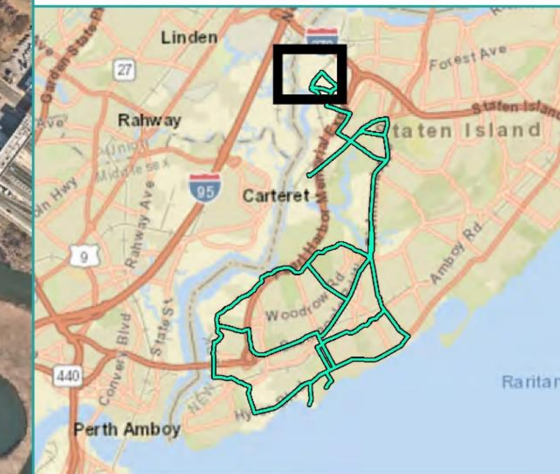

0 150 300 600 Feet
0 80 160 Meters

Map Projection: NAD 1983 UTM Zone 18N
Basemap: Nearmap Aerial, March 2023

LEGEND

- Goethals or Fresh Kills Onshore Interconnection Cable Route Option
- Potential Fresh Kills/Goethals Substation and/or Converter Station
- Municipal Boundaries
- County Boundaries
- State Waters Boundary

Figure 4.9-7

River Road Substation and/or Converter Station Site

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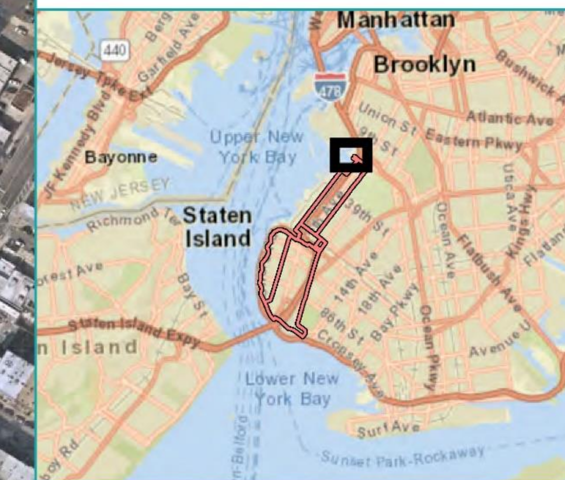
ATLANTIC SHORES offshore wind



0 75 150 300 Feet

0 40 80 Meters

N W E S

Map Projection: NAD 1983 UTM Zone 18N
Basemap: Nearmap Aerial, March 2023

LEGEND

- Gowanus Onshore Interconnection Cable Route Option
- Potential Gowanus Substation and/or Converter Station
- Municipal Boundaries
- County Boundaries

Figure 4.9-8

Sunset Industrial Park Substation and/or Converter Station Site

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4.9.3 Onshore Substation and/or Converter Station Design and Construction

The onshore substations and/or converter stations may use either an air-insulated switchgear design or a gas-insulated switchgear design pending the substations' final detailed design. The substation design and specific equipment will depend on whether the onshore interconnection cables are HVAC or HVDC and the capacity being injected into the system.

Full-volume containment will be provided for major oil-containing equipment such as oil-filled transformers and reactors (as required by applicable industry standards) and could be comprised of individual containment systems (pits) or a central collection system with a pump. Any oil containment system will be sized to contain the oil in a single piece of equipment plus rainwater, melted snow, or washdown sized in accordance with applicable industry standards. If indoor lead-acid batteries are used for the 125 volts direct current (VDC) control system, they will also be outfitted with spill containment and absorbent mats.

Construction activities for each onshore substation and/or converter station may include the following:

- surveying
- land clearing and rough grading and fencing
- trenching and excavation (for ground grid, equipment foundations, and cable and conduit trenches/duct banks)
- installation of equipment foundations
- installation of substation equipment
- wiring and connections
- final grading
- commissioning
- energization
- system testing.

Onshore substation and/or converter station sites may be disturbed during clearing and grading. Tree removal may be required and will be minimized to the extent practicable.

A crane may be used to erect equipment and poles, to set major substation equipment (e.g., transformers, reactors, STATCOMs, harmonic filters, buswork, switchgear, breakers, switches, prefabricated buildings) onto foundations, and to move construction equipment (e.g., storage containers, offices, welders, generators, cable reels, cable pullers) around the site.

General substation lighting will be manually engaged on an as-needed basis if examination of equipment occurs at night. The expected use of general substation lighting will be daily during construction, start-up, and commissioning, and about three times a year during normal operations.

Light fixtures will be light-emitting diode (LED) floodlights mounted on dedicated poles or lightning masts (likely 40 to 50 ft [12 to 15 m] high) to illuminate the general substation area. Illumination levels are expected to be no more than 22 lux (2 foot-candle [fc]). Any nighttime lighting for repairs or detailed inspections would be on an as-needed basis. This should be infrequent.

In addition to general substation lighting, one photocell-controlled pole-mounted LED streetlight-style fixture will be placed at the entrance gate. The fixture will be hooded to minimize glare and off-site spillover. Light fixtures will also be placed at entrance doors to the substation control building and other buildings. These fixtures will be wall-mounted and equipped with hoods to direct and limit the illumination. Atlantic Shores will coordinate with local officials to ensure the lighting scheme complies with any applicable municipal requirements.

During construction, a job-site safety program will be implemented to prevent public access to the construction site. Once the onshore substation and/or converter station is operational, a security plan will control site access by employing fencing (with earth grounding), screening barriers, camera systems, signage, and physical barriers. Existing vegetative buffers will be enhanced (only native vegetative species will be used) and setback, landscaping, buffering, screening, and/or lighting will be provided along exposed sides of the site. Atlantic Shores expects to coordinate with local authorities regarding the use of vegetative buffers at the onshore substations and/or converter stations. A stormwater management system will be designed for the onshore substation and/or converter station sites and will include low-impact development (LID) strategies (e.g., grass water quality swales to capture and convey site runoff, deep sump catch basin(s) to pretreat surface runoff, etc.) designed to capture, treat, and recharge stormwater runoff in accordance with State pollutant discharge elimination system programs and/or Municipal Separate Storm Sewer System (MS4) standards as appropriate.

4.10 Proposed Construction Vessels, Vehicles, and Aircraft

The following discussion summarizes the vessels, vehicles, and aircraft expected to be used during offshore and onshore construction. Vessels, vehicles, and aircraft intended for use O&M activities are described in Section 5.6.

4.10.1 Offshore Construction

Construction of the offshore portion of the Project will require the use of many different types of vessels. Some of these vessels are typical ocean-going vessels, while others are purpose-built to perform specific tasks related to construction of offshore wind and/or buried cable installation. Alongside these vessels, helicopters are sometimes used for crew transfer operations and may also be used for visual inspection of equipment while vessels continue with installation activities. Atlantic Shores may also use fixed-wing aircraft to support environmental monitoring and mitigation.

Offshore construction will be divided into different campaigns including foundation installation, scour protection installation, OSS installation, WTG installation, inter-array cable installation, inter-link cable installation (if needed), and export cable installation. While performing construction tasks, vessels may anchor, jack-up, or maintain their position using DP systems. DP systems use a continually adjusting propulsion system to keep the vessel steady in a single location. Jack-up vessels have legs that lower into the seabed and brace the vessel as it elevates above sea level, where it can safely perform operations in a stable, elevated position.

Atlantic Shores has not yet selected the specific vessels that will carry out construction activities. For the purposes of this Construction and Operations Plan (COP), representative vessel types are presented rather than specific vessels, and vessel specifications such as length, width, and speed are based on typical ranges for each type of vessel. Because the number of vessels and the number of vessel trips depend on the specific vessels used, estimates were generated using sample vessels and preliminary Project plans. Currently anticipated vessel types are shown in Table 4.10-1.

Currently, maximum estimates for the total number of vessels required for any single offshore construction activity range from two vessels for scour protection installation to up to 16 vessels for OSS installation. For export cable installation, Atlantic Shores estimates that up to six vessels could be operating at once. In the unlikely event that all Project-related construction activities were to occur simultaneously, up to 24 vessels could be present within the Offshore Project Area at any one time.

Table 4.10-1 Representative Offshore Construction Vessels

Role	Vessel Type	Count	Approx. Length	Approx. Width	Approx. Operational Speed (knots)
Foundation Installation					
Foundation Installation	Bulk Carrier	1	722-755 ft (220-230 m)	66-82 ft (20-25 m)	10
	Medium heavy Lift Vessel	1	591-722 ft (180-220 m)	131-164 ft (40-50 m)	10
	Jack-Up Vessel	1	591-607 ft (180 – 185 m)	197 ft (60 m)	10
Bubble Curtain Support Vessel	Tugboat	1	230-246 ft (70 – 75 m)	49-66 ft (15 – 20 m)	10
Transport Barge	Barge	2-3	394-410 ft (120 – 125 m)	98-115 ft (30 – 35 m)	3-10
Towing Tugboat	Tugboat	2-6	98-115 ft (30 – 35 m)	33-49 ft (10 – 15 m)	3-10
Support Vessel	Service Operation Vessel	1	295-344 ft (90 – 105 m)	49-66 ft (15 – 20 m)	10
Crew Transfer and Noise Monitoring	CTV	1	82-98 ft (25 – 30 m)	30-33 ft (9 – 10 m)	29
OSS Installation					
OSS Installation	Large Heavy Lift Vessel	1	640-656 ft (195 – 200 m)	279-295 ft (85 – 90 m)	10
	Medium Heavy Lift Vessel	1	591-722 ft (180 – 220 m)	131-164 ft (40-50 m)	10
Bubble Curtain Support Vessel	Tugboat	1	230-246 ft (70 – 75 m)	49-66 ft (15 – 20 m)	10
Transport Barge	Barge	4	394-410 ft (120 – 125 m)	98-115 ft (30 – 35 m)	10
Towing Tugboat	Tugboat	4	98-115 ft (30 – 35 m)	33-49 ft (10 – 15 m)	10
Assistance Tugboat	Tugboat	2	230-246 ft (70 – 75 m)	49-66 ft (15 – 20 m)	10
Crew Transfer and Noise Monitoring	CTV	1	82-98 ft (25 – 30 m)	30-33 ft (9 – 10 m)	29

Role	Vessel Type	Count	Approx. Length	Approx. Width	Approx. Operational Speed (knots)
Scour Protection					
Scour Protection Installation	Fall Pipe Vessel	1	623-640 ft (190 – 195 m)	131-148 ft (40 – 45 m)	10
Dredging	Dredger	1	640-656 ft (195 – 200 m)	131-148 ft (40 – 45 m)	10
WTG Installation					
WTG Installation	Jack-Up Vessel	1	591-607 ft (180 – 185 m)	197 ft (60 m)	10
Towing Tugboat	Towing Tugboat	2	98-115 ft (30 – 35 m)	33-49 ft (10 – 15 m)	10
Feeder Vessel	Jack-Up Feeder	2	407-410 ft (124-125 m)	128-131 ft (39-40 m)	10
	Barge	2-3	394-410 ft (120 – 125 m)	98-115 ft (30 – 35 m)	10
	Harbor Tugboat	1	98-115 ft (30 – 35 m)	33-49 ft (10 – 15 m)	10
WTG Commissioning and Crew Transfer	Service Operation Vessel	1	295-344 ft (90 – 105 m)	49-66 ft (15 – 20 m)	10
	CTV	1	82-98 ft (25 – 30 m)	30-33 ft (9 – 10 m)	29
Inter-Array Cable Installation					
Cable Installation	Cable Installation Vessel	1	246-541 ft (75 – 165 m)	82-115 ft (25 – 35 m)	10
Support Vessel	Service Operation Vessel	1	295-344 ft (90 – 105 m)	49-66 ft (15 – 20 m)	10
Inter-Array Cable Installation					
Cable Burial Vessel	Cable Installation Vessel	1	246-541 ft (75 – 165 m)	82-115 ft (25 – 35 m)	10
Dredging	Dredger	1	640-656 ft (195 – 200 m)	131-148 ft (40 – 45 m)	10
Anchor Handling Tug Supply (AHTS) Vessel	AHTS	2	246-262 ft (75 – 80 m)	49-66 ft (15 – 20 m)	10
Rock Dumping Vessel	Fall Pipe Vessel	1	623-640 ft (190 – 195 m)	131-148 ft (40 – 45 m)	10

Role	Vessel Type	Count	Approx. Length	Approx. Width	Approx. Operational Speed (knots)
Export Cable Installation					
Cable Installation	Cable Installation Vessel	1	246-541 ft (75 – 165 m)	82-115 ft (25 – 35 m)	10
Support & Jointing Vessel	Support Vessel	1	312-328 ft (95 – 100 m)	66 ft (20 m)	10
Dredging	Dredger	1	640-656 ft (195 – 200 m)	131-148 ft (40 – 45 m)	10
AHTS Vessel	AHTS	1	246-262 ft (75 – 80 m)	49-66 ft (15 – 20 m)	10
Rock Dumping Vessel	Fall Pipe Vessel	1	640-656 ft (195 – 200 m)	131-148 ft (40 – 45 m)	10
Fuel Bunkering					
Towing Tugboat	Towing Tugboat	1	98-115 ft (30 – 35 m)	33-49 ft (10 – 15 m)	10
Transport Barge	Barge	1	394-410 ft (120 – 125 m)	98-115 ft (30 – 35 m)	10

4.10.2 Onshore Construction

Onshore construction can be broken into two key activities: construction of the onshore substation and/or converter station and installation of the onshore interconnection cables/duct bank. Onshore construction will be performed using standard construction equipment typical for onshore infrastructure projects such as the installation of new transmission lines.

Onshore construction equipment can be expected to include excavators, concrete trucks, forklifts, trenchers, loaders, and backhoes. Typical grading equipment will be used for any clearing and grading needed at the onshore substation and/or converter station site. Onshore substation and/or converter station equipment is expected to be delivered by large trucks and may include oversized-load deliveries. Installation of substation equipment could also require the use of cranes and other support vehicles.

Installation of the onshore interconnection cables and concrete duct bank will require the use of typical construction equipment such as dump trucks, front-end loaders, concrete trucks, and excavators. Cable installation will also require construction vehicles that are more specifically designed for cable management such as winches and cable reel trucks.

4.10.3 Construction Port Facilities and Staging Areas

Atlantic Shores has identified several port facilities in New Jersey, New York, the Mid-Atlantic, and New England that may be used for major construction staging activities for the Project. In addition, some components, materials, and vessels could come from U.S. Gulf Coast or international ports.

Construction ports will be utilized for the following functions:

- crew transfers
- component fabrication and assembly
- receiving and offloading shipments of Project components
- storing Project components
- preparing Project components for installation
- loading Project components onto installation vessels or other suitable vessels for delivery to the Offshore Project Area for installation
- preparing vessels to tow floating components to the Lease Area.

A list of U.S. ports considered for temporary use during major construction staging activities is provided in Table 4.10-2 and depicted on Figure 4.10-1; it is likely that only some of the ports identified will be utilized for Project construction.

Other industrial ports not identified in Table 4.10-2 may be utilized for limited, basic activities associated with marine construction in general rather than offshore wind specifically. These activities may include, but are not limited to, refueling (although some refueling is expected to occur offshore), restocking supplies, and sourcing parts for repairs.

All port facilities being considered to support Project construction are located within industrial waterfront areas with existing marine industrial infrastructure or where such infrastructure is proposed for development within the required Project timeframe. Some port requirements specifically pertaining to offshore wind construction projects include the following:

- high load-bearing ground and deck capacity, especially quayside
- adequate vessel berthing parameters, including depth of berths to accommodate large installation vessels
- suitable laydown and fabrication space, which may require grading and resurfacing.

Atlantic Shores will not implement any port improvements but may contribute financial support to a port's redevelopment as part of a multi-developer economic incentive package. Any port development will occur independent of the Project, including any permitting or approvals that the port facility owner/lessor may need to obtain. If structures, vessels, and/or cranes more than 200 ft (61 m) high are required to accommodate construction, necessary approvals from the Federal Aviation Administration (FAA) will be obtained.

Identifying a wide range of construction ports for the Project is important because many port entities have plans to upgrade or further develop port facilities in support of the burgeoning offshore wind industry. It is essential for the Project to have the ability to utilize the most appropriate port facilities for construction given uncertainties regarding which planned port upgrades will be completed within the Project's development schedule and projected demand for the port facilities by other offshore wind developers. While Atlantic Shores anticipates that a subset of the ports identified in Table 4.10-2 will be utilized for Project construction; the ports ultimately selected for use will depend on the status of port upgrades and final construction logistics planning.

Table 4.10-2 Ports That May Be Used During Construction of the Project

Port	Location	Description	Staging/Pre-Assembly Activities that May Occur			
			WTG	OSS	Foundation	Offshore Cables
New Jersey Wind Port	Lower Alloways Creek, New Jersey	New Jersey plans to develop the New Jersey Wind Port as a marshaling and manufacturing site for offshore wind projects. Phase 1 of port construction is targeted to start in 2021, and New Jersey anticipates the port will become available in 2023 with a 30-acre (0.12-km^2) marshaling area, 25-acre (0.10-km^2) manufacturing site, and heavy-lift wharf. Phase 2 of port construction is targeted to start in 2023. As part of Phase 2, more than 160 acres (0.65 km^2) of additional marshaling and manufacturing space with additional berths and room for Tier 2 suppliers is expected to become available in 2024-2026 (State of New Jersey 2020).	• Includes full tower assembly	•	• For piled, suction bucket, and gravity foundations	•
Port of Paulsboro	Paulsboro, New Jersey	The Paulsboro Marine Terminal comprises 200 acres (0.81 km^2) on the Delaware River. Its available berth is approximately 850 ft (260 m) in length, with a water depth of approximately 40 ft (12 m) at Mean Low Water (MLW). The port is currently being developed for staging and manufacturing monopiles. The existing 850-foot-long (260-m-long) quayside is currently fully utilized, but an additional 1,500-ft (457-m) quayside is under construction and will have a bearing capacity of 1,500 pounds per square foot (psf) (73 ton/m^2). Construction is expected to be completed in 2021 (South Jersey Port Corporation 2020).	•	• For smaller OSS types	• For piled and gravity foundations	•

Port	Location	Description	Staging/Pre-Assembly Activities that May Occur			
			WTG	OSS	Foundation	Offshore Cables
Repauno Port & Rail Terminal	Greenwich Township, New Jersey	Repauno Port & Rail Terminal (Repauno) is a 1,600-acre (6.47 km^2) site along the Delaware River in Greenwich Township, New Jersey. Formerly the site of a DuPont manufacturing facility, the site is currently being redeveloped into a multi-use port facility for energy products, roll-on/roll-off, project cargo, bulk cargo, warehousing, and logistics. The port features a new multi-purpose dock with an approximately 40-ft (12-m) draft capable of handling a wide variety of products.	•	• For smaller OSS types	• For piled and gravity foundations	•
New York Ports						
Arthur Kill Terminal	Staten Island, New York	The Arthur Kill Terminal is a proposed 32-acre (0.13 km^2) port facility in Staten Island, New York that will be developed for offshore wind facility staging and assembly. The terminal will feature strong bearing capacity for WTGs, on-site warehouse storage for equipment, and an approximately 1,300 ft (396 m) quayside designed for simultaneous vessel berthing (Atlantic Offshore Terminals c2020). The facility may be operational by 2023.	• Includes full tower assembly	•	• For piled, suction bucket, and gravity foundations	•

Port	Location	Description	Staging/Pre-Assembly Activities that May Occur			
			WTG	OSS	Foundation	Offshore Cables
Port of Albany	Albany, New York	The 343-acre (1.39 km^2) Port of Albany features deep-water facilities and wharfs on both sides of the Hudson River, including 4,200 ft (1,280 m) of wharf on the Albany side of the river and 1,200 ft (366 m) on the Rensselaer side of the river. The undeveloped portion of the Port of Albany at Beacon Island may be used to support offshore wind development activities. The developed portion of the Port is used for bulk and break bulk, heavy lift/project cargo, offshore wind development activities, and other various functions (Port of Albany 2019).	•		• For piled and gravity foundations	•
Port of Coeymans Marine Terminal	Coeymans, New York	The 400-acre (1.6 km^2) Port of Coeymans Marine Terminal is a privately-owned port located on the Hudson River approximately 10 mi (16 km) south of Albany and 100 mi (160 km) north of New York City. The inlet channel associated with the terminal has approximately 3,260 ft (994 m) of water frontage (COWI North America 2017; Port of Coeymans 2020). The Port serves a variety of projects such as bridge assembly and construction and is the resource and disaster recovery hub of the Northeast.	•		• For piled and gravity foundations	•

Port	Location	Description	Staging/Pre-Assembly Activities that May Occur			
			WTG	OSS	Foundation	Offshore Cables
Virginia Ports						
Portsmouth Marine Terminal	Portsmouth, Virginia	Portsmouth Marine Terminal occupies 287 acres (1.2 km^2) on the west bank of the Elizabeth River in Portsmouth, Virginia. The terminal is operated by CSX Intermodal Terminals, Inc. and serves both domestic and international freight. It currently handles containers, breakbulk, and roll-on/roll-off cargo. The facilities include approximately 3,540 ft (1,079 m) of wharf and three berths (Virginia Port Authority 2020).	• Includes full tower assembly	•	• For piled, suction bucket, and gravity foundations	•
Specialty Ports						
Ingleside	Ingleside, Texas	Jackets, topsides, onshore and offshore modules, living quarters, subsea kits, piles, and tendons are fabricated at this 500-acre (2-km^2) manufacturing site. The site also houses the world's largest offshore lifter that is 550 ft (167 m) tall and can lift 13,000 tons.		•	• For piled, suction bucket, and gravity foundations	

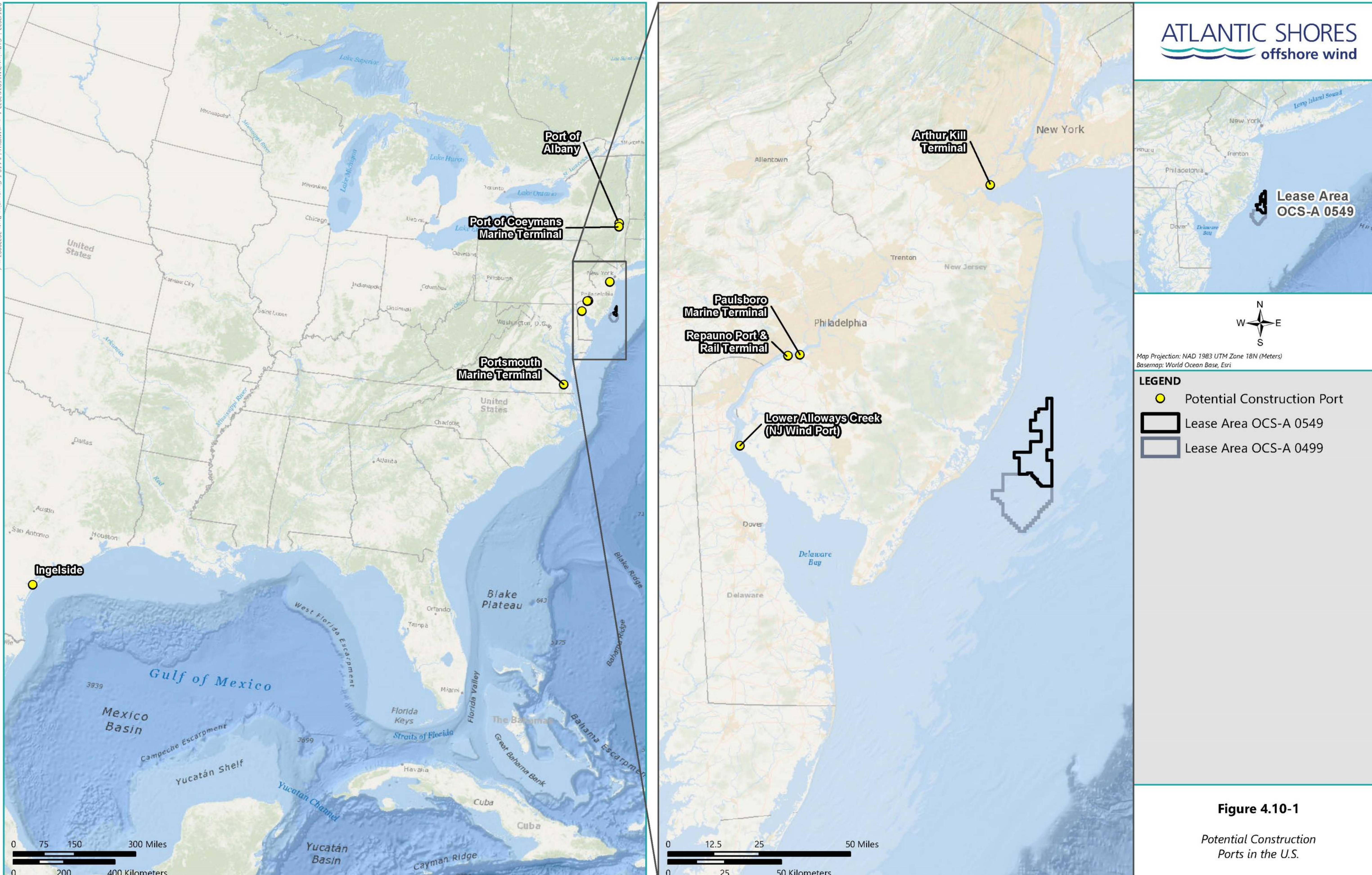

Figure 4.10-1

Potential Construction Ports in the U.S.

4.11 Summary of Maximum Design Scenario and Seafloor Disturbance

This section describes how the PDE described in Sections 4.1 through 4.9 was used to define the maximum design scenario for the resource assessments in Volume II. Potential effects to resources were evaluated using the maximum potential build-out of the Project:

- The maximum onshore build-out of the Project is defined as construction at landfall sites in both New Jersey and New York, installation of onshore interconnection cables, and construction of new onshore substations and/or converter stations (one for each designated POI).
- The maximum onshore build-out of the Project is defined as construction at either or both landfall sites, installation of onshore interconnection cables within identified interconnection cable routes, and construction of new onshore substations and/or converter stations.
- The maximum offshore build-out of the Project is defined as installation of up to 157 WTGs, 8 small OSSs,[14] one permanent met tower, two temporary metocean buoys, up to 8 offshore export cables (with a maximum total length of 416.5 mi [670.2 km]), 466 mi (750 km) of inter-array cables, and 62.1 mi (100 km) of inter-link cables, along with associated scour and cable protection.

In addition to using the maximum onshore or offshore build-out of the Project, each specific resource section in Volume II further describes if there are any additional aspects of the PDE used to define the maximum design scenario for that resource (such as if all 157 WTGs are assumed to use a particular foundation type).

The maximum area of total permanent and temporary seabed disturbance in the Lease Area and ECCs from construction of the Project is provided in Table 4.11-1. The maximum area of total permanent and temporary seabed disturbance for the Project is provided in Tables 4.11-2 and 4.11-3, respectively. The "Basis of Calculation" column describes which option included within the PDE was used to calculate the maximum potential seabed disturbance.

14 Alternatively, for some resources, the maximum design scenario considers four medium or three large OSSs.

Table 4.11-1 Maximum Total Seabed Disturbance

Installation Activity	Maximum Area of Seafloor Disturbance			Basis of Calculation
	Permanent Disturbance	Additional Temporary Disturbance	Total[a]	
WTG Foundation Installation (Including Scour Protection)	0.63 mi² (1.63 km²)	0.43 mi² (1.11 km²)	1.06 mi² (2.75 km²)	**For permanent disturbance:** 157 suction bucket jacket foundations with a total permanent footprint (foundation + scour protection) of 111,987.6 ft² (10,404.0 m²) each. **For additional temporary disturbance:** 157 mono-bucket foundations with an additional seabed disturbance of 76,835.7 ft² (7,138.3 m²) each. **For total disturbance:** 157 suction bucket jacket foundations with a total seabed disturbance of 159,348.8 ft² (14,804.0 m²) each. See Table 4.2-1 in Section 4.2.
WTG Installation and Commissioning	N/A (Included in WTG foundation footprint)	0.09 mi² (0.23 km²)	0.09 mi² (0.23 km²)	157 WTGs installed with 10,763.9 ft² (1000.0 m²) of disturbance from one jack-up WTG installation vessel and 4,869.5 ft² (452.4 m²) of disturbance from one jack-up feeder vessel at each WTG position. See Table 4.3-2 in Section 4.3.
OSS Foundation Installation (Including Scour Protection), Topside Installation, and Commissioning	0.03 mi² (0.11 km²)	0.04 mi² (0.10 km²)	0.06 mi² (0.16 km²)	**For permanent disturbance:** Three large OSSs using suction bucket jacket foundations, with a total permanent footprint (foundation + scour protection) of 282,961.4 ft² (26,288.0 m²) each. **For additional temporary disturbance:** Eight small OSSs using mono-bucket foundations, each with an additional seabed disturbance of 76,835.7 ft² (7,138.3 m²) for foundation installation and 58,125.1 ft² (5,400.0 m²) for topside installation and commissioning. **For total disturbance:** Eight small OSSs using suction bucket jacket foundations, each with a total seabed disturbance of 159,348.8 ft² (14,804.0 m²) for foundation installation and 58,125.1 ft² (5,400.0 m²) for topside installation and commissioning. See Table 4.2-1 in Section 4.2 and Tables 4.4-1, 4.4-2, and 4.4-4 in Section 4.4.
Export Cable Installation (Including HDD and Cable Protection)				
New York Landfall Site to OSS	0.39 mi² (1.01 km²)	3.00 mi² (7.76 km²)	3.40 mi² (8.81 km²)	Installation of export cables to Asbury and New York Landfall Sites with a total length of 416.7 mi (670.6 km) for all cables, along with six 2,153-ft² (200-m²) HDD pits and four 2,583 ft² (240-m²) cofferdams at the landfall site. See Table 4.5-1 in Section 4.5 and Section 4.7.1.
Monmouth Landfall Site to OSS	0.35 mi² (0.90 km²)	2.21 mi² (5.73 km²)	2.56 mi² (6.63 km²)	Installation of export cables with a total length of 334.4 mi (538.1 km) for all cables, along with six 2,153-ft² (200-m²) HDD pits and four 2,583 ft² (240-m²) cofferdams at the landfall site. See Table 4.5-1 in Section 4.5 and Section 4.7.1.

Installation Activity	Maximum Area of Seafloor Disturbance			Basis of Calculation
	Permanent Disturbance	Additional Temporary Disturbance	Total[a]	
Inter-Array Cable Installation (Including Cable Protection)	0.41 mi^2 (1.06 km^2)	2.49 mi^2 (6.45 km^2)	2.90 mi^2 (7.51 km^2)	Installation of 466 mi (750.0 km) of inter-array cables. See Table 4.5-2 in Section 4.5.
Inter-Link Cable Installation (Including Cable Protection)	0.06 mi^2 (0.16 km^2)	0.42 mi^2 (1.09 km^2)	0.48 mi^2 (1.24 km^2)	Installation of 62.1 mi (100.0 km) of inter-link cables. See Table 4.5-2 in Section 4.5.
Met Tower Installation (Including Scour Protection)	N/A	N/A	N/A	There is sufficient conservatism in the total estimates of permanent and temporary seafloor disturbance from WTG foundation installation to account for the impacts from the met tower's installation. See Section 4.6.1.
Metocean Buoy Installation	N/A	0.01 mi^2 (0.03 km^2)	0.01 mi^2 (0.03 km^2)	Installation of two temporary metocean buoys with a total temporary seafloor disturbance of 0.005 mi2 (0.013 km2) each. See Section 4.6.2.
Max. Total Seabed Disturbance in the Lease Area	1.38 mi^2 (3.58 km^2)	4.00 mi^2 (10.36 km^2)	5.38 mi^2 (13.93 km^2)	Combined seabed disturbance from WTG foundation installation, WTG installation and commissioning, OSS installation and commissioning, met tower installation, metocean buoy installation, inter-array and inter-link cable installation, and installation of the portion of the export cables within the Lease Area.
Max. Total Seabed Disturbance in the ECCs	0.75 mi^2 (1.94 km^2)	5.21 mi^2 (13.5 km^2)	5.96 mi^2 (15.44 km^2)	Combined seabed disturbance from the installation of five export cables in the Northern ECC and four export cables in the Monmouth ECC from the landfall sites to the boundary of the Lease Area (see Table 4.5-1 in Section 4.5).

Note:
For WTG, OSS, and met tower foundations, the foundation type with the maximum footprint is not the same as the type with the maximum area of additional seabed disturbance. Thus, the sum of the maximum area of permanent disturbance and additional temporary disturbance does not equal the total seabed disturbance.

5.0 Operations and Maintenance

Once commissioned, the Project is designed to operate for up to 30 years.[15] O&M activities will ensure that the Project functions safely and efficiently during this time. To minimize equipment downtime and maximize energy generation, Atlantic Shores will conduct O&M activities through scheduled, predictive, and remotely controlled activities. O&M activities will be performed by experienced, well-trained personnel.

The health and safety of people and protection of the environment are at the forefront of planning and execution for all O&M activities (see Section 1.5.3). Atlantic Shores will reinforce this priority by ensuring that personnel comply with all applicable HSSE laws and regulations and by developing and refining O&M procedures through an iterative process that incorporates knowledge gained throughout the Project's operations and from other offshore wind projects.

The Project's O&M strategy builds upon the following guiding principles:

- health and safety
- environmental protection
- compliance with regulations
- maximum availability and energy output of wind farm
- efficient use of resources and personnel to minimize costs
- continuous improvement of operational processes.

The Project incorporates these guiding principles into all aspects of its operational planning and execution. In addition, Atlantic Shores requires its subcontractors to follow these guiding principles.

5.1 Monitoring and Control Systems

Monitoring systems are vital tools for recording data and maintaining assets, performing quality assurance, and monitoring asset performance.

All facilities associated with the Project, including the wind turbine generators (WTGs) and offshore substations (OSSs), are designed to operate autonomously. The Project will be equipped with a supervisory control and data acquisition (SCADA) system to interface between the WTG controllers, OSSs, onshore substations and/or converter stations, and all environmental and condition monitoring sensors and to provide detailed performance and system information.

[15] Atlantic Shores' Lease Agreement OCS-A 0549 includes a 30-year operating term, which may be extended or otherwise modified in accordance with applicable regulations in 30 CFR Part 585.

Monitored parameters may include but are not limited to temperature, vibration, status, current, and voltage. The SCADA system is configured to provide notifications to the Project's operator of any alarms or warnings from Project components.

The SCADA system is remotely accessible to the Project's operator through a remote-control center. The SCADA system also provides remote control of the Project's equipment, allowing the operator to override automatic operations, remotely reset the Project's systems, adjust control parameters, and shut down equipment for maintenance or at the request of grid operators, regulators, or search and rescue (SAR) (e.g., shut down of WTGs upon the U.S. Coast Guard's [USCG's] request). The operator will continuously monitor the status, production, and health of the Project 24 hours per day. Performance and fault statistics will be stored and analyzed for long-term trends as well as changes in performance of individual components.

Data from the SCADA system will be primarily transmitted through the fiber optics that are included in the offshore cables, but the SCADA system will also incorporate redundancies such as multiple network connections (e.g., a combination of satellite and/or wireless network technology) to ensure constant control of the Project assets.

The condition monitoring systems of various subsystems generate data that can be used to identify underperformance issues and to predict major equipment failures before they occur. Proactive utilization of real-time data and monitoring techniques will reduce downtime, repair costs, production losses, and enable root cause analyses to limit similar failures across the Project. Examples of condition monitoring systems include structural strain monitoring, cable DTS, and WTG bearing vibration.

The export cables will include a monitoring system, such as DTS, for constant monitoring of the cables' temperature at points along their length to help identify anomalous conditions (i.e., potential changes in cable burial depth) that may require maintenance and/or corrective action. The inter-array cables and inter-link cables (if used) may also use a monitoring system such as DTS. Other monitoring systems, such as a DAS system and/or OLPD monitoring, can also be used to constantly assess the status of the offshore cables. A DAS system employs fiber optics within the cables to detect noises that could result from anomalous conditions such as insufficient cable depth, vibrations, and potential damage. An OLPD monitoring system can identify the presence and location of insulation damage that could eventually lead to cable failures.

5.2 Communication Systems

In addition to the SCADA system, the Project will likely utilize a number of additional communication systems to manage overall operations. Examples of such systems include, but are not limited to the following:

- weather monitoring and forecasting to maximize efficient working hours, safe transfers, and appropriate weather windows
- vessel tracking and sea surveillance to avoid and minimize potential interactions with marine mammals, fishing vessels, and recreational boaters

- radio and cellular networks for voice and data communications offshore and onshore
- personnel/people tracking for efficient and safe planning.

Offshore communication is typically supported by existing infrastructure, such as wireless network technology or typical marine and aviation communications channels that can be assisted by mounting marine very high frequency (VHF) radio antennas and wireless antennas on the OSSs. Data transfer from offshore Project components is enabled through wireless communication (e.g., Wi-Fi, WiMax protocols, or wireless network technology) and can be supported by fiber optic cables that are bundled with the offshore cables.

As with control systems, offshore wind communications systems will incorporate redundancies, such as multiple network connections.

5.3 Lighting and Marking

The WTGs, OSSs, meteorological (met) tower, and their associated foundations will be equipped with marine navigation lighting and marking in accordance with USCG and BOEM guidance. To aid mariners navigating within and near the Lease Area, each WTG, OSS, and met tower position will be maintained as a Private Aid to Navigation (PATON). Based on USCG District 5 Local Notice to Mariner 45/20, Atlantic Shores expects to include unique alphanumeric identification on each WTG and/or foundation, yellow flashing lights on each foundation that are visible in all directions, and Mariner Radio Activated Sound Signals (MRASS) on select foundations. Atlantic Shores anticipates that the marine navigation lights on structures along the perimeter of the Lease Area will be visible at a range of 3 or 5 nautical miles (nm) (depending on the structure's location), whereas lights on interior structures will be visible at a range of 2 nm. Automatic Identification System (AIS) will be used to mark each WTG, OSS, and met tower position (virtually or using physical transponders). Atlantic Shores will work with the USCG and BOEM to determine the appropriate marine lighting and marking schemes for the proposed offshore facilities, including the number, location, and type of AIS transponders. Additional information on marine navigation lighting and marking will be provided within the Project Navigation Safety Risk Assessment (NSRA) which is currently being conducted and will be provided upon completion.

All WTGs and the met tower will contain aviation obstruction lights in accordance with Federal Aviation Administration (FAA) and/or BOEM guidance to aid aircraft operating in the Lease Area. Based on current guidance in FAA Advisory Circular 70/7460-1M, the aviation obstruction lighting system on the WTGs will include red flashing lights on the nacelle and, if the WTG exceeds 699 feet (ft) (213.36 meters [m]), an additional level of flashing red lights on the tower. The lights will be arranged so that they are visible by a pilot approaching from any direction. In accordance with Advisory Circular 70/7460-1M, the color of the WTGs will be no lighter than RAL 9010 (Pure White) and no darker than RAL 7035 (Light Grey). If the height of the OSSs exceeds 200 ft (61 m) above Mean Sea Level (MSL) or any obstruction standard contained in 14 CFR Part 77, the OSSs will include an aviation obstruction lighting system in compliance with FAA and/or BOEM requirements. Atlantic Shores is proposing the use of an Aircraft Detection Lighting System (ADLS), subject to FAA and BOEM approval, which could substantially reduce the amount of time that the aviation obstruction lights are actually illuminated.

An ADLS automatically activates all aviation obstruction lights when aircraft approach the Lease Area; at all other times, the lights are off. Additional information regarding the use of an ADLS will be provided within the forthcoming NSRA.

Other temporary lighting (e.g., helicopter hoist status lights) may be utilized on the WTGs for safety purposes when necessary. Similarly, some outdoor OSS lighting (in addition to any required aviation or marine navigation lighting) will be necessary for maintenance that may occur at night. Atlantic Shores anticipates using controls to ensure that outdoor OSS lighting will be illuminated only when the OSS is manned. When unmanned, general outdoor lighting will be off.

5.4 Operations, Maintenance, and Inspections

Atlantic Shores will develop a comprehensive O&M Plan for the Project, which will include plans for scheduled and un-scheduled inspections and maintenance activities to keep the Project operating with optimum reliability and performance throughout the design life. A risk-based maintenance approach will be used to balance long-term operating costs with the Project's performance.

Scheduled maintenance is performed on a fixed, predetermined schedule (e.g., annually) and may consist of remote monitoring, inspections, testing, replacement of consumables, and preventive maintenance. As part of the scheduled maintenance, self-inspections will be conducted in accordance with 30 CFR §§ 585.824 and 585.825. Scheduled maintenance of offshore facilities will typically be performed during non-winter months when accessibility is highest. The frequency of inspections, tests, and maintenance will be based on industry standards and best practices that optimize the O&M of the Project.

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

All maintenance activities will follow the procedures outlined in each Project's Safety Management System (SMS) (see Section 1.5.3.1). Maintenance activities will only be performed after appropriate preparatory actions have been taken according to the O&M Plan, including risk assessment and method statement development, marine traffic coordination, and checking that communication and remote monitoring and control systems are functional. Atlantic Shores will document and record all maintenance activities according to the O&M Plan.

Atlantic Shores will provide access to and accommodate BOEM or its qualified third-party inspectors for the purposes of conducting inspections or reviewing maintenance records according to 30 CFR §§ 585.820-585.823.

5.4.1 WTGs

5.4.1.1 Scheduled Maintenance

Scheduled maintenance of WTGs includes regularly scheduled inspections and routine maintenance of mechanical and electrical components. Most scheduled maintenance and associated crew transfer will be performed using crew transfer vessels (CTVs), service operation vessels (SOVs), and/or helicopters (see Section 5.6). The types and frequency of inspections and maintenance activities are based on detailed original equipment manufacturer (OEM) specifications. Annual maintenance campaigns are dedicated to general upkeep (e.g., bolt tensioning, crack and coating inspection, safety equipment inspection, cleaning, high-voltage component service, and blade inspection) and replacement of consumable components (e.g., lubrication, oil changes).

Preventative maintenance (e.g., planned replacement of components such as motors and brakes) occurs less frequently (e.g., every 5 to 10 years) but is also regularly scheduled.

5.4.1.2 Unscheduled Maintenance

Unscheduled inspections and minor repairs, such as replacement of small components, can be performed via the regular maintenance vessels. Replacement of large components (e.g., blades, generators, gearboxes, and large bearings) or structural repair may require support vessels, such as jack-up vessels with cranes, as well as larger teams of technicians.

5.4.2 OSS Topsides

5.4.2.1 Scheduled Maintenance

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

5.4.2.2 Unscheduled Maintenance

Corrective maintenance for OSS topside infrastructure includes minor structural repairs discovered during inspections, electrical repairs discovered either during inspections or through operational faults, and relatively rare movable part overhauls. Replacement of major components (e.g., transformers) is expected to occur infrequently and will likely require support vessels similar to those required for WTG major component replacement activities.

5.4.3 Foundations and Scour Protection

5.4.3.1 Scheduled Maintenance

WTG, OSS, and met tower foundations will be inspected both above and underwater at regular intervals to check their condition including checking for corrosion, cracking, and marine growth (see Table 5.4-1). Scheduled maintenance of foundations will also include safety inspections and testing, coating touch up, preventative maintenance of cranes, electrical equipment, and auxiliary equipment, and removal of marine growth.

5.4.3.2 Unscheduled Maintenance

Unscheduled maintenance will be conducted for minor component repair/replacement if damage to a foundation occurs (e.g., due to an accidental event or conditions that exceed the foundation's design loads). Corrective action will be taken if any issues with scour protection are discovered.

5.4.4 Offshore Cables

5.4.4.1 Scheduled Maintenance

As described in Section 5.1, the offshore export cables will be continuously monitored using either a DTS, a DAS system, and/or OLPD monitoring. The inter-array cables and inter-link cables (if used) may also use a monitoring system. In addition, cable surveys will be performed at regular intervals to identify any issues associated with potential scour and depth of burial. Annual surveys will be performed for the first few years of operation, and provided no abnormal conditions are detected during those initial surveys, surveys will continue for the life of the Project at a reduced frequency. Cable terminations and hang-offs will be inspected and maintained during scheduled maintenance of foundations, OSS, or WTGs.

5.4.4.2 Unscheduled Maintenance

In the unlikely event that a cable becomes exposed, the issue will be addressed by reburying the cable and/or applying cable protection. If a cable repair is required, it is expected that the damaged segment of the cable will be recovered from the seafloor. If required, a new section of cable would be spliced into the existing cable onboard a vessel within a controlled environment. After the new segment of cable was rejoined to the existing cable, the repaired cable would be lowered to the seafloor and reburied. The new cable segment may be reburied in an omega bight configuration. The planned cable spacing (as described in Section 4.5.2.1) is sufficient to allow for a cable repair to occur within each ECC. Vessels supporting these procedures will typically be of the same type as those used during construction (see Section 4.10.1).

Atlantic Shores will store spare cable at an O&M facility, a dedicated warehouse, or with the cable supplier to expedite the repair process in the unlikely event that the Project experiences a cable failure.

5.4.5 Onshore Substations and/or Converter Stations and Onshore Interconnection Cables

5.4.5.1 Scheduled Maintenance

Electrical systems at the onshore substations and/or converter stations such as transformers, switchgear, harmonic filters, reactive power equipment, revenue meters, protection and control systems, and auxiliary services will be regularly monitored. Scheduled maintenance of the onshore interconnection cables will also be performed; any necessary maintenance will be accessed through manholes and completed within the installed transmission infrastructure.

5.4.5.2 Unscheduled Maintenance

Unscheduled inspections and minor repairs, such as troubleshooting, testing, and replacement of small components, can be performed *in situ*. Manlifts and small cranes may be used to work on elevated equipment. For larger pieces of equipment (e.g., transformers, reactors, major static synchronous compensator (STATCOM) components, breakers, or structure equipment) that require in-shop service or replacement, heavy duty construction equipment, such as cranes similar in size to those used during construction, may be used to aid in removal and replacement. Although unlikely, if a section of onshore interconnection cable fails, cable pulling equipment would be needed.

5.4.6 Representative Inspection and Maintenance Schedule

A representative schedule of the Project's inspection and maintenance activities is presented in Table 5.4-1. This schedule provides an overview of the estimated frequency of inspection and maintenance activities; it is expected that this schedule will be updated during the detailed design process.

Table 5.4-1 Schedule of Planned Preventive Maintenance Activities

Project Component	Activity	Frequency
WTG	Inspections	Annual
	Maintenance of mechanical, electrical, structural, and safety systems	Annual
	Retrofits/Upgrades	As needed
	Oil change (Gearbox (if any), bearings, transformers)	2-4 times over lifespan, as needed
OSS	Inspections	Annual
	Maintenance of medium-voltage and high-voltage systems, auxiliary systems, and safety systems	Annual
	Diesel generator refueling	As needed
Foundation	Above water inspection	Annual
	Below water inspection	20% of positions per year (*may be modified based on site and design risk assessment)
	Maintenance of structural, auxiliary, and safety systems	Annual
Offshore Cables (Export, inter-Array, and inter-Link)	Survey	Annually during the first few years of operations and at less frequent intervals thereafter (may be

Project Component	Activity	Frequency
		modified based on site and design risk assessment)
	Electrical tests	Every 5 years
Onshore Substation and/or Converter Station	Inspection	Annual
	Maintenance of medium-voltage and high-voltage systems, auxiliary systems, and safety systems	Annual
Onshore Interconnection Cables	Visual and thermographic inspections of cables and terminations inside vaults	Annual
	Electrical tests	Every 5 years

5.5 O&M Facility and Ports

Once operational, the Project will be supported by existing O&M and port facilities which will be the primary location for O&M operations including material storage, day-to-day management of inspection and maintenance activities, vehicle parking, marine coordination, CTV vessel docking, and dispatching of technicians. Atlantic Shores does not currently anticipate installing helicopter landing pads on the OSSs, though this feature may be added depending on the O&M strategy employed (see Section 5.6). The O&M facilities will provide a safe and efficient operational flow of activities and equipment and include the following:

- office space, including a server/IT room to house the Project's critical IT infrastructure and a control room for surveillance and coordination of offshore activities and Project operations
- warehouse space, including full-height access for deliveries and equipment storage, a temperature and humidity-controlled electrical storage room, and a lifting facility
- harbor area and quayside, including but not limited to vessel mooring, unloading capabilities, a crane, berthing area, and emergency spill response equipment
- outdoor area and parking, including storage space for spare parts and materials.

The O&M facilities may also be supported with the use of existing warehouse or office space within an industrial, commercial, and/or waterfront area.

Atlantic Shores will likely establish a long-term CTV base at the O&M facility in Atlantic City. If Atlantic Shores employs an SOV-based O&M strategy, those SOVs would likely be operated out of existing ports such as Lower Alloways Creek Township, the Port of New Jersey/New York, or another industrial port identified in Table 4.10-2 that has suitable water depths and quayside facilities to support an SOV.

Atlantic Shores has developed a list of ports encompassing those that are most likely to support major construction and marshaling activities (Table 4.10-2). O&M facilities are anticipated to be existing sites (SOV and a parcel developed by Atlantic Shores Services LLC [as described in Atlantic Shores South COP and developed for those other projects]), and those impacts are considered with respect to Environmental Justice, air emissions and other environmental resources. Atlantic Shores may use other ports listed in Table 4.10-2 to support O&M activities such as some crew transfer, bunkering,[16] spare part storage, and load-out of spares to vessels. In addition, routine port activities such as refueling, and supply replenishment may occur outside of the ports identified in Table 4.10-2. While Atlantic Shores anticipates that the ports listed in Table 4.10-2 can support the Project's regular maintenance needs, it is possible that, if significant non-routine maintenance is needed, it could require unplanned use of another U.S. or international port.

5.6 Proposed Vessels, Vehicles, and Aircraft

A combination of CTVs, SOVs, other smaller vessels, and helicopters may be used to access infrastructure in the Lease Area. The vessels are likely to be dispatched from the quayside at the existing O&M facility or other supporting O&M ports. The logistical approach will aim to share facilities and vessels, where possible, to maximize efficiency and minimize the environmental impact of transporting personnel, materials, and tools. In addition to CTVs, SOVs, and smaller vessels, the Project may also use jack-up, heavy-lift, or other larger support vessels on an infrequent basis for large component repair or replacement. If the characteristics of the O&M facility's port are unsuitable for the types of vessels required to complete the repair or for the quayside logistics required to manage larger components, a nearby port will be used (see Section 5.5). In addition, Atlantic Shores may use fixed-wing aircraft to support environmental monitoring and mitigation.

Atlantic Shores may utilize a CTV-based logistical approach due to the proximity of the Lease Area to the existing O&M facilities and the O&M facilities' port characteristics (e.g., water depths). CTVs enable fast and practical transport of personnel and equipment to the Project's offshore facilities when the transit distance is relatively short (see Figure 5.6-1 for a representative photo of a CTV). CTVs may transit daily between the CTV base and Lease Area. Helicopters can be used when rapid-response O&M activities are needed or when poor weather limits the use of CTVs. Helicopters would be based within reasonable distance of the Project at a general aviation airport.

SOVs are relatively large vessels that offer considerable capacity for personnel and spare parts, allowing for service trips that are several weeks in duration (see Figure 5.6-1). SOVs include sleeping quarters for technicians and may include workshop space. SOVs are capable of transferring technicians to WTGs and OSSs through the use of gangways. Typically, an SOV is equipped with a dynamic positioning (DP) system, lifting and winch capacity, and may support a helipad. SOVs are only limited by the need to return to port to restock fuel, food, and spare parts but are typically used in conjunction with smaller daughter crafts/workboats or CTVs to enable quick transport of personnel or supplies between the vessel and port or offshore assets. An SOV-based O&M strategy may also rely upon helicopters to shuttle technicians and equipment within the Lease Area.

16 Some refueling could also occur offshore. All activities described in this paragraph would be conducted in accordance with applicable Jones Act requirements and other applicable law.

In addition to CTVs, SOVs, and helicopters, other vessels and vehicles may be used to support O&M activities over the lifetime of the Project:

- Although CTVs and SOVs are the most common vessels around which O&M logistical approaches are designed, an alternative approach employs a service accommodation and transfer vessel (SATV), which is larger than a CTV and supports week-long service campaigns.
- Larger support vessels (e.g., jack-up vessels) may be used infrequently to perform some routine maintenance activities, periodic corrective maintenance, and significant repairs (if needed). These vessels are similar to vessels used during construction.
- Survey vessels may be required for subsea inspection campaigns.
- Cable laying vessels may support cable repair campaigns.
- Other monitoring and inspection needs may be met by unmanned aerial vehicles, remotely operated vehicles (ROVs), or underwater drones.
- Various land-based vehicles, including trucks and heavy equipment machinery, may be utilized during the operations phase. Heavy equipment use during O&M will be more infrequent than during construction and would typically be needed to address occasional unplanned failures. The O&M facility and any potential warehouses will likely use electric forklifts and flatbed trucks to transport components. The Project may also purchase one or more small trucks or sport utility vehicles for shared staff use.

Up to six vessel trips per day are expected to operate in the Offshore Project Area at any given time during normal O&M activities in support of the Project, though additional vessels (a maximum of up to 22 vessels) may be required in other maintenance or repair scenarios. Depending on whether SOVs or CTVs are primarily used, Atlantic Shores estimates that approximately 550 to 2,050 vessel round trips to the Offshore Project Area will occur annually during the Project's operations, which is an average of two to six vessel trips per day. These vessel trips may be supplemented by helicopters to assist in personnel transport. The actual level of vessel activity during O&M will depend on the specific maintenance needs that develop as well as the final design of the offshore facilities.

Example Crew Transfer Vessel (CTV)

Example Service Operation Vessel (SOV)

Figure 5.6-1

Crew Transfer Vessel (CTV) and Service Operation Vessel (SOV) Examples

6.0 Decommissioning

Decommissioning will broadly occur in the reverse order of construction and will be conducted in accordance with the applicable requirements discussed in Section 6.1.

6.1 Decommissioning Requirements

In the Partial Assignment of Lease for Lease Area OCS-A 0549 dated April 18, 2022, the Bureau of Ocean Energy Management (BOEM) States that the segregated lease is subject to all terms and conditions of the original lease. Therefore, Atlantic Shores will follow the decommissioning requirements stated in Section 13, Removal of Property and Restoration of the Leased Area on Termination of Lease, of the original Lease Agreement for Lease Area OCS-A 0499. Pursuant to the applicable regulations in 30 CFR §585.902, and unless otherwise authorized by BOEM under 30 CFR §585.909, Atlantic Shores will be required to remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seabed of all obstructions created by activities on the leased area, including any Project easements(s). Removal or decommissioning activities must be completed within two years after lease termination (whether by expiration, cancellation, contraction, or relinquishment) in accordance with an approved Site Assessment Plan (SAP), Construction and Operations Plan (COP), or approved Decommissioning Application and applicable regulations in 30 CFR Part 585. Per 30 CFR §585.910(a), all offshore facilities must be removed to 15 feet (ft) (4.5 meters [m]) below the mudline, unless otherwise authorized by BOEM.

Atlantic Shores will submit a Decommissioning Application to BOEM prior to decommissioning any Project facilities. BOEM's process for reviewing and approving this plan will include consultations with municipal, state, and federal agencies, other stakeholders, and the public.

6.2 Decommissioning Activities

The anticipated decommissioning process for each Project component is described in the following sections. Vessels used to complete offshore decommissioning activities will likely resemble those used during installation and could include jack-up vessels, heavy-lift vessels, and support vessels such as tugboats and crew transfer vessels (CTVs) (see Section 4.10.1). For onshore decommissioning activities, equipment will likely include truck-mounted winches, cable reels, and cable reel transport trucks.

When possible, Project components removed during decommissioning will be recycled (e.g., steel foundation components). However, some materials may have no scrap value or capability to be recycled (e.g., fiberglass wind turbine generator [WTG] components); these materials would be broken down and disposed of at an approved onshore solid waste facility.

After the offshore facilities are removed, Atlantic Shores will verify site clearance in accordance with 30 CFR §585.910(b).

6.2.1 WTGs

Atlantic Shores will drain WTG components of any fluids and chemicals according to the established O&M procedures and the OSRP (see Section 1.5.3.2 and Appendix I-D), which will be collected and properly disposed of or recycled. Before removing the WTGs, inter-array cables will be disconnected. WTG components will then be disassembled and removed from their foundations, shipped to shore, and recycled or scrapped. Removing the WTG blades, rotor, nacelle, and tower will involve the use of vessels with cranes that are similar to those utilized for installation and assembly.

6.2.2 Offshore Substations

Similar to WTGs, before OSS decommissioning activities commence, any export cables, inter-array cables, and inter-link cables will be disconnected from the OSS. The OSS topsides will then be disassembled and removed from their foundations using cranes, shipped to shore, and recycled or scrapped. In accordance with the OSRP, OSS equipment will be drained of any fluids and chemicals, which will be collected and then properly disposed of or recycled. Any sulfur hexafluoride (SF_6) or other arc suppressant used in gas-insulated switchgear will be carefully removed for reuse.

6.2.3 WTG and OSS Foundations

The procedures used for decommissioning the WTG and OSS foundations will depend on the type of foundation:

- **Piled foundations**. These foundation types will be cut below the mudline and will be completely removed above that cut. To facilitate cutting, any sediment within the piles will be suctioned out and collected; after foundation removal, any collected sediment will be placed in the depression left after removal using a vacuum pump and diver or ROV-assisted hoses to minimize turbidity. Cutting steel foundations will likely be accomplished with underwater acetylene cutting torches, mechanical cutting, and/or a high-pressure water jet. Once cut, a crane will lift the foundation onto a vessel for transport to port; a foundation may be cut into multiple sections for ease of transport.
- **Suction bucket foundations**. Injecting water into the suction buckets will essentially reverse the installation process, pushing them back out of the seabed sediment and enabling complete removal of these foundations.
- **Gravity foundations**. Ballast within the foundations will be removed and the foundations will be floated away from the installation site. If it is not possible to re-float the gravity foundation, it will be disassembled on-site, and all components will be removed.

Pending environmental assessment and regulatory approval, some foundations may be left in place as artificial reefs. In addition, scour protection around foundations may be removed or left in place pending future environmental assessment. If it is determined that scour protection needs to be removed, it will be excavated with a dredging vessel or removed by vessel's crane and transported to port for reuse or disposal.

6.2.4 Offshore Cables

Export cables, inter-array cables, and inter-link cables (if present) will either be retired in place or removed from the seabed. The decision regarding whether to remove these cables and any overlying cable protection will be made based on future environmental assessments and consultations with Federal, State, and municipal resource agencies. For example, if cable protection is functioning as reef habitat, it may be less disruptive and more beneficial to leave such structures in place and undisturbed on the seabed.

If, after consultation with applicable regulatory agencies, Atlantic Shores determines that offshore cables should be removed from the seabed, any overlying cable protection will be removed first, then the cables will be extracted from the seabed. Where these cables are buried in dense sediments, it may be necessary to fluidize overlying sediments before extracting the cables. Cables freed from the seabed will be coiled onto reels or cut into manageable lengths and transported to port for recycling.

6.2.5 Met Tower

Similar to WTGs and OSS topsides, the met tower will be disassembled and removed from its foundation using cranes, shipped to shore, and recycled or scrapped. Decommissioning of the met tower's foundation will follow the steps outlined in Section 6.2.3.

6.2.6 Onshore Facilities

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

6.3 Financial Assurance for Decommissioning

Financial assurance for the Project will be provided in accordance with the terms and conditions required by BOEM in the Lease Agreement for Lease Area OCS-A 0549 and applicable requirements under 30 CFR Part 585, Subpart E.

7.0 Chemical Products and Solid and Liquid Wastes

Construction and O&M activities will generate some quantity of solid and liquid wastes. Wastes and chemical products can be categorized as either hazardous or non-hazardous. Hazardous waste can include, but is not limited to, waste oils and oily materials (e.g., grease tubes, oily rags, oil filters), lead-acid batteries, aerosol cans, paints, varnishes, cleaners, solvents, and adhesives.

The Project-generated solid and liquid wastes will be treated, released, stored, and/or disposed of in accordance with applicable federal, state, and local regulations. Vessels may discharge some liquid wastes (e.g., domestic water, uncontaminated bilge water and ballast water, treated deck drainage and sumps, and uncontaminated fresh or seawater from vessel air conditioning). Other waste, such as solid waste or chemicals, solvents, oils and, greases from equipment, vessels or facilities will be stored and properly disposed of onshore or incinerated offshore. Vessels associated with the Project will comply with the USCG's waste and ballast water management regulations found at 33 CFR Part 151 and USCG's oil and hazardous material pollution prevention regulations found at 33 CFR Part 155, among other regulations. Project vessels covered under the EPA's National Pollutant Discharge Elimination System (NPDES) Vessel General Permit are also subject to the effluent limits in Section 2 of the Vessel General Permit, which incorporate numerous regulations including, but not limited to, 40 CFR Part 110, 40 CFR Part 116, 40 CFR Part 117, and 33 CFR 151.10. Atlantic Shores will also require offshore contractors to participate in a marine trash and debris prevention training program.

All onshore waste with the potential to cause environmental harm will be stored in containers placed in designated, secure, and bermed locations away from depressions and drainage lines that carry surface water until they are collected by the selected waste contractor. Atlantic Shores has developed protocols to minimize the chance of foreseeable spills (see Section 1.5.3.2) and will ensure that spill kits are present at all locations where hazardous materials are held. Waste generated away from storage areas will be kept in portable bunds (temporary spill berms) until removed, and waste oils will be recycled where appropriate.

Tables 7.0-1 through 7.0-3 provide examples of potential chemical products that may be used on the wind turbine generators (WTGs) and offshore substations (OSSs) as well as at the onshore substations and/or converter stations. As the Project design and planning progresses, Atlantic Shores will develop a detailed chemical and waste management plan. This plan will describe waste streams, storage and handling, and plans for proper disposal, recovery, recycling, or reuse. Atlantic Shores currently anticipates that chemical products for the WTGs, OSSs, and onshore substations and/or converter stations will be included in the equipment at the time of installation. During O&M, chemical transfer will occur during certain activities, such as oil changes or replenishing fuel for emergency generators.

As described in Section 1.5.3.2, Atlantic Shores is developing spill response plans for the onshore and offshore Project facilities that outline spill prevention measures as well as provisions for spill containment, removal, and mitigation. A draft Oil Spill Response Plan (OSRP) is provided in Appendix I-C.

Table 7.0-1 List of Potential Chemical Products Used for WTGs

Component	Description	Approximate Quantity per WTG		Approximate Total Quantity for Project (157 WTGs)	
		Gallons	Liters	Gallons	Liters
Emergency generator fuel	Diesel fuel	400	1,514	62,800	237,698
Hydraulic systems	Hydraulic fluid	350	1,325	54,950	208,025
Yaw/pitch system grease	Grease	150	568	23,550	89,176
Drive rain, yaw, pitch system	Gear and bearing lubricating oil	500	1,893	78,500	297,201
Gearbox	Gear and bearing lubricating oil	581	22001	91,217	3,454,157
Transformer	Biodegradable dielectric insulating fluid/synthetic ester oil	1,800	6,814	282,600	1,069,798
Hydraulic accumulators	Nitrogen	21,134	80,000	3,318,038	12,560,000
Equipment cooling system	Water/glycol	400	18,001	62,800	2,826,157
Passive tower damper system	Water/glycol	3,700	14,006	580,900	2,198,942
Switchgear	Electrical insulator/arc suppressor (gas)	243	110 kg	38,151	17,270 kg

Table 7.0-2 List of Potential Chemical Products Used for OSSs

Component	Description	Approximate Quantity per Small OSS		Approximate Quantity per Medium OSS		Approximate Quantity per Large OSS	
		Gallons	Liters	Gallons	Liters	Gallons	Liters
Diesel fuel storage	Diesel fuel	7,500	28,391	12,000	45,425	20,000	75,708
Diesel engines	Internal motor lubrication	5	19	10	38	15	57
Hydraulic Fluid	Lubrication	300	1,136	550	2,082	550	2,082
Main power transformers, earthing transformers	Biodegradable dielectric insulating fluid, mineral oil, or synthetic ester oil	26,000	98,421	78,000	295,262	130,000	492,104
Reactors	Biodegradable dielectric insulating fluid, mineral oil, or synthetic ester oil	11,000	41,640	33,000	124,919	55,000	208,198
Uninterruptible power supply (UPS) batteries	Electrolyte inside lead/acid batteries or valve-regulated lead acid battery	250	946	400	1,514	400	1,514
Dry Fire Suppressant	Firefighting	--	2,560	--	3,840	--	5,120
Firefighting aid	Aqueous film-forming foam and water mixtures at 3% by volume	3,500	13,249	4,000	15,142	5,000	18,927
Diesel engine cooling	Water/glycol	30	114	50	189	50	189
Equipment Cooling System	Water/glycol	1,000	3,785	2,000	7,571	3,000	11,356
Switchgear	Electrical insulator/arc suppressor	1,500 kg	4,300 kg	4,300 kg	Switchgear	Electrical insulator / arc suppressor	1,500 kg
Air conditioning/ condensers	Refrigerant	90 kg	180 kg	360 kg	Air conditioning/ condensers	Refrigerant	90 kg

Table 7.0-3 List of Potential Chemical Products Used for Onshore Substations and/or Converter Stations

Component	Description	Approximate Quantity per Onshore Substation	
		Gallons	Liters
Diesel fuel storage	Diesel fuel	1,500	5,678
Diesel engines	Internal motor lubrication	10	38
Main power transformers, earthing transformers	Biodegradable dielectric insulating fluid, mineral oil, or synthetic ester oil	162,500	615,129
Reactors	Biodegradable dielectric insulating fluid, mineral oil, or synthetic ester oil	110,000	416,395
UPS batteries	Electrolyte inside lead/acid batteries or valve-regulated lead acid battery	400	1,514
Diesel engine cooling	Water/glycol	25	95
Equipment cooling system	Water/glycol	1,250	4,732
Switchgear	Electrical insulator/arc suppressor	5,000 kg	Switchgear
Air conditioning/ condensers	Refrigerant	360 kg	Air conditioning/ condensers

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