Appendix S- Environmental Assessment and Applicant Proposed Measures

Ocean Wind 1
An Ørsted & PSEG project

Ocean Wind 1 Offshore Wind Farm Project

Attachment S

Environmental Assessment and Applicant Proposed Measures

August 2022

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Abbreviations and Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
AC	alternating current
A	ampere
AIS	Automatic Identification System
AMAPPS	Atlantic Marine Assessment Program for Protected Species
APM	Applicant Proposed Measures
ASMFC	Atlantic Marine Fisheries Commission
ATV	all-terrain vehicle
BMP	best management practices
BOEM	Bureau of Energy Management
BRI	Biodiversity Research Institute
CAFRA	Coastal Area Facility Review Act
Caltrans	California Department of Transportation
CEA	classification exception area
CFE	controlled flow excavation
CFR	Code of Federal Regulations
CMECS	Coastal and Marine Ecological Classification Standard
CPUE	catch per unit effort
CTD	conductivity, temperature and depth
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMP	Coastal Zone Management Program
dB	decibels
DO	dissolved oxygen
DOD	Department of Defense
DPS	distinct population segment
EBS	Ecological Baseline Studies
ECR	Export Cable Route
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EMF	electromagnetic fields
ENSP	Endangered and Nongame Species Program
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHA	Flood Hazard Area
FIRM	Flood Insurance Rate Map

FLiDAR	floating light detection and ranging
ft	feet
FW2	estuarine freshwaters
GIS	geographical information system
HAPC	habitat areas of particular concern
HDD	horizontal directional drilling
HDPE	high density polyethylene
HRG	high resolution geophysical
HRG&G	high resolution geophysical and geotechnical
HVAC	high voltage alternative current
HVDC	high voltage direct current
Hz	hertz
IBA	Important Bird Areas
IBSP	Island Beach State Park
ICPC	International Cable Protection Committee
IHA	Incidental Harassment Authorization
IPaC	information for planning and consultation
ISS	Intertidal and Subtidal Shallows
kHz	kilohertz
km	kilometer
LCP	Linear Construction Project
Lease	Ocean Wind BOEM Lease Area OCS-A 0498 Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf
LiDAR	light detection and ranging
LSRP	Licensed Site Remediation Professional
m	meter
MEC	Munitions and Explosives of Concern
mg/L	milligrams per liter
MHP	Materials Handling Plan
MHW	mean high water
MLW	mean low water
MMP	Materials Management Plan
MMPA	Marine Mammal Protection Act
MMSC	Marine Mammal Stranding Center
MP	Milepost
msl	mean sea level
N.J.A.C.	New Jersey Administration Code
N.J.S.A.	New Jersey Statutes Annotated
NARW	North Atlantic right whale
NAVD	North American Vertical Datum
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NHP	National Heritage Program
NHPA	National Historic Preservation Act
NJDEP	New Jersey Department of Environmental Protection
NJDFW	New Jersey Division of Fish and Wildlife
NJDOT	New Jersey Department of Transportation

NJHPO	New Jersey Historic Preservation Office
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NT	non-trout
NVIC	navigation and inspection circular
NWI	National Wetlands Inventory
Ocean Wind	Ocean Wind, LLC
OCGS	Oyster Creek Generating Station
OCS	Outer Continental Shelf
OCW01	Ocean Wind 1 Offshore Wind Farm
Orsted	Orsted Wind Power North America LLC
OSRP	Oil Spill Response Plan
OWEDA	Offshore Wind Economic Development Act of 2010
PAM	Passive Acoustic Monitoring
PAPE	Preliminary Area of Potential Effect
PCE	tetrachloroethene
PI	Program Interest
PMA	Pineland Management Areas
ppm	parts per million
PSEG	Public Service Enterprise Group Renewable Generation LLC
PSMMP	protected species mitigation and monitoring plan
PSO	protected species observers
PSU	practical salinity units
PTS	permanent threshold shift
RAR	Remedial Action Report
RMS	root mean square
ROW	right-of-way
SAV	submerged aquatic vegetation
SAR	Stock Assessment Report
SE1	brackish
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Control, and Countermeasures
SRP	Site Remediation Program
SSAP	Sediment Sampling and Analysis Plan
SSS	sea surface salinity
SST	sea surface temperature
SWPPP	Stormwater Pollution Prevention Plan
SWSQ	Surface Water Quality Standards
TCE	trichloroethane
TDS	total dissolved solids
TJB	transition joint bay
TPH	total petroleum hydrocarbons
TSS	total suspended solids
TTS	temporary threshold shift
UME	unusual mortality event

USACE	United States Army Corp of Engineers
USCG	United States Coast Guard
USEPA	U.S. Environmental Protection Agency
USDA	United States Department of Agriculture
USDOE	United States Department of Energy
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UXO	unexploded ordnance
VOC	volatile organic compounds
WEA	Wind Energy Area
WMA	Watershed Management Area
WTG	wind turbine generator
YOY	young of the year
µg/L	micrograms per liter

1. Introduction

Ocean Wind, LLC (Ocean Wind), a joint venture between Ørsted Wind Power North America, LLC (Ørsted) and Public Service Enterprise Group Renewable Generation LLC (PSEG), proposes to construct and operate the Ocean Wind 1 Offshore Wind Farm Project (OCW01, or Project) pursuant to the Bureau of Ocean Energy Management (BOEM) requirements for the Ocean Wind BOEM Lease Area OCS-A 0498 Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (Lease).

The Project includes up to 98 wind turbine generators (WTGs), up to three offshore alternating current (AC) substations, array cables linking the individual turbines to the offshore substations, one substation interconnector cable linking two substations to each other, offshore export cables, onshore export cable systems,[1] two onshore substations, and connections to the existing electrical grid in New Jersey (underground cables would be required to connect each onshore substation to the existing grid). The WTGs and offshore substations, array cables, and substation interconnector cable will be located in federal waters approximately 13 nautical miles (nm, 15 statute miles) southeast of Atlantic City. The offshore export cables will be buried below the seabed surface within federal and state waters. The onshore export cables, substations, and grid connections will be located in Ocean and Cape May Counties, New Jersey. The location of the Project is depicted on **Figure 1.1-1** through **Figure 1.1-4** and specifically consists of:

- Wind Farm Area: This is the area where the turbines, array cables, offshore substations, the substation interconnector cable, and portions of the offshore export cables are located;
- Offshore export cable route (ECR) corridors: Area in which the offshore export cable systems will be installed, including the inshore area within Barnegat Bay for Oyster Creek;
- Onshore ECR corridors: Area in which onshore export cable systems will be installed;
- Onshore substations; and
- Onshore grid connections.

The proposed Project is scheduled for installation from 2023 through 2024, and the Project is scheduled to have first power in 2024.

[1] The onshore export cable systems will include the onshore export cable, transition joint bays, onshore splice vaults/grounding link boxes and fiber optic system, including manholes.

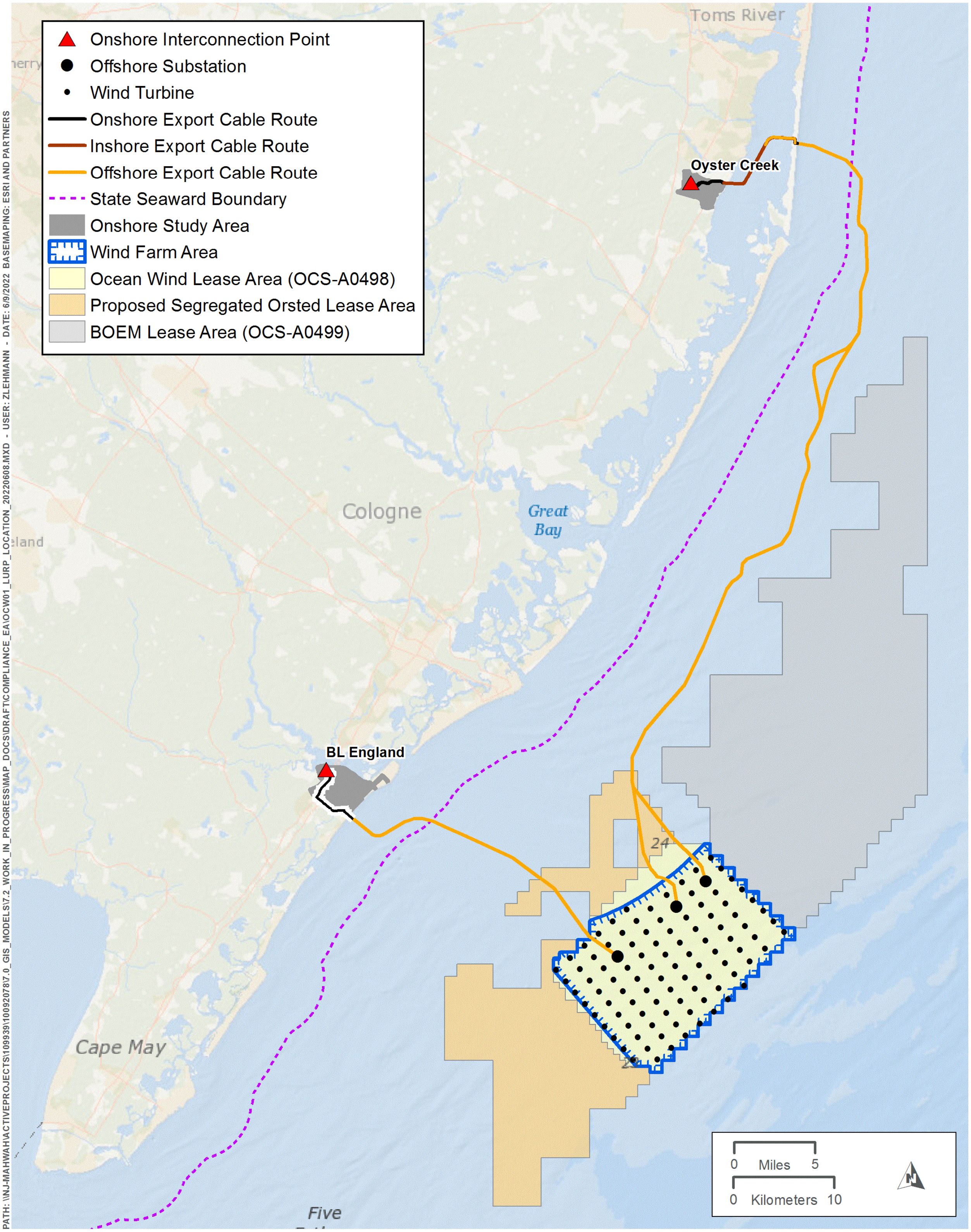

Figure 1.1-1. Lease Area and Project Boundaries.

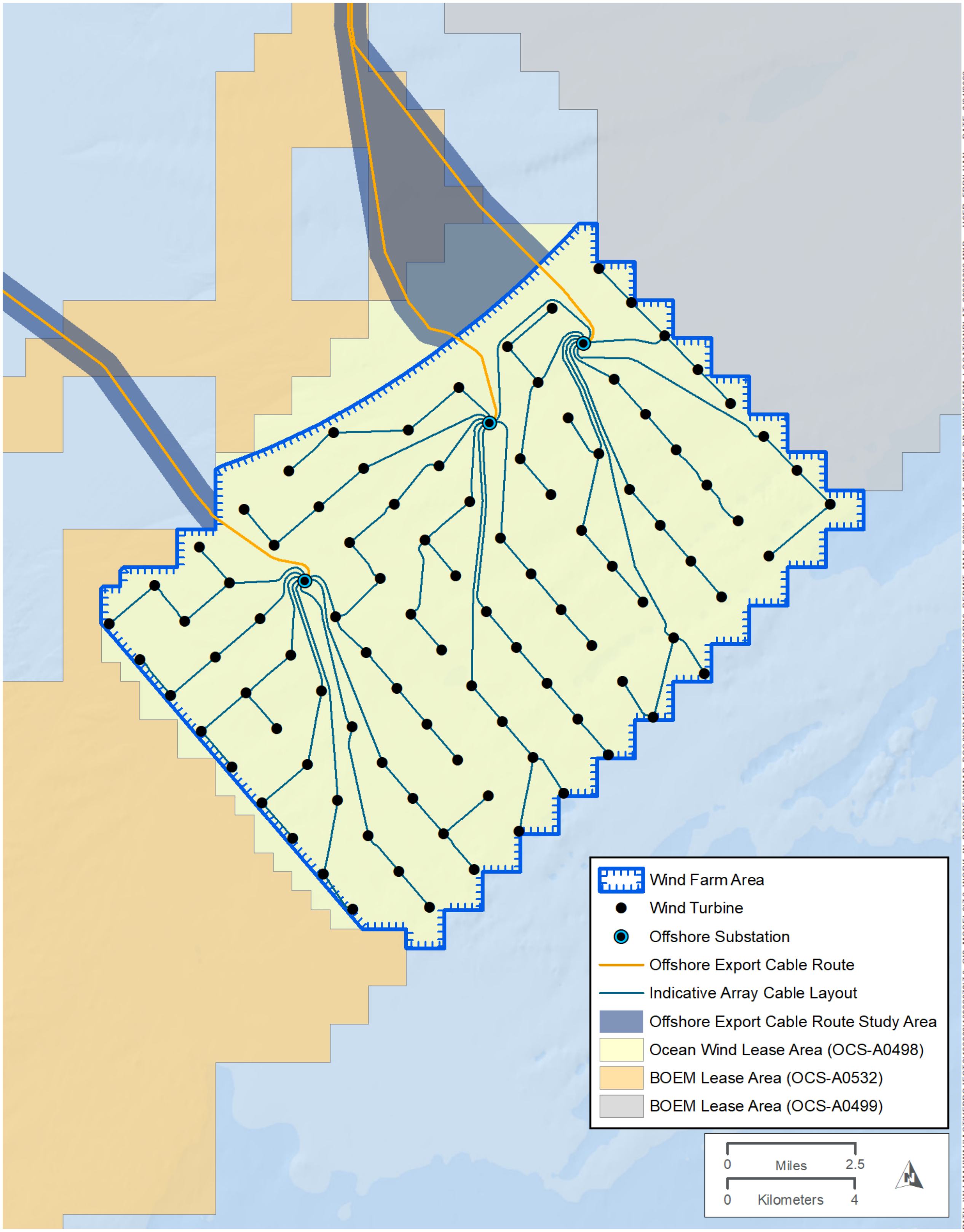

Figure 1.1-2. Indicative Wind Farm Area Location Plan.

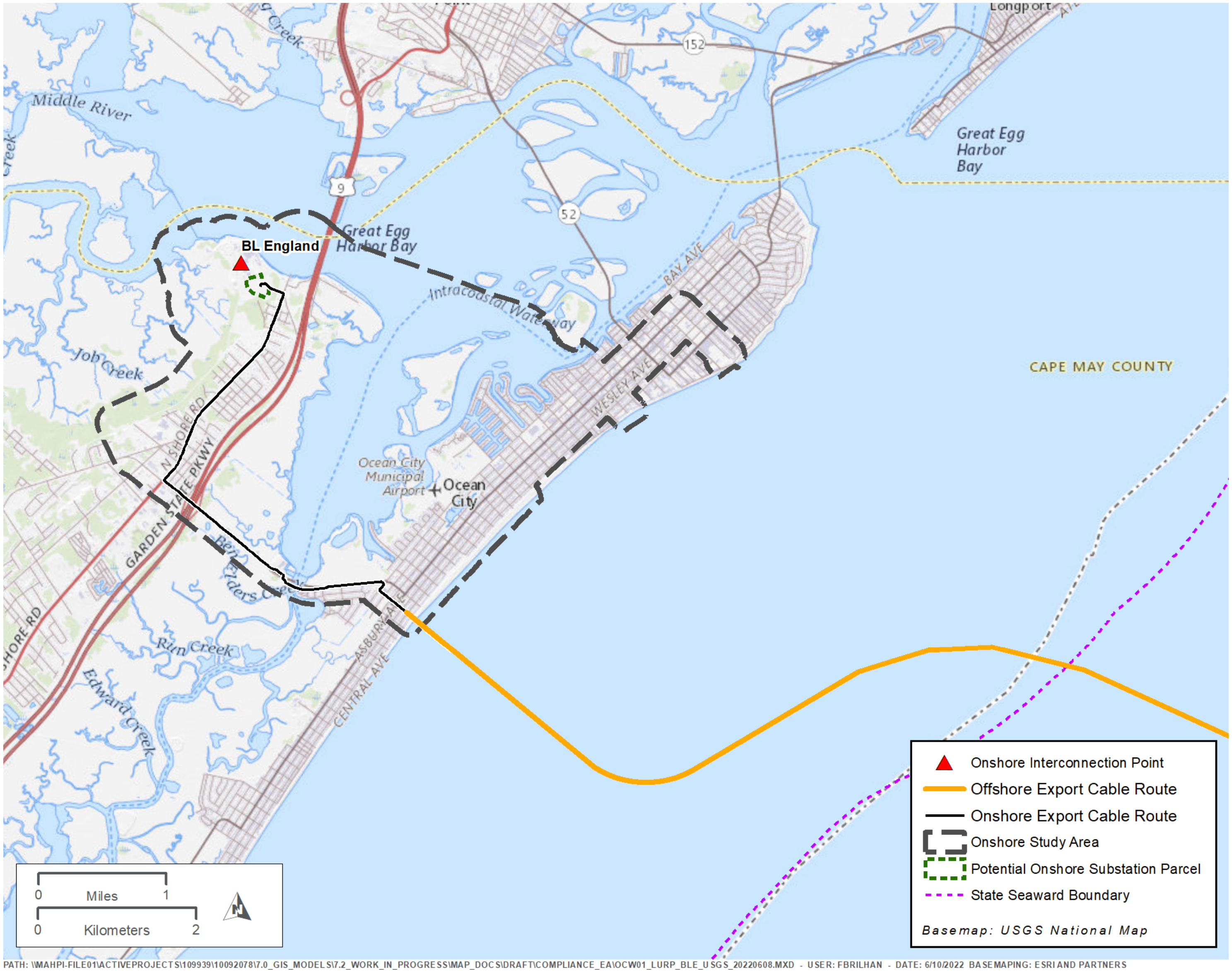

Figure 1.1-3. Project Location - BL England.

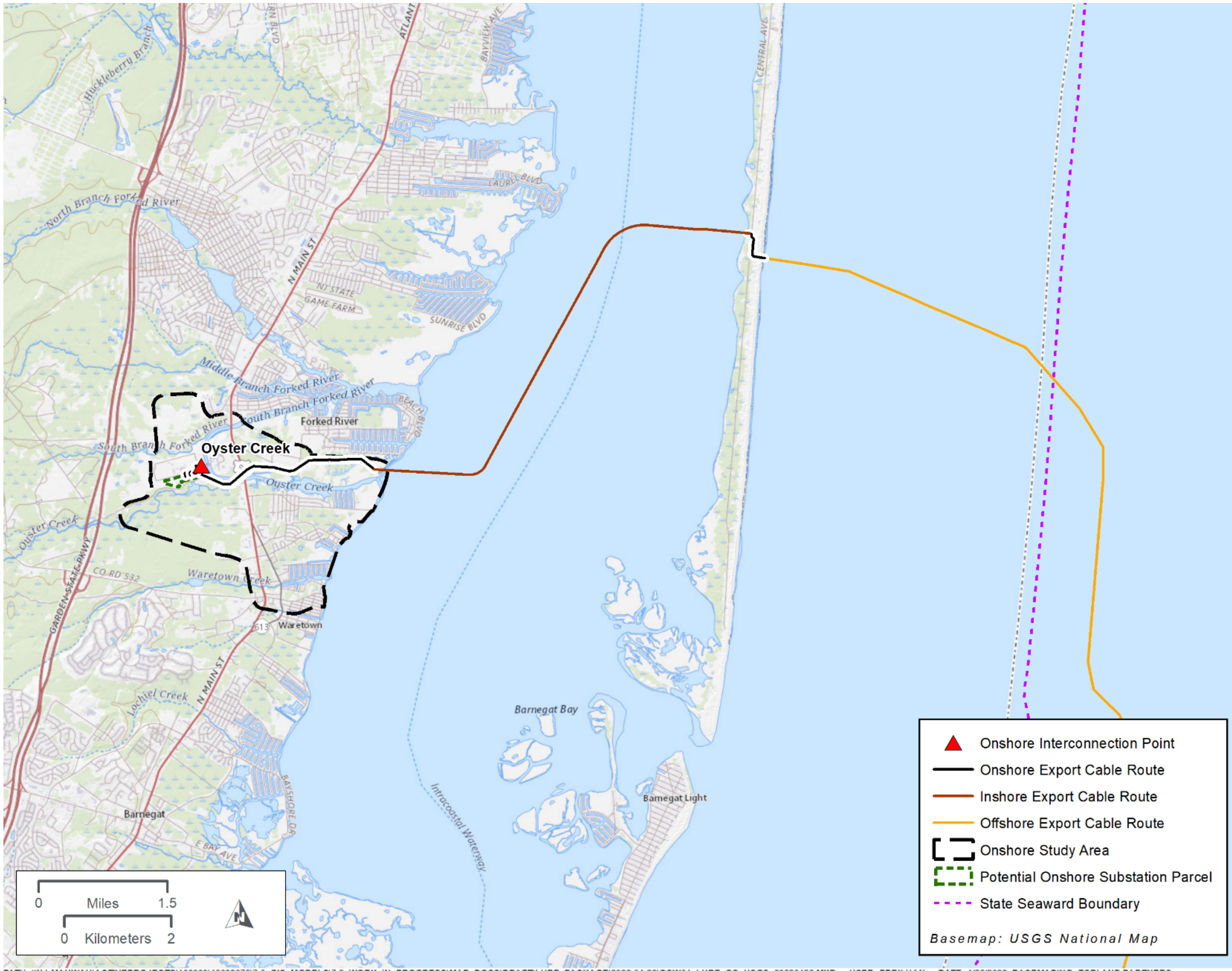

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Figure 1.1-4. Project Location – Oyster Creek

2. Proposed Project

Section 2 of the application describes installation and design technologies for the proposed Project facilities. Detailed graphical design of Project components, workspace and design technology details are provided in Appendix C – Site Plans. **Table 2-1** summarizes which technologies will be utilized by facility and location. **Table 2.5-1** provides the applicable Applicant Proposed Measures (APMs) to avoid, minimize, or mitigate Impacts associated with the Project, and proposed monitoring.

Table 2.1-1. Installation technologies by facility and location.[1]

Project Component Within State Waters (Milepost)	Installation Technology								
	Seabed Preparation (Displacement Plow/Subsea Grab)	Jet Trenching Technologies (Jet Sled/ /CFE/Vertical Injection)	Dredging (Mechanical Excavation)	Jet-Assisted Cable Plow	HDD	Open Cut	Transition Joint Bay	Cable Duct Installation	Onshore Grid Interconnection
BL England									
Offshore Export Cable (MP 5 through 10.3)[1]	X	X	X	X					
Offshore Landfall (MP 4.3 through 5)	X	X	X		X				
Onshore Export Cable Route (MP 0 through 4.3)					X		X	X	
Onshore Substation (MP0)								X	X
Oyster Creek									
Offshore Export Cable (MP 9.5 through 12.5)	X	X	X	X					
Offshore Landfall (MP 9 through 9.5)	X	X	X		X				
Crossing of Island Beach State Park (MP 8.8 through 9)						X	X	X	
Barnegat Bay Crossing and Lacey Township Landfall (MP 2.5 through 8.8)	X	X			X	X[2]			
Onshore Export Cable Route (MP 0 through 2.5)					X		X	X	
Onshore Substation (MP 0)								X	X

[1] Reference Project Plans in Appendix C for milepost locations

[2] Open Cut is an alternate installation technique for the Oyster Creek mainland landfalls

2.1 BL England

2.1.1 Offshore Export Cable

The BL England offshore ECR contains a single cable that begins within the Wind Farm Area at one offshore substation and proceeds approximately 20 miles northwest to the Atlantic Ocean landfall at 35th Street within

Ocean City. Within state waters, the ECR will extend for approximately 6 miles before terminating at the onshore transition joint bay (TJB) within the horizontal directional drilling (HDD) workspace. Along the ECR, the cable has been sited to avoid existing sensitive resources to the maximum extent practicable including prime fishing areas, artificial reefs, submerged wrecks/obstructions, and state and federal borrow areas. **Table 2.1.1-1** lists temporary and permanent impacts to offshore state-regulated resources.

2.1.2 Offshore Landfall

The offshore ECR terminates at a single onshore TJB within the onshore HDD workspace. The transition to shore is made via HDD from an HDD exit pit location approximately 1,600 feet (ft) from the mean high water (MHW) line in Ocean City. The cable landfall HDD will be approximately 2,500 ft in length and surface onshore within 35th Street in Ocean City between Central Avenue and Asbury Avenue. The existing paved areas within the city streets will be utilized as temporary workspace from West Avenue to the beach bulkhead at 35th Street. Using HDD at landfall from the Atlantic Ocean will allow the Project to avoid impacts to sensitive resources such as beaches, dunes, and overwash areas. Additionally, HDD will allow the Project to avoid surficial impacts to beachfront Green Acres-encumbered parcels owned by Ocean City (Block 611.11, Lots 137 and 145). Use of HDD will also avoid impacts to the ongoing USACE beach nourishment operations within Ocean City. The cable will be approximately 50 ft below the peak of the dunes on the beach and approximately 35 ft below USACE's construction template for beach nourishment activities (see Appendix C Design Plans). The cable will also be buried between 10 and 15 ft below the beach nourishment project's depth of closure elevation of -22 ft NAVD88. Based on correspondence with USACE, while all of Ocean City's beaches are within USACE's beach nourishment program, this portion of the Ocean City beach is not actively being renourished and has remained stable for many years. The alignment to land within the 35th Street roadway right-of-way (ROW) was selected because it is previously disturbed with sufficient space to allow for HDD work areas. Noise attenuation measures such as sound screens and/or curtains will be implemented, and construction will take place in winter months so as to reduce impacts to local residents and tourism/recreation.

Table 2.1.1-1. Offshore BL England Ocean Wind 1 Project Area proposed temporary and permanent impacts to state-regulated resources.

Regulated Resource	Jetting/Jet-assisted Cable Plow Trench		Jetting/Jet-assisted Cable Plow Skids		Dredging Activities			Mooring and Anchoring Activities		Shoreline Stabilization		TOTAL		
	Temporary (acres)	Permanent (acres)	Temporary (acres)	Permanent (acres)	Temporary (acres)	Volume (cubic yards)	Permanent (acres)	Temporary (acres)	Permanent (acres)	Temporary (acres)	Permanent (acres)	Temporary (acres)	Volume (cubic yards)	Permanent (acres)
State Open Waters	2.134	0.000	16.082	0.000	0.711	6,682	0.000	0.265	0.000	0.000	0.000	19.192	6,682	0.000
Submerged Aquatic Vegetation Habitat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shellfish Habitat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intertidal and Subtidal Shallows	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prime Fishing Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-

2.1.3 Onshore Export Cable Route

After making landfall at 35th Street, the ECR would travel northwest within the paved areas of 35th Street before turning to the northeast for a distance of approximately 330 ft, at which point the ECR turns back to the northwest and onto Roosevelt Boulevard. The cable would remain within the Roosevelt Boulevard, Cape May County ROW adjacent to coastal wetlands to the north until the alignment exits Roosevelt Boulevard paved areas just prior to the bridge crossing Peck Bay/Crook Horn Creek. The ECR exits the pavement to the south of Roosevelt Boulevard and onto Waterview Boulevard, then continues on Nautilus Drive within the roadway, to a previously disturbed parking area at the end of Nautilus Drive. At this point the cable will cross beneath Crook Horn Creek south of the Roosevelt Boulevard Bridge via HDD technology with the entry/exit pit within the paved area at the end of Nautilus Drive. On the west side of Crook Horn Creek, the cable will exit the HDD within a previously disturbed area used as a rowing club, south of the Roosevelt Boulevard Bridge before crossing to the north side of Roosevelt Boulevard and re-entering the northbound paved ROW of Roosevelt Boulevard. HDD installation under Crook Horn Creek will avoid impacts to submerged aquatic vegetation (SAV), shellfish, wetlands, and a Green Acres encumbered parcel north of the bridge (Block 3350.01, Lot 17 owned by Ocean City). From here, the cable will continue to follow Roosevelt Boulevard into Upper Township to the northwest entirely within paved areas for approximately 1.1 miles before turning northeast onto State Route 9 (North Shore Road) for 1.8 miles. The onshore ECR will then turn northwest onto Clay Avenue and terminate at the proposed onshore substation within the prior golf course area at the decommissioned BL England Generating Station in Upper Township.

2.1.4 Onshore Substation

The onshore substation has been sited within approximately 12 acres of Upper Township Block 479, Lot 76. The substation was sited within a previously disturbed, dilapidated golf course. An NJDEP LOI for the property was issued March 19, 2019 (File No. 0511-03-0011.4 FWW180001). Because this LOI is valid for a period of five years, it was relied upon for siting of the proposed substation. Subsequent wetlands within the proposed substation location were identified by NJDEP staff during a wetland verification site visit in November 2021.

Of the areas made available by the owner (at the time that Ocean Wind 1 entered into an option agreement), the portion of the parcel selected was chosen for substation development because of its proximity to the onshore interconnection point at the BL England Generating Station. The topography of the proposed development area is also relatively flat and would not require extensive import of fill. Siting the onshore substation in this area would also make use of the adjacent generating station access road and limit the amount of additional impervious surface required to access the substation. The areas outside of the proposed development area but within the parcel contain an extensive wetland complex that includes freshwater forested wetlands and coastal wetlands north of the railroad ROW. Wetlands and their associated transition areas identified by the 2019 LOI are avoided within the proposed development parcel. The additional wetlands identified during the 2021 field verification that cannot be avoided will be mitigated for in accordance with State and Federal regulations. Refer to **Table 2.1.4-1** below for summary of temporary and permanent impacts to state regulated resources.

Table 2.1.4-1. BL England Ocean Wind 1 Project onshore proposed temporary and permanent impacts to state-regulated Resources

Regulated Resource	Onshore Export Cable Installation		Onshore Substation		Total	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Freshwater Wetlands	-	-	1.289	0.653	1.289	0.653
Freshwater Wetlands Transition Area	-	-	1.294	0.010	1.294	0.010

Regulated Resource	Onshore Export Cable Installation		Onshore Substation		Total	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Coastal Wetlands	0.006	-	-	-	0.006	-
Coastal Wetlands Transition Area	0.472	-	-	-	0.472	-

2.2 Oyster Creek

2.2.1 Offshore Export Cable

The Oyster Creek offshore ECR contains two cables and begins within the Wind Farm Area at two offshore substations and proceeds north for approximately 57 miles to the Atlantic Ocean side of Island Beach State Park (IBSP). Within state waters, the two cables will run parallel to each other separated by approximately 300 ft at the 3 nm boundary, before narrowing to approximately 200 ft just prior to HDD landfall at IBSP. Along the ECR, the cables will avoid the majority of the existing sensitive resources to the maximum extent practicable including prime fishing areas, artificial reefs, submerged wrecks/obstructions, and state and federal borrow areas. Within state waters, just prior to landfall the ECR will cross approximately 1.7 miles of the Cedar Creek Prime Fishing Ground in a nearly straight alignment so as to minimize the impacts to the area. **Table 2.2.1-1** lists temporary and permanent impacts to offshore state-regulated resources.

Table 2.2.1-1. Offshore Oyster Creek Ocean Wind 1 Project Area proposed temporary and permanent impacts to state-regulated resources

Regulated Resource	Jetting/Jet-assisted Cable Plow Trench		Jetting/Jet-assisted Cable Plow Skids		Dredging Activities				Mooring and Anchoring Activities		Shoreline Stabilization		TOTAL			
	Temporary (ac)	Permanent (ac)	Temporary (ac)	Permanent (ac)	Temporary (ac)	Temporary Volume (CY)	Permanent Volume (CY)	Permanent (ac)	Temporary (ac)	Permanent (ac)	Temporary (ac)	Permanent (ac)	Temporary (ac)	Temporary Volume (CY)	Permanent Volume (CY)	Permanent (ac)
State Open Waters	6.311	-	41.253	-	26.279	118,359	18,030	3.645	1.644	-	-	0.083	56.24	118,359	18,030	3.728
Submerged Aquatic Vegetation Habitat	-	-	-	-	1.803	8,120	4,507	0.911	0.020	-	-	0.083	1.832	8,120	4,507	0.994
Shellfish Habitat	3.425	-	20.622	-	4.748	21,386	18,030	3.645	0.695	-	-	-	29.495	21,386	18,030	3.645
Intertidal and Subtidal Shallows	-	-	-	-	3.936	13,093	-	-	0.025	-	-	0.083	3.961	13,093	-	0.083
Prime Fishing Areas	1.335	-	10.061	-	-	-	-	-	0.094	-	-	-	11.490	-	-	-

*Dredging impacts within SAV habitat are based on the Department's mapped SAV, dated 1986. SAV surveys from 1979 (NJDEP), Rutgers (2009, 2003, 1996-99), Ocean Wind 1 (2021) have determined that the prior channel west of IBSP does not currently support SAV

2.2.2 Offshore Landfall

The offshore ECR terminates at two onshore TJBs within the onshore HDD workspace. The transition to shore is made via HDD from two HDD exit pit locations in the Atlantic Ocean approximately 950 ft from the MHW line at IBSP. The two cable landfall HDDs will be approximately 1,550 ft in length and will surface onshore within the southern auxiliary lot of Swimming Area #2. The existing paved areas within the remaining parking lot for Swimming Area #2 will be utilized as temporary workspace so as to minimize the impacts to natural resources. The area comprises previously disturbed areas that have been paved. HDD landfall from the Atlantic Ocean will allow the Project to avoid impacts to sensitive resources such as beaches, dunes, and overwash areas. The alignment to land in the auxiliary parking lot of Swimming Area #2 was selected as this area is seasonally used by the park (closed between October and June) and represents a previously disturbed, paved area with sufficient space to allow for HDD work areas.

2.2.3 Crossing of Island Beach State Park

To cross IBSP, the proposed route will begin within the auxiliary parking lot of Swimming Area #2 at the TJBs within the HDD workspace and will continue north for approximately 1,100 ft through the western side of the main parking lot via traditional cable duct installation, then northwest approximately 300 ft across Shore Road to the maintenance area workspace on the western shoreline. From the maintenance area workspace, the route will continue via open cut into Barnegat Bay within a prior channel (previously disturbed and unmaintained), before traversing southwest across Barnegat Bay.

Utilization of the previously disturbed main parking lot adjacent to the north and the maintenance area to the west of Shore Road avoids impacts on Shore Road, which is the main thoroughfare to the southern portion of the island. Some minor clearing and wetland disturbance will be required west of Shore Road, but the route through the maintenance area allows for direct access to the prior channel. Utilization of the prior channel to the west of the maintenance area will make use of a previously disturbed area of deeper water and minimize the impacts to SAV and Intertidal and Subtidal Shallows (ISS). Furthermore, deeper water within this area allows for substantially less dredging than other routes, and greater likelihood of using jetting technology for longer distances (see Appendix A Alternatives Analysis of the Application). Additionally, this will minimize the amount of added length to the export cable route, making this alternative feasible from an engineering perspective, without the need for a high voltage alternative current (HVAC) booster. Use of open-cut installation allows for a reduced cable separation (20 m for open cut rather than 50 m for HDD), which keeps the majority of workspace within the prior channel and outside of areas containing dense SAV beds.

2.2.4 Barnegat Bay Crossing and Lacey Township Landfall

The ECR will cross the shallow waters of Barnegat Bay from the open cut landfall on IBSP, starting within the prior channel traveling due west with a cable separation of approximately 65 ft, before widening to 160 ft outside of the channel and turning southwest for approximately 3.5 miles. The ECR then turns due west again before the inshore portion of the ECR terminates at two onshore TJBs within the onshore HDD workspace at the Holtec Property. The preferred method of installation for the transition to shore is HDD from two HDD exit pits between 700 and 800 feet from the MHW line at Lacey Township in Barnegat Bay. Geotechnical investigations upon which installation design depends are ongoing. Ocean Wind 1 anticipates that the preliminary data from these surveys needed to complete installation design will be available in Q4 2022. At that time, data will be reviewed to determine whether HDD is the installation technique with the least environmental impact, or whether the risk of inadvertent return is such that open cut would result in the least impact. The offshore plans included in Appendix C provide details for the preferred option HDD installation as well as alternative installation in the event that open cut installation would minimize impacts. Should open cut trenching be required, more detail and advanced design will be presented in a subsequent permit submittal to NJDEP. Potential additional impacts of open cut trenching can be found in **Table 2.2.4-1**.

Table 2.2.4-1. Potential additional impacts to NJDEP-regulated resources as a result of open cut trenching cable installation

Regulated Resource	Temporary (acres)	Temporary Volume Removed (CY)	Permanent (acres)	Permanent Volume Removed (CY)
State Open Water	2.22	24,300	-	-
Submerged Aquatic Vegetation	1.1	12,100	-	-
Shellfish Habitat	1.9	21,100	-	-
Intertidal and Subtidal Shallows	1.2	12,800	-	-

*Impacts to be further refined later based on advanced engineering should open cut trenching be required

Through Barnegat Bay, Ocean Wind 1 sited the cable to minimize impacts to NJDEP-mapped SAV and shellfish resources. Furthermore, based on the most recent studies available (2009 mapped SAV and Ocean Wind 1 Phase 1 SAV mapping), much of these areas show substantially less SAV and shellfish to be currently present in these areas as compared to previous mapping. Ocean Wind 1 will conduct additional in-water video collection in summer 2022 to further refine the delineations of SAV beds near the Project footprint, document percent cover, and identify species. The results will be used to inform final Project design to minimize impacts to SAV. Six months prior to cable installation (within the growing season), a focused pre-construction in-water SAV survey will be conducted to characterize the SAV condition (e.g., shoot density) within the Project's potential area of impact.

The Lacey Township landfall is located at the shore of Barnegat Bay within a parcel owned by Holtec (Lacey Township Block 100, Lot 1.06). The two HDDs will extend for a distance of approximately 1,200 ft and were designed to target previously disturbed areas on land where possible. Landfall via HDD at the Holtec Property in Lacey Township will allow for avoidance of impacts to shellfish habitat, SAV, ISS, beaches, and mapped coastal wetlands. HDD operations onshore will be minimized through the use of timber matting in the workspace around the HDD entry pits. While there will be a very small area of permanent impacts to wetlands in this location (likely the size of four manhole covers), all temporary impacts from construction activities will be restored to pre-construction contours and impacts (both temporary and permanent) will be mitigated. At the HDD entry pit, a small hardstand area around the TJB will permanently remain below the ground surface, with two manholes flush with the ground surface to allow for access and maintenance during operation as needed.

2.2.5 Onshore Export Cable Route

The proposed onshore ECR proceeds west across the Holtec Property in Lacey Township through undeveloped land, following previously disturbed upland berms and dirt trails. The cable will be installed within a small area of coastal wetlands, wetland transition area and riparian zone while within these previously disturbed areas (see **Table 2.2.5-1**). Use of historically disturbed upland berms and trails minimizes impacts to wetlands and state open waters. The cable will follow the berms and trails west and then southwest, just south of the existing paved access road on the Holtec Property. Along this route a small concrete headwall will be replaced in-kind within the Holtec Property, approximately 1,400 ft from the HDD landfall area. The ECR then crosses a forested area that will require minor clearing of some brush and trees. The cables will be installed within two duct banks that range from 6 to 15 ft in separation through the Holtec Property. This route will avoid disturbance to roads, in the form of pavement opening for installation of utilities, in the vicinity of the New Jersey Department of Transportation's (NJDOT) combined disposal facility (CDF).

This route traverses a previously disturbed but currently undeveloped area and will shorten the distance to the onshore substation, allowing the cables to function at maximum capacity. This route will also allow for reduced conflict with existing users along the narrow Holtec Property access road east of Route 9. Based on correspondence with local stakeholders, the road serves as emergency access to the Vincent Clune Park and also as NJDOT access to the state-owned CDF. The shortened route south of the Holtec Property access road also reduces sharp turns along Route 9 and consolidates the Oyster Creek and Route 9 HDD crossings.

As the ECR approaches Route 9, it turns to the southwest and crosses underneath Route 9 and Oyster Creek using HDD methodology, surfacing in an existing private access road owned by Holtec, south of Oyster Creek (Ocean Township Block 41, Lot 43). The route then continues back into Lacey Township within this previously disturbed, paved access road for approximately 3,000 linear ft, until the termination at the proposed onshore substation parcel. The HDD crossing of Oyster Creek allows for a more direct route to the substation and avoids road opening work and major traffic attenuation along Route 9. Using HDD under Oyster Creek will also allow for avoidance of surficial impacts to open waters, and freshwater and coastal wetlands. Utilizing the existing paved access road to run the cable west to the substation parcel will allow for avoidance to adjacent wetlands and watercourses.

Table 2.2.5-1. Onshore Oyster Creek Ocean Wind 1 Project Area proposed temporary and permanent impacts to state-regulated resources.

Regulated Resource	Onshore Export Cable Installation		Onshore Substation		Total	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Freshwater Wetlands	0.032	0.143	0.008	1.22	0.040	1.363
Freshwater Wetlands Transition Area	3.147	2.109	0.120	-	3.267	2.109
Coastal Wetlands	5.368	0.031	-	-	5.368	0.031
Coastal Wetlands Transition Area	1.212	0.002	-	-	1.212	0.002
Riparian Zone	2.046	0.0006	-	-	2.046	0.0006
State Open Waters	0.091	-	-	-	0.091	-

2.2.6 Onshore Substation

The onshore substation has been sited within the eastern portion of Lacey Township's Block 1001, Lot 4.06, a parcel acquired by Ocean Wind 1 for development. The parcel has been historically disturbed as part of the development of the former Oyster Creek Nuclear Generating Station and was often used for storage and staging, based on historic aerial imagery. The eastern portion of the parcel was selected for development of the substation because of its proximity to the onshore interconnection point, flat topography and lack of natural resources. The area is dominated by early successional forest and scrub shrub habitat dominated by eastern red cedar. An NJDEP Letter of Interpretation (LOI) for the property was issued August 15, 2017 (1512-17-0013.1 FWW170001) identifying isolated freshwater wetlands of intermediate value. Because this LOI is valid for a period of five years, it was relied upon for siting of the proposed substation. Subsequent to the siting of the substation, wetlands within the proposed substation location were identified by NJDEP staff during a wetland verification site visit in November 2021. The western portion of the parcel contains varying topography with a "gully" feature that slopes from an elevation of approximately 27 ft (North American Vertical Datum [NAVD]88) down to 19 ft elevation before returning to approximately 26 ft elevation and would require a significant amount of fill to develop. Therefore, the substation was sited in the eastern portion of the parcel. Refer to **Table 2.2.5-1** above for summary of temporary and permanent impacts to onshore state-regulated resources.

2.3 Applicant Proposed Measures to Avoid, Minimize and Mitigate Impacts

Table 2.3-1 provides application proposed measures (APMs) to avoid, minimize and mitigate impacts associated with the Project as well as proposed environmental monitoring associated with the Project.

Table 2.3-1. Applicant Proposed Measures (APMs) to Avoid, Minimize, or Mitigate Impacts, and Proposed Monitoring

APM Number *	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
General																				
Project Siting																				
GEN-01	Site onshore export cable corridors and landfall within existing rights-of-way or previously disturbed/developed lands to the extent practicable.	●	●	●	●	●	●	●					●	●	●		●			●
GEN-02	Site onshore, cable landfall and offshore facilities to avoid known locations of sensitive habitat (such as known nesting beaches) or species during sensitive periods (such as nesting season); important marine habitat (such as high density, high value fishing grounds as determined by fishing revenues estimate [BOEM Geographical Information System (GIS) Data]); and sensitive benthic habitat; to the extent practicable. Avoid hard-bottom habitats and seagrass communities, where practicable, and restore any damage to these communities.	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
GEN-03	Avoid areas that would require extensive seabed or onshore alterations to the extent practicable.	●	●	●	●	●	●	●	●	●	●	●				●	●			●
GEN-04	Bury onshore and offshore cables below the surface or seabed to the extent practicable and inspect offshore cable burial depth periodically during project operation, as described in the Project Description, to ensure that adequate coverage is maintained to avoid interference with fishing gear/activity.	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
GEN-06	Develop and implement a site-specific monitoring program to ensure that environmental conditions are monitored during construction, operation, and decommissioning phases, designed to ensure environmental conditions are monitored and reasonable actions are taken to avoid and/or minimize seabed disturbance and sediment dispersion, consistent with permit conditions. The monitoring plan will be developed during the permitting process, in consultation with resource agencies.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Design																				
GEN-07	Implement aircraft detection lighting system (ADLS)[2] on wind turbine generators (WTGs). Comply with Federal Aviation Administration (FAA),		●				●	●			●	●	●	●	●	●	●	●	●	●

[2] ADLS would be used to provide continuous 360-degree radar surveillance of the airspace around the Project from the sea level to above aircraft flight altitudes, automatically issuing signals to activate obstruction lighting when aircraft are detected at a defined outer perimeter.

APM Number *	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
	BOEM, and U.S. Coast Guard (USCG) lighting, marking and signage requirements to aid navigation per USCG navigation and inspection circular (NVIC) 02-07 (USCG 2007) and comply with any other applicable USCG requirements while minimizing the impacts through appropriate application including directional aviation lights that minimize visibility from shore. Information will be provided to allow above water obstructions and underwater cables to be marked in sea charts, aeronautical charts, and nautical handbooks.																			
	Construction																			
GEN-08	To the extent practicable, use appropriate installation technology designed to minimize disturbance to the seabed and sensitive habitat (such as beaches and dunes, wetlands and associated buffers, streams, hard-bottom habitats, seagrass beds, and the near-shore zone); avoid anchoring on sensitive habitat; and implement turbidity reduction measures to minimize impacts to sensitive habitat from construction activities.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
GEN-10	Prepare waste management plans and hazardous materials plans as appropriate for the Project.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
GEN-11	Establish and implement erosion and sedimentation control measures in a Stormwater Pollution Prevention Plan (SWPPP, authorized by the state), and Spill Prevention, Control, and Countermeasures (SPCC) Plan to minimize impacts to water quality (signed/sealed by a New Jersey Professional Engineer and prepared in accordance with applicable regulations such as NJDEP Site Remediation Reform Act, Linear Construction Technical Guidance, and Spill Compensation and Control Act). Development and implementation of an Oil Spill Response Plan (OSRP, part of the SPCC plan) and SPCC plans for vessels.	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
GEN-12	Where HDD trenchless technology methods are used, develop, and implement an Inadvertent Returns Contingency Plan that includes measures to prevent inadvertent returns of drilling fluid to the extent practicable and measures to be taken in the event of an inadvertent return.	●	●		●	●	●		●	●	●	●		●		●	●		●	
	Restoration																			
GEN-13	Restore disturbance areas in the Onshore Project Area to pre-existing contours (maintaining natural surface drainage patterns) and allow vegetation to become reestablished once construction activities are completed, to the extent practicable.	●	●	●	●	●	●	●		●				●			●			

APM Number *	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
Communication																				
GEN-14	Develop and implement a communication plan to inform the USCG, Department of Defense (DOD) headquarters, harbor masters, public, local businesses, commercial and recreational fishers, among others of construction and maintenance activities and vessel movements, as coordinated by the Marine Coordination Center and Marine Affairs.		●				●		●				●	●	●	●	●	●	●	
GEN-15	Develop and implement an Onshore Maintenance of Traffic Plan to minimize vehicular traffic impacts during construction. Ocean Wind 1 would designate and utilize onshore construction vehicle traffic routes, construction parking areas, and carpool/bus plans to minimize potential impacts.			●		●	●						●	●	●		●			
GEN-16	Prior to the start of operations, Ocean Wind 1 will hold training to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring procedures, and review operational procedures. This training will include all relevant personnel, crew members and protected species observers (PSO). New personnel must be trained as they join the work in progress. Vessel operators, crew members and protected species observers shall be required to undergo training on applicable vessel guidelines and the standard operating conditions. Ocean Wind 1 will make a copy of the standard operating conditions available to each project-related vessel operator.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
GEN-17	Implement Project and site-specific safety plans (Safety Management System,).		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Geological Resources																				
GEO-02	Take reasonable actions (use BMPs) to minimize seabed disturbance and sediment dispersion during cable installation and construction of project facilities.	●	●			●			●	●	●	●				●			●	●
GEO-03	Conduct periodic and routine inspections to determine if non-routine maintenance is required.	●	●				●	●	●	●	●	●	●	●		●	●	●	●	●
GEO-04	In contaminated onshore areas, comply with state regulations requiring the hiring of a Licensed Site Remediation Professional (LSRP) to oversee the linear construction project and adherence to a Materials Management Plan (MMP). The MMP prepared for construction can also be followed as a best management practice when maintenance requires intrusive activities.	●	●		●	●	●		●	●	●	●	●	●	●	●	●			

APM Number*	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
Water Quality																				
WQ-01	Implement turbidity reduction measures to minimize impacts to hard-bottom habitats, including seagrass communities, from construction activities to the extent practicable.		●						●	●	●	●				●				
WQ-02	All vessels will be certified by the Project to conform to vessel operations and maintenance protocols designed to minimize the risk of fuel spills and leaks.		●				●		●	●	●	●				●		●	●	
Air Quality																				
AQ-01	Use low sulfur fuels to the extent practicable (15 parts per million [ppm] per 40 Code of Federal Regulations [CFR] §80.510(c) as applicable).			●										●						
AQ-02	Select engines designed to reduce air pollution to the extent practicable (such as U.S. Environmental Protection Agency [USEPA] Tier 3 or 4 certified).			●										●						
AQ-03	Limit engine idling time.			●										●						
AQ-04	Comply with international standards regarding air emissions from marine vessels.			●										●						
AQ-05	Implement dust control plan.	●	●	●																
Terrestrial and Coastal Habitats and Fauna																				
TCHF-01	Coordinate with the New Jersey Department of Environmental Protection (NJDEP) and United States Fish and Wildlife Service (USFWS) to identify unique or protected habitat or known habitat for threatened or endangered and candidate species and avoid these areas to the extent practicable.				●	●	●	●	●	●	●	●								
TCHF-02	Conduct maintenance and repair activities in a manner to avoid or minimize impacts to sensitive species and habitat such as beaches, dunes, and the near-shore zone.		●		●	●	●	●	●	●	●	●	●		●					
TCHF-03	Wetland mitigation options are being coordinated with state and federal agencies and may include a mix of banking and onsite restoration, depending on agency preference and availability.		●		●	●														
Birds																				
BIRD-01	Evaluate avian use by conducting pre-construction surveys for raptor nests, wading bird colonies, seabird nests, and shorebird nests during nesting periods. (Focus being listed species or species identified of special concern by the federal or state government.)						●													
BIRD-04	Use lighting technology that minimizes impacts on avian and bat species to the extent practicable.						●	●												

APM Number *	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
BIRD-06	WTG air gaps (minimum blade tip elevation to the sea surface) to minimize collision risk to marine birds which fly close to ocean surface.						●													
Bats																				
BAT-02	If tree clearing is required in areas with trees suitable for bat roosting during the period when northern long-eared bats may be present, develop avoidance and minimization measures in coordination with USFWS and NJDEP and conduct pre-construction habitat surveys.							●												
Benthic Resources																				
BENTH-01	Ocean Wind 1 is conducting appropriate pre-siting surveys to identify and characterize potentially sensitive seabed habitats and topographic features.	●	●		●	●			●	●		●				●			●	●
BENTH-02	Use standard underwater cables which have electrical shielding to control the intensity of electromagnetic fields (EMF). EMF will be further refined as part of the design or cable burial risk assessment.								●	●	●	●				●			●	
BENTH-03	Conduct a submerged aquatic vegetation (SAV) survey of the proposed inshore export cable route.				●	●			●	●		●								
Fish and EFH																				
FISH-01	Evaluate geotechnical and geophysical survey results to identify sensitive habitats (e.g., shellfish and SAV beds) and avoid these areas during construction, to the extent practicable.				●				●	●		●	●		●	●	●		●	
FISH-02	Ocean Wind 1 will coordinate with NJDEP, NMFS and USACE regarding time of year restrictions for winter flounder and river herring, as well as summer flounder habitat areas of particular concern (HAPC).				●				●	●					●	●				
Marine Mammals and Sea Turtles																				
MMST-01	Vessels related to project planning, construction, and operation shall travel at speeds in accordance with National Oceanic and Atmospheric Administration (NOAA) requirements or the agreed to adaptive management plan per the Project PSMMMP when assemblages of cetaceans are observed. Vessels will also maintain a reasonable distance from whales, small cetaceans, and sea turtles, as determined through site-specific consultations (specifics to be added based on consultation).										●	●								
MMST-02	Project-related vessels will be required to adhere to NMFS Regional Viewing Guidelines for vessel strike avoidance measures during construction and operation to minimize the risk of vessel collision with										●	●								

APM Number*	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
	marine mammals and sea turtles. Operators shall be required to undergo training on applicable vessel guidelines.																			
MMST-03	Vessel operators will monitor NMFS North Atlantic right whale (NARW) reporting systems (e.g., the Early Warning System, Sighting Advisory System) for the presence of NARW during planning, construction, and operations within or adjacent to Seasonal Management Areas and/or Dynamic Management Areas.										●									
MMST-04	Ocean Wind 1 will post a qualified observer as agreed to during the NMFS incidental take authorization process, on site during construction activities to avoid and minimize impacts to marine species and habitats in the Project Area.										●	●				●				
MMST-05	Obtain necessary permits to address potential impacts on marine mammals from underwater noise and establish appropriate and practicable mitigation and monitoring measures in coordination with regulatory agencies.										●	●								
MMST-06	Develop and implement a PSMMP.										●	●								
Socioeconomics and Environmental Justice																				
SOC-01	Comply with NJDEP noise regulations (New Jersey Administrative Code [N.J.A.C.] 7:29), which limit noise from industrial facilities received at residential property lines to 50 decibels (dB) during nighttime (10:00 p.m. to 7:00 a.m.) and 65 dB during daytime as well as specific octave band noise limits, and comply with any local noise regulations, to the extent practicable, to minimize impacts on nearby communities.												●	●	●		●			
Cultural, Historical, and Archaeological Resources																				
CUL-01	Develop and implement an Unanticipated Discovery Plan.																			●
CUL-02	Use the results of geotechnical and geophysical surveys to identify potential cultural resources. Any cultural resources found will be avoided to the extent practicable. Where avoidance is not practicable, coordinate with relevant agencies and affected tribes to determine minimization and mitigation as necessary.																			●
CUL-03	Conduct background research and consult with the State Historic Preservation Office (SHPO) to determine the need for cultural resource surveys onshore. Any cultural resources found will be avoided to the extent																			●

APM Number *	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
	practicable. Where avoidance is not practicable, coordinate with SHPO and affected tribes to determine minimization and mitigation as necessary.																			
CUL-04	The Project has been designed to minimize visual impacts to historic and cultural properties to the extent feasible. The Project's layout was adjusted to align turbines at the eastern portion of the lease area, so that closest turbines are at least 15 miles from shore. Visibility of the turbine array from all identified properties within the Preliminary Area of Potential Effect would be minimized and mitigated further by measures adopted in this table including ADLS and markings (GEN-07), and as in Appendix N.																			●
CUL-05	Mitigation in the form of documentation, planning, or educational materials will be coordinated with stakeholders.																			●
Recreation and Tourism																				
REC-01	Develop a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season, where practicable.												●		●	●		●	●	
REC-02	Coordinate with local municipalities to minimize impacts to popular events in the area during construction, to the extent practicable.												●		●	●		●	●	
Commercial and For-Hire Recreational Fishing																				
CFHFISH-01	Work cooperatively with commercial/recreational fishing entities and interests to ensure that the construction and operation of the Project will minimize potential conflicts with commercial and recreational fishing interests. Review planned activities with potentially affected fishing organizations and port authorities to prevent unreasonable fishing gear conflicts.												●		●	●		●	●	
CFHFISH-02	Develop and implement a Fisheries Communication and Outreach Plan. The plan includes the appointment of a dedicated fisheries liaison as well as fisheries representatives who will serve as conduits for providing information to, and gathering feedback from, the fishing industry, as well as Project-specific details on fisheries engagements.		●										●		●	●	●	●	●	
CFHFISH-03	Implement Orsted's corporate policy and procedure to compensate commercial/recreational fishing entities for gear loss as a result of Project activities.												●		●	●	●		●	
Land Use and Coastal Infrastructure																				
LU-01	Develop crossing and proximity agreements with utility owners prior to utility crossings. (Crossing agreements in U.S. waters are supported by the		●						●								●	●	●	

APM Number *	Applicant Proposed Measure**	Geological Resources	Water Quality	Air Quality	Terrestrial & Coastal Habitats	Terrest. & Coastal Fauna	Birds	Bats	Benthic Resources	Fish & EFH	Marine Mammals	Sea Turtles	Demog. Employ. & Econ.	Environmental Justice	Rec. & Tourism	Comm. & For-Hire Rec. Fishing	Land Use & Coastal Infrastructure	Nav. & Vessel Traffic	Other Marine Uses	Cultural Resources
	International Cable Protection Committee (ICPC), which provides a framework for establishing cable crossing agreements.)																			
Navigation and Vessel Traffic																				
NAV-02	Site facilities to avoid unreasonable interference with major ports and USCG-designated Traffic Separation Schemes.												●		●		●	●	●	
Other Marine Uses																				
OUSE-01	Evaluate geotechnical and geophysical survey results to identify existing conditions, existing infrastructure, and other marine uses. Areas of other marine uses will be avoided to the extent practicable, and Ocean Wind 1 will coordinate with other users where avoidance is not practicable.	●															●	●	●	●
Visual																				
VIS-01	Address key design elements, including visual uniformity, use of tubular towers, and proportion and color of turbines.												●	●	●		●			●
VIS-02	Ocean Wind 1 has used appropriate viewshed mapping, photographic and virtual simulations, computer simulation, and field inventory techniques to determine the visibility of the proposed project. Simulations illustrate sensitive and scenic viewpoints.												●	●	●		●			●
VIS-03	Seek public input in evaluating the visual site design elements of proposed wind energy facilities.												●	●	●		●			●
VIS-04	Security lighting for onshore facilities will be downshielded to mitigate light pollution.																●			
VIS-05	Where substation components may be visible and highly contrasting with their surroundings, the Project would provide supplemental plantings and other landscape elements to screen the substation from public view.												●	●	●		●			●
VIS-06	Consideration will be given to visually adapt the buildings and other substation components into their physical context. The forms, lines, colors, and textures of these components will be influenced by their immediate surroundings and selected to minimize visual contrast and potential visual impact. Non-reflective paint will be used on all Project components.												●	●	●		●			●

* APM numbers were assigned to allow easy reference to specific measures. Each APM number includes an abbreviation of general (GEN) or the most pertinent resource area (e.g., NAV for Navigation) along with a number.

3. Existing Conditions

3.1 Sediment and Soils

The onshore facilities at BL England and Oyster Creek are within the Outer Lowland Province of the Atlantic Coastal Plain, which is characterized by broad plains and gently sloping hills. The Outer Lowland Province is characterized by coastal estuaries, swamplands, and near sea level relief (US Geological Survey 2017). Based on the Digital Elevation Model and Light Detection and Ranging (LiDAR) data, the Project elevation ranges between sea level and approximately 60 ft (18.5 m) above mean sea level (msl).

NJDEP provides surficial geology and bedrock data collected by USGS for the State of New Jersey in GIS format. The dataset provides the locations, boundaries, and names of geologic formations throughout New Jersey. Bedrock below BL England consists of the Cohansey formation in the upper 197 to 263 ft (60 to 80 m), and bedrock below Oyster Creek is the Wildwood Member of the Kirkwood Formation (Fugro 2018).

The bedrock units are overlain by surficial sediments and coastal plain deposits. Surficial sediment thickness is less than 10 ft in several areas within the onshore cable corridor (NJDEP and USGS 2018). Thick coastal plain deposits underlie the surficial sediments in the region. These deposits may be comprised of sand, gravel, silt, and clay lithologies associated with the Cape May, Pennsauken, Bridgeton, Beacon Hill, Cohansey, and Kirkwood formations (Waldner and Hall 1991; Duncan et al. 2000; Nordfjord et al. 2009). Buried channels marking glacial meltwater pathways in the late Pleistocene may incise these deposits and include a similar range of fill materials. Channel orientations are predominantly in the onshore-offshore direction.

Based on United States Department of Agriculture (USDA) soil maps and descriptions, surface soils underlying the BL England project area consist of urban land, sand, sandy loam, and loamy sand. Soils at the substation and interconnection line are Urban land, Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded, and Galloway loamy sand, 0 to 5 percent slopes. Surface soils underlying the Oyster Creek Project consist of sand, coarse sand, sandy loam, peat, and mucky peat. Soils at the substation and interconnection line are Lakehurst sand, 0 to 2 percent slopes. **Tables 3.1-1** and **3.1-2** below present the soil units underlying the onshore ECR.

Table 3.1-1. Soil Units Underlying BL England.

Map Unit Symbol	Soil Unit	Soil Type
BEADV	Beaches, 0 to 15 percent slopes, very frequently flooded	Sand
USPSBR	Urban land-Psamments, wet substratum complex, 0 to 2 percent slopes, rarely flooded	Not applicable
USPSAS	Urban land-Psamments, sulfidic substratum complex, 0 to 2 percent slopes, occasionally flooded	Not applicable
UR	Urban land	Not applicable
BEXAS	Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded	Sand
DoeBO	Downer sandy loam, 2 to 5 percent slopes, Northern Tidewater Area	Sandy loam
EveB	Evesboro sand, 0 to 5 percent slopes	Sand
GamB	Galloway loamy sand, 0 to 5 percent slopes	Loamy sand

Table 3.1-2. Soil Units Underlying Oyster Creek.

Map Unit Symbol	Soil Unit	Soil Type
AptAv	Appoquinimink-Transquaking-Mispillion complex, 0 to 1 percent slopes, very frequently flooded	Mucky peat
BerAr	Berryland sand, 0 to 2 percent slopes, rarely flooded	Sand
AtsAo	Atsion sand, 0 to 2 percent slopes, Northern Tidewater Area	Peat
LakB	Lakehurst sand, 0 to 5 percent slopes	Slightly decomposed plant material
WHe1	Herring Creek mucky silt loam, 0 to 1 m water depth	Mucky silt loam
PssA	Psamments, 0 to 2 percent slopes	Coarse sand
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	Muck

3.2 Water Resources and Wetlands

3.2.1 Watercourses

3.2.1.1 BL England

The BL England onshore facilities lie within four watersheds: Tuckahoe River (Hydrologic Unit Code [HUC] 11 No. 02040302070), Great Egg Harbor Bay/Lakes Bay/Skull Bay/Peck Bay (HUC 11 No. 02040302060), Crook Horn Creek (HUC 11 No. 02040302080), and Atlantic Coast - 34th St to Corson Inlet (HUC 11 No. 02040302940) (**Figure 3.2.1-1**). The watersheds are located within the Great Egg Harbor Watershed Management Area (WMA) 15 and Cape May WMA 16. The major watercourses draining these watersheds into the Great Egg Harbor Bay include Patcong Creek, and the Great Egg Harbor, Middle, and Tuckahoe Rivers. The NJDEP surface water quality standards (SWQS) were established for protection and enhancement of surface water sources, such as use designations and water quality-based effluent limitations. The watercourses within this area are predominantly categorized as FW2-NT/SE1, meaning that they are non-trout (NT) estuarine freshwaters (FW2) or brackish (SE1). In all FW2 waters, the designated uses include maintenance, migration, and propagation of natural and established biota, primary contact recreation, industrial and agricultural water supply, and public potable water supply after conventional filtration treatment. In SE1 waters, the designated uses include shellfish harvesting in accordance with N.J.A.C. 7:12; maintenance, migration, and propagation of natural and established biota; and primary contact recreation.

The proposed onshore ECR crosses Crook Horn Creek at Roosevelt Boulevard between Ocean City and Upper Township. This watercourse is classified as FW2-NT/SE1 (**Figure 3.2.1-2**). The Atlantic Ocean is classified SCC1. SC is the general surface water classification applied to coastal saline waters. Category One Waters (C1) are designated for the purposes of implementing the antidegradation policies set forth at N.J.A.C 7:9B-1.5(d), for protection from measurable changes in water quality based on exceptional ecological significance, exceptional recreational significance, exceptional water quality significance or exceptional fisheries resource(s) to protect their aesthetic value (color, clarity, scenic setting) and ecological integrity (habitat, water quality and biological functions).

-

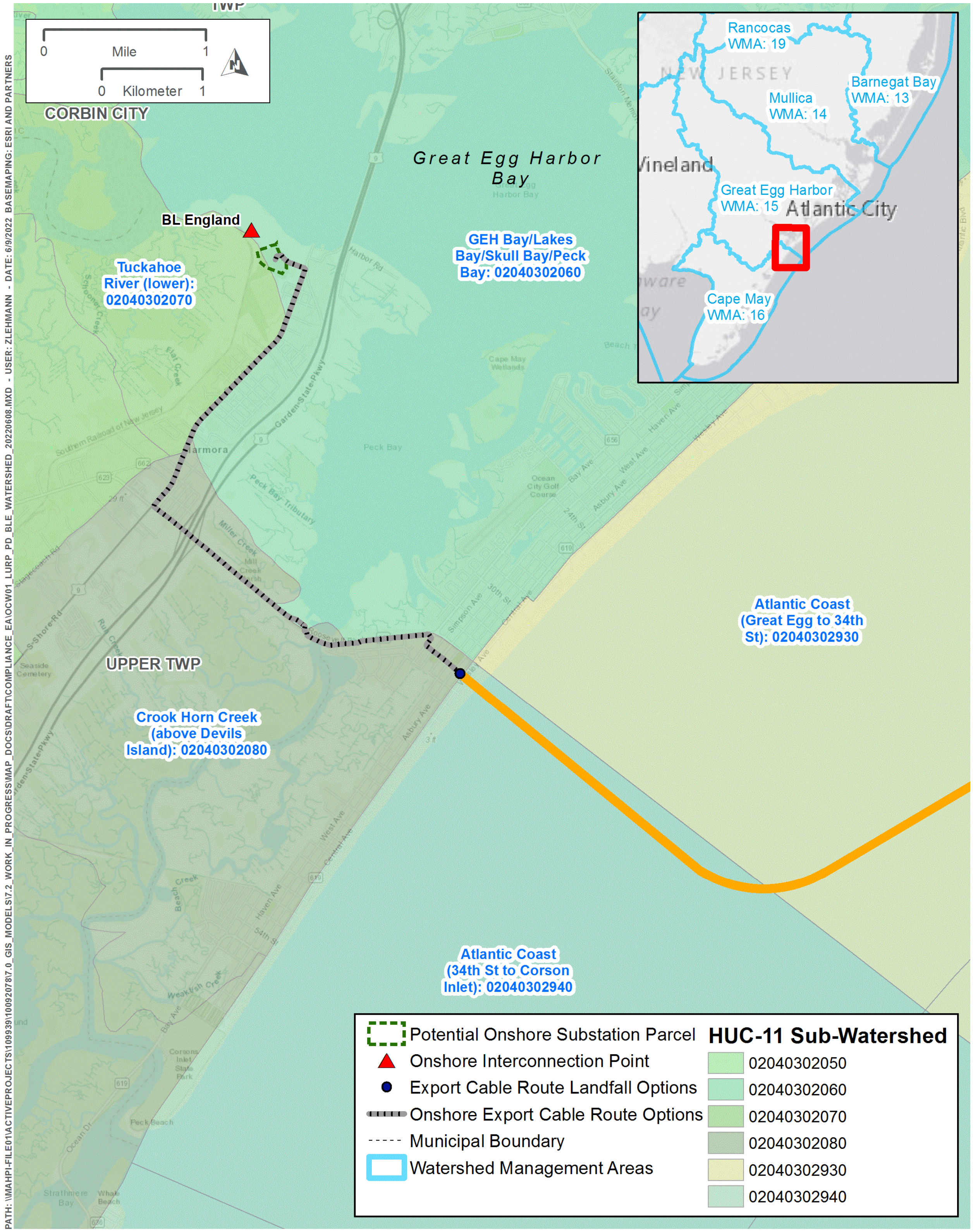

Figure 3.2.1-1. BL England Watershed Management Area.

PATH: \\MAHPI-FILE01\ACTIVEPROJECTS\109939\10092078\7.0_GIS_MODELS\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\COMPLIANCE_EA\OCW01_LURP_BLE_SWQS_20220609.MXD - USER: ZLEHMANN - DATE: 6/9/2022 BASEMAPING: ESRI AND PARTNERS

Figure 3.2.1-2. BL England Water Quality Classifications.

3.2.1.2 Oyster Creek

The Oyster Creek onshore facilities in New Jersey lie within four watersheds: Oyster Creek (HUC) 11 No. 02040301110, Barnegat Bay South (HUC 11 No. 02040301120) Barnegat Bay Central (HUC11 No. 02040301100), and Atlantic Coast (HUC 11 No. 02040301910) (**Figure 3.2.1-3**). All of the watersheds are located within the Barnegat Bay WMA (WMA 13). The onshore ECR crosses Oyster Creek near Route 9 and along the access road to the proposed substation. Based on NJDEP's SWQS, these watercourses are classified as non-trout saline and estuarine freshwaters or brackish (FW2-NT/SE1) (**Figure 3.2.1-4)**. Barnegat Bay is classified as SE1C1.

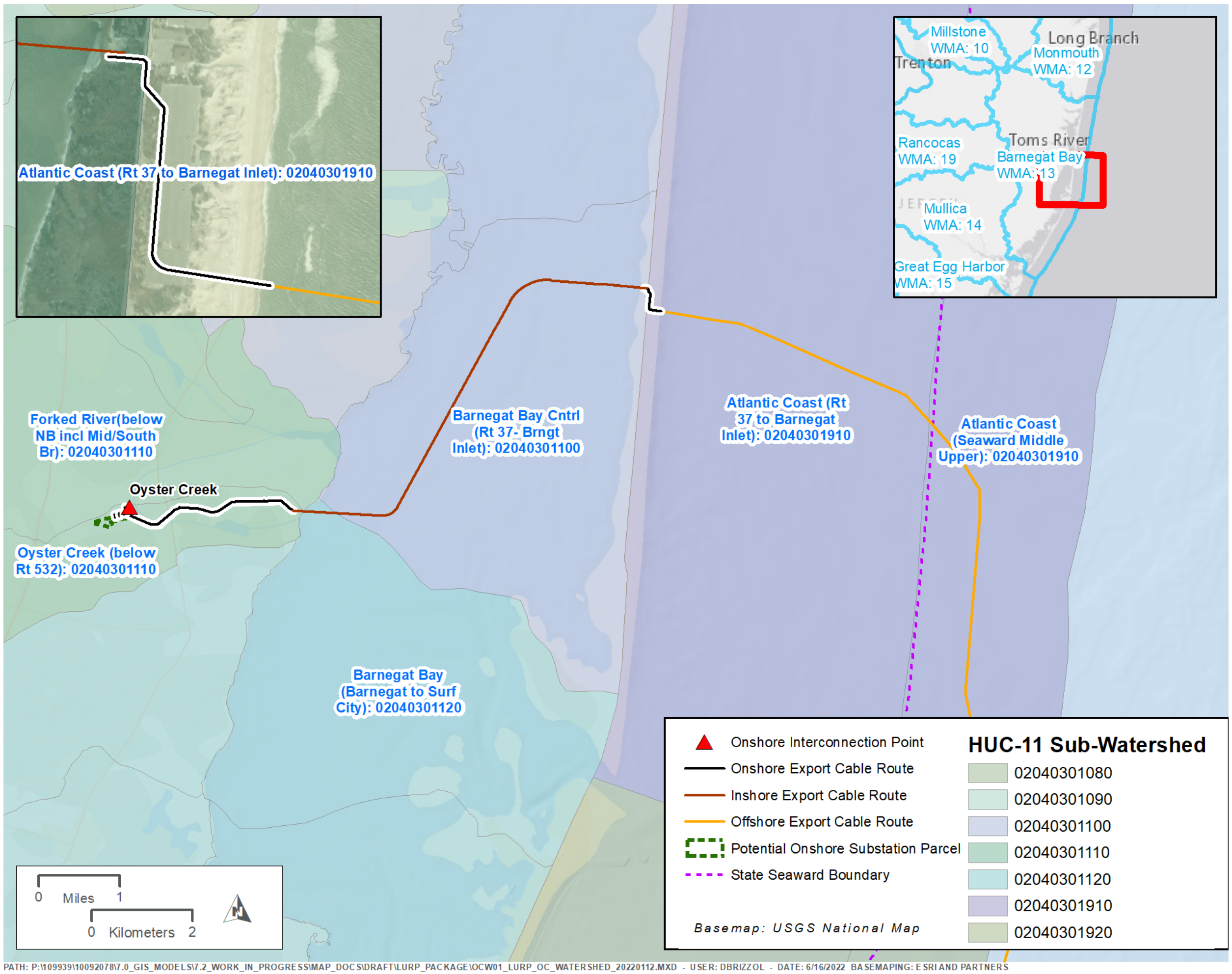

Figure 3.2.1-3. Oyster Creek Watershed Management Area.

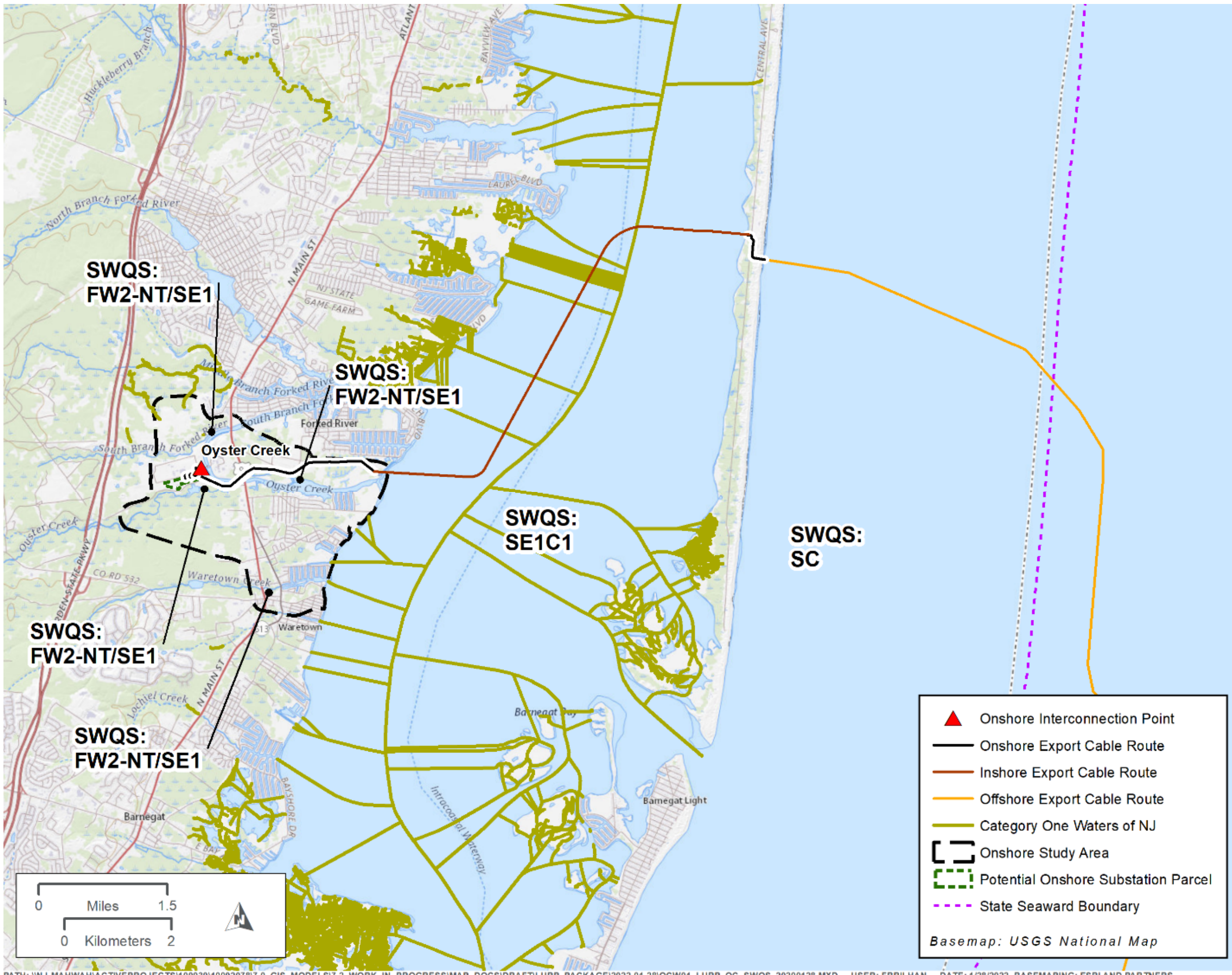

Figure 3.2.1-4. Oyster Creek Water Quality Classifications.

3.2.2 Water Quality – Coastal Waters

NJDEP conducts annual coastal water quality monitoring as required by the Clean Water Act (CWA). These data are utilized for New Jersey's Integrated Report to identify impaired waters. The monitoring program includes 250 locations and 1,000 samples collected per year for dissolved oxygen (DO), nutrients, and chlorophyll. **Table 3.2.2-1** provides the results of the annual coastal water quality monitoring from 1989 to 2009 at the locations collected in the New Jersey Atlantic Ocean waters. These monitoring locations are representative of the area within the offshore export cable corridors.

Table 3.2.2-1. Results from Annual Coastal Water Quality Samples taken near the Offshore Export Cable Corridors (1989-2009).

Water Quality Parameter	Unit	Mean	Maximum	Count of Samples
Great Egg Harbor Bay				
Ammonia	µg/L	61	385	188
Nitrate	µg/L	48	2288	194
Total Nitrogen	µg/L	344	2471	192

Water Quality Parameter	Unit	Mean	Maximum	Count of Samples
Total Phosphorus	µg/L	41	96	95
Chlorophyll a	µg/L	2	19	124
Dissolved Oxygen	µg/L	7	9	190
Barnegat Bay				
Ammonia	µg/L	28	247	1163
Nitrate	µg/L	38	550	1173
Total Nitrogen	µg/L	442	1820	1152
Total Phosphorus	µg/L	33	187	662
Chlorophyll a	µg/L	5	24	726
Dissolved Oxygen	µg/L	7.7	10	1146
Atlantic Ocean				
Ammonia	µg/L	27	504	1188
Nitrate	µg/L	38	259	1218
Total Nitrogen	µg/L	314	8457	1201
Total Phosphorus	µg/L	39	286	803
Chlorophyll a	µg/L	3	50	1021
Dissolved Oxygen	µg/L	7.7	15.1	1188

Note: µg/L = micrograms per liter; mg/L = milligrams per liter

Source: Connell 2010.

Barnegat Bay

The NJDEP conducts annual assessments of the state's waterways for water quality parameters and biological indicators. These measurements include DO, temperature, pH, turbidity, and Enterococci bacteria taken throughout the year (approximately 5-10 times per year). Approximately 440 sites in New Jersey within or near Barnegat Bay are included in the assessment. Sampling in 2013 season included DO, total suspended solids (TSS) and clarity, and chlorophyll a. **Table 3.2.2-2** summarizes the results of the Barnegat Bay Interim Assessment Report for DO, turbidity, clarity, and chlorophyll a (NJDEP 2014).

Out of the 440 sites, there were five within Barnegat Bay that were non-attaining for turbidity and two that were non-attaining for DO. For Manahawkin Bay and Upper Little Egg Harbor areas of measurement, 50 percent of the 18 stations were below the > 5 mg/L DO target. For samples taken from 15 stations in Lower Little Egg Harbor, 44 percent were below the > 5 mg/L DO target (NJDEP 2014). Upper Little Egg Harbor, and Lower Little Egg Harbor Bay water quality were designated as fully supporting recreation and shellfish, but not supporting wildlife due to increased turbidity and low DO levels. At Toms Estuary, recreation, aquatic life, shellfish, and fish consumption designated uses were all considered not supporting due to Enterococci bacteria, DO, total coliform, and metal contamination in fish.

Table 3.2.2-2. Summary of Water Quality Data from Barnegat Bay Interim Assessment Report (NJDEP 2014b).

Assessment Unit	Number of Stations				
	DO Concentration (mg/L)	DO Saturation (%)	TSS Concentration (mg/L)	% Light Through Water	Chlorophyll a Concentration (µg/L)
Point Pleasant Canal and Bay Head Harbor	2	1	2	0	2

Assessment Unit	Number of Stations				
	DO Concentration (mg/L)	DO Saturation (%)	TSS Concentration (mg/L)	% Light Through Water	Chlorophyll a Concentration (µg/L)
Metedeconk Estuary	5	0	2	0	2
Metedeconk and lower tributaries - Bay	20	4	16	4	16
Toms Estuary	16	1	5	1	5
Central West	15	3	11	0	11
Central East	9	2	7	0	7
Central Bottom	5	1	3	1	3
Manahawkin Bay and Upper Little Egg Harbor	18	3	12	3	12
Lower Little Egg Harbor Bay	15	3	12	3	12

Note: µg/L = micrograms per liter; mg/L = milligrams per liter

3.2.2.1.1 Salinity

In general, the average salinity increases in the offshore direction off New Jersey with waters close to the coast heavily influenced by the Hudson River outflow and coastal runoff. In the late summer/early fall (August/September) favorable winds compress low-salinity waters to a band along the coast (approximately 6.2 miles wide). During the spring, the freshwater from the Hudson River freshet (late March/early April) is generally restricted along the coast. During the summer, a buoyant freshwater layer can extend further offshore.

The salinity signature of the offshore export cable corridor is characterized by high seasonal variability due to the seasonal river discharge and wind variations. The NJDEP conducted ecological baseline studies between 2008 and 2009 (NJDEP 2010a). Boat-based surveys were conducted to collect various water quality parameters within the Atlantic Ocean. Sea surface salinity (SSS) profiles were conducted at the beginning of the survey day, at noon, and end of the survey day as well as the end of each trackline whenever possible (NJDEP 2010a). The mean seasonal SSS for winter is approximately 30.2-31.5 practical salinity units (PSU) and between 29-31 PSU for spring. This range for spring is caused by the Hudson River outflow during the spring freshet, where the freshwater is close to the coast. The SSS for summer ranges between approximately 30 - 31.5 PSU for the summer and 30.5-31.75 PSU for the fall.

3.2.2.1.2 Water Temperature

Boat-based surveys were conducted to collect various water quality parameters within the Atlantic Ocean. Conductivity, temperature, and depth (CTD) profiles were conducted at the beginning of the survey day, at noon, and end of the survey day as well as the end of each trackline whenever possible (NJDEP 2010a). The minimum sea surface temperature (SST) value collected was 36 degrees Fahrenheit (°F) (2 degrees Celsius [°C]) during winter and the maximum SST value collected was 79°F (26°C) during summer.

Seasonal fluctuation from 2003 to 2016 spanned as much as 68°F (20°C) at the surface and 59°F (15°C) at the bottom, with thermal stratification beginning in April and increasing into August (Guida et al. 2017). Actual surface and bottom temperatures varied substantially from year to year, particularly during the fall. Surface to bottom temperature gradients were warmer and the surface and cooler at the bottom, with a stratified condition in spring and summer and isothermal condition following the fall turnover during winter.

3.2.3 Groundwater

3.2.3.1 Sole Source Aquifer

The onshore facilities are located within a sole source aquifer known as the New Jersey Coastal Plain Aquifer. A sole source aquifer is an aquifer that supplies at least 50 percent of the drinking water for its service area and is the only reasonable drinking water source for that area (USEPA 2015). The New Jersey Coastal Plain Aquifer System meets these requirements and is recognized by the USEPA as a sole source aquifer for the southern half of New Jersey (USEPA 2015, NJDEP 1999). Several aquifers compose this larger aquifer system. They are the Kirkwood-Cohansey aquifer system, the Atlantic City 800-foot sand, the Wenonah-Mount Laurel aquifer, the Englishtown aquifer, and the Potomac-Raritan-Magothy aquifer system (USGS 1985). The high production yields and storage capacities of the aquifer system as a whole are directly due to the unconsolidated deposits that form the geology of the Coastal Plain Province. In general, these deposits are highly permeable beds of sand and gravel that allow for the storage of groundwater. Deposits of silt and clay form mostly confining layers in between the more permeable deposits, which restrict the vertical migration of water. Aquifer recharge occurs directly by the vertical leakage of water through confining beds from precipitation or by seepage from surface water (USGS 1985).

The New Jersey Ambient Ground Water Quality Monitoring Network program utilizes 150 wells throughout northern and southern New Jersey to evaluate shallow groundwater quality. The chemical and physical characteristic measured in each well-water sample include pH, specific conductivity, DO, temperature, alkalinity, major ions, trace elements, nutrients, gross-alpha particle activity, volatile organic compounds (VOCs), total dissolved solids (TDS), and pesticides. In southern New Jersey, shallow groundwater has a more acidic pH and lower TDS levels, reflecting the coastal plain origin (New Jersey Geological and Water Survey 2016). In the urbanized areas of southern New Jersey, lower DO levels are detected due to large proportions of impervious surface area. Specific conductivity increases in southern New Jersey have been attributed to application of road salt during the winter. Urban areas in New Jersey have high concentrations of nutrients, such as nitrate and nitrite, in groundwater due to possible leakage from septic and sewer systems. Pesticides, VOCs, trace elements, and major ion concentrations were all higher in the urban areas of Southern New Jersey compared to undeveloped areas.

3.2.3.2 Wellhead Protection Areas

3.2.3.2.1 BL England

In New Jersey, a Well Head Protection Area (WHPA) is a mapped area around a public community water supply (PCWS) or a public non-community water supply (PNCWS) well that delineates the horizontal extent of groundwater captured by a well pumping at a specific rate over 2-, 5-, and 12-year periods of time for unconfined wells and a 50-foot radius delineated around each confined PCWS well (NJDEP Division of Water Supply and Geoscience). WHPAs are divided into Tiers 1 through 3 based on the time it takes for groundwater to move and recharge a pumping well (NJ Geological Survey 2003).

Based on a review of the statewide NJDEP WHPA mapper, there are no public community water supply WHPAs that overlap with the BL England proposed facilities. Based on NJ Geo-Web mapper review, four non-community well WHPAs overlap with the onshore ECR workspace within the Roosevelt Boulevard ROW. The onshore ECR workspace overlaps with Tiers 1, 2 and 3 for these wells depending on the well. The onshore ECR also overlaps with three non-community well WHPAs along Clay Avenue within the Clay Avenue ROW. The onshore ECR workspace overlaps with Tiers 2 and 3 for these wells. The BL England substation overlaps with one non-community well WHPA, including Tiers 1 through 3.

3.2.3.2.2 Oyster Creek

Based on a review of the statewide NJDEP WHPA mapper, there are no public community water supply WHPAs that overlap with the Oyster Creek proposed facilities. Based on NJ Geo-Web mapper review, one non-community well WHPA overlaps with the Oyster Creek onshore ECR within the access road to the Oyster Creek Generating Station (OCGS). The onshore ECR workspace overlaps with Tier 3 of the WHPA. The onshore ECR at IBSP overlaps with one non-community WHPA within the auxiliary lot of Swimming Area #2. The workspace overlaps with Tiers 1 through 3 of the WHPA.

3.2.4 Wetlands

Readily available data was reviewed to identify wetlands within the Project Area. Wetland surveys were also completed for the Project. Ocean Wind 1 has included these wetland delineation reports, including mapping, as part of this application (Appendix I). The wetland delineation surveys are referred to as site surveys for the remainder of this appendix. In addition, the delineated wetland communities are depicted on the ecological communities figures in Section 3.4.1 (**Figures 3.4.1-6 and 3.4.1-7**). Wetland habitat identified during delineations is discussed in Section 3.4.1 and specific wetlands crossed by the Project are discussed in Section 4.2.

3.2.4.1 BL England

NJDEP and National Wetlands Inventory (NWI) wetland data were reviewed for the BL England portion of the Project. Estuarine wetlands are dominated by large contiguous swaths of tidal saline low marsh communities fringed by common reed (*Phragmites australis)*. Tidal wetlands within the vicinity of the BL England Project facilities are limited to areas adjacent to Roosevelt Boulevard and the Great Egg Harbor shoreline at the BL England generating station property. NWI data is consistent with NJDEP data that shows estuarine and marine wetlands present along the backbays, major watercourses, and their tributaries (**Figure 3.2.3-1**).

Watercourse and wetland delineations were conducted on multiple dates from 2019 through 2021 as the Project siting was refined. Freshwater wetlands in the BL England study area consisted of forested, scrub/shrub, and emergent wetlands (**Figure 3.2.3-1** and Appendix I). This area is highly disturbed due to its historic use as a golf course and there are large swaths of emergent wetland areas that are routinely mowed. HDR wetland scientists conducted wetland field visits with USACE and NJDEP representatives in November 2021. Based on the walk through, wetland extents and resource values were updated and confirmed by the NJDEP. This correspondence can be found in Appendix F. The final wetland delineation reports are included as part of this permit package (Appendix I).

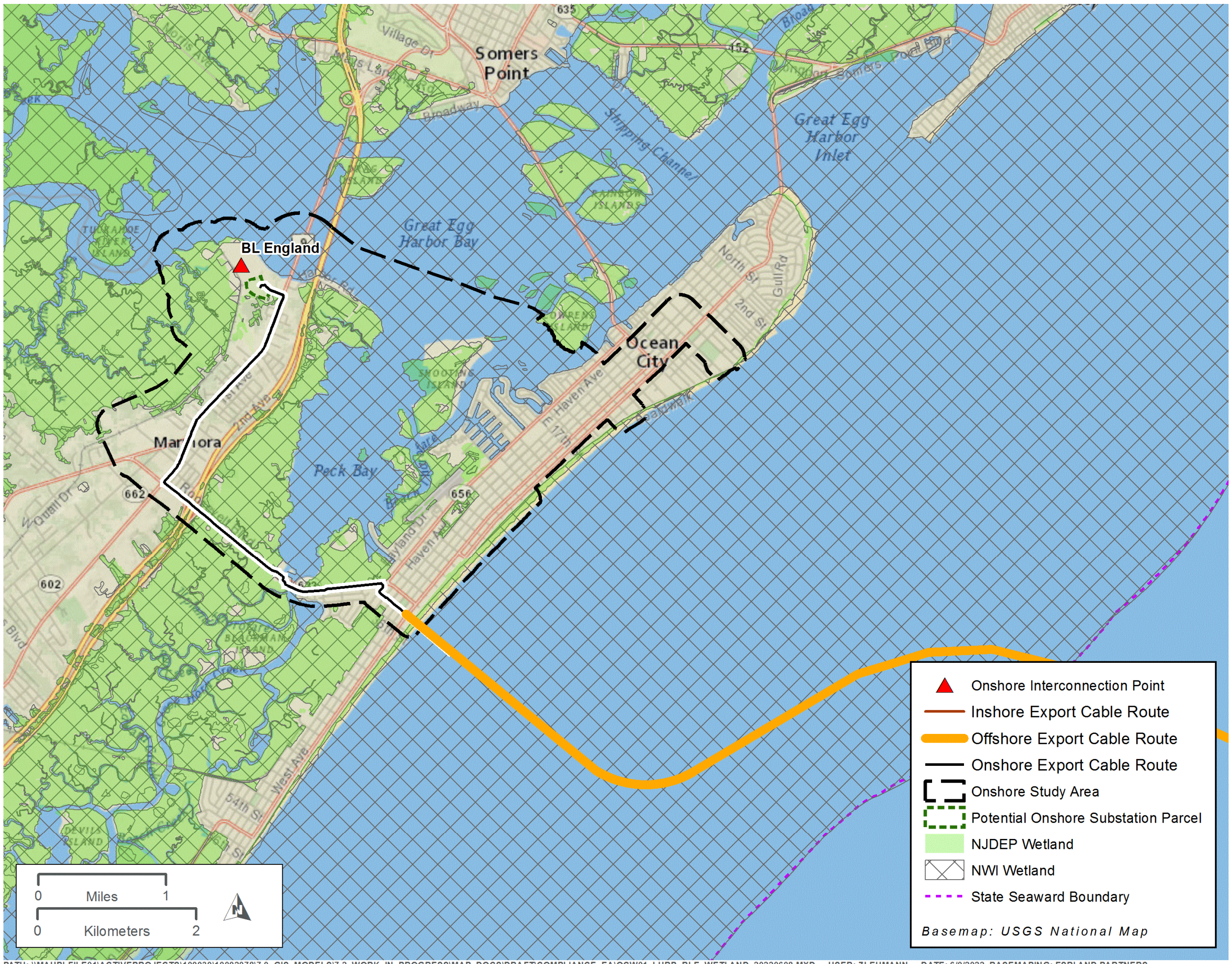

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Figure 3.2.3-1. BL England NWI and NJDEP Wetland Data.

3.2.4.2 Oyster Creek

Based on the NJDEP and NWI wetland data, estuarine and freshwater wetlands are found within the Oyster Creek area (**Figure 3.2.3-2**). According to NJDEP data, wetlands are concentrated along the Forked River, Oyster Creek, and their tributaries. Tidal wetlands within the Oyster Creek area are limited to areas adjacent to Barnegat Bay and the mouths of Oyster Creek and Forked River. A large area of low saline marsh dominates the area at the mouth of Forked River. Low saline marsh common reed dominated coastal wetlands and scrub shrub wetlands dominate the area at the mouth of Oyster Creek.

HDR conducted watercourse and wetland delineations on May 5 and 7, 2020, August 10 and 11, 2020, and September 3, 2020, for the Oyster Creek Generating Station (OCGS), and parcels along the onshore ECR. HDR wetland scientists conducted wetland field visits with USACE and NJDEP representatives. Based on the walk through, wetland extents and resource values were confirmed by the NJDEP. This correspondence can be found in Appendix F. The final wetland delineation reports are included as part of this permit package (Appendix I). HDR conducted a watercourse and wetland delineation at the IBSP Project Area on November 19, 2021. In March 2022, NJDEP conducted a field visit to verify delineated boundaries at Island Beach State Park.

Site surveys were conducted at parcels crossed by the Project to confirm wetland boundaries. Dominant vegetation along the ECR through IBSP includes common reed (*Phragmites australis*), eastern red cedar, and greenbriar (*Smilax rotundifolia*). Wetlands on the Holtec property transition from coastal to freshwater wetlands (**Figure 3.2.3-2** and Appendix I). Coastal wetlands are dominated by common reed (*Phragmites australis*) with some smooth cordgrass (*Spartina alterniflora*). Freshwater wetlands on the Farm property include manmade ditches that were historically disturbed and forested wetlands. Along the Discharge Drive access road, wetlands have some tidal influence along Oyster Creek and consist of freshwater emergent wetlands with common reed south of the access road. Some forested wetland areas consisting of Atlantic white cedar (*Chamaecyparis thyoides*) and red maple (*Acer rubrum*) swamp are also present in this area. At the proposed substation site, wetlands consist of emergent areas with common reed, tussock sedge (*Carex stricta*), Eastern red cedar (*Juniperus virginiana*) and fall panic grass (*Panicum dichotomiflorum*).

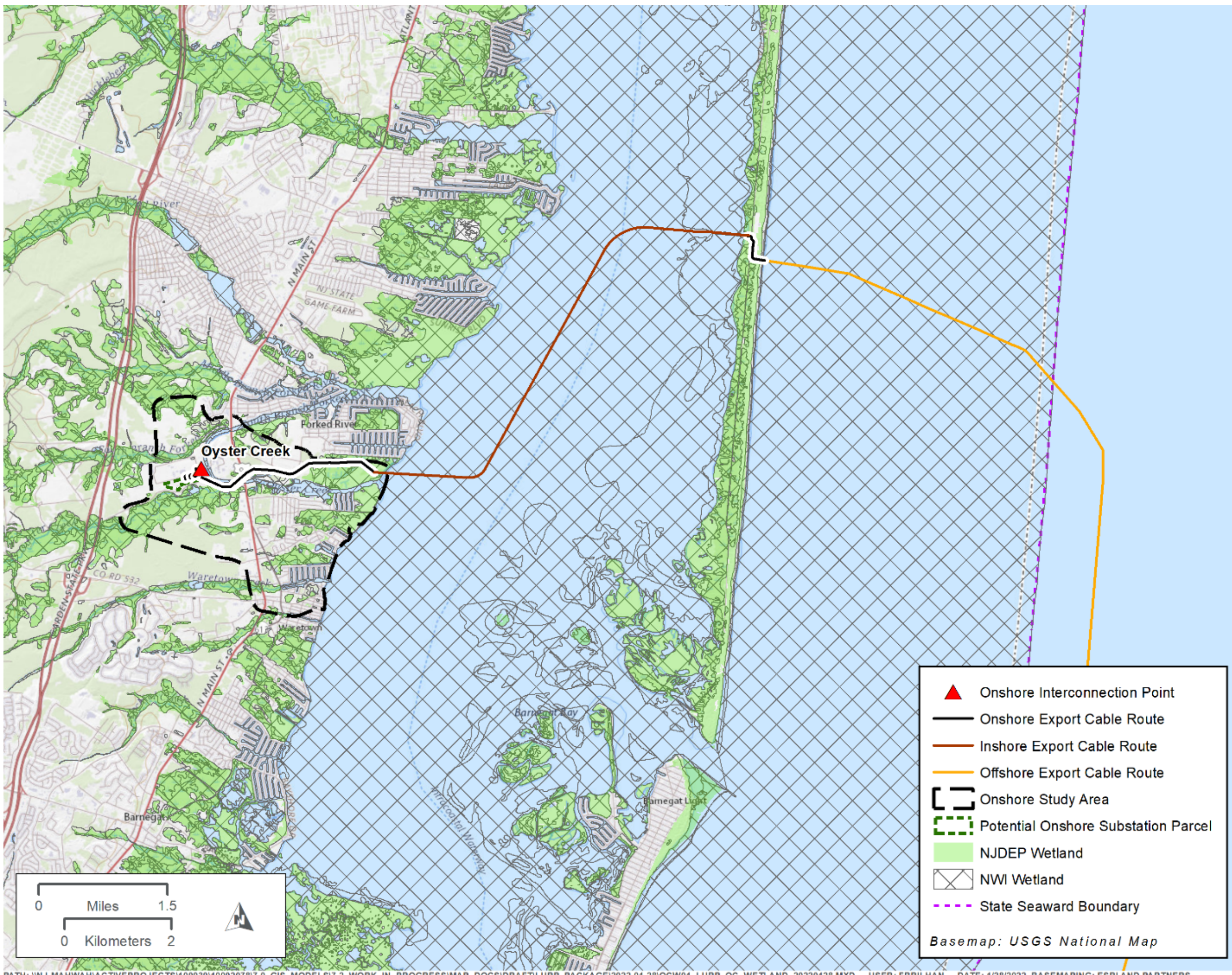

Figure 3.2.3-2. Oyster Creek NWI and NJDEP Wetland Data.

3.3 Floodplains, Riparian Zones, Coastal Zone, Tidelands, Pinelands

3.3.1 Floodplains

3.3.1.1 BL England

The effective Federal Emergency Management Agency (FEMA) maps for the BL England area are dated October 5, 2017. The effective Flood Insurance Rate Map (FIRMs) were updated in 2017 (FEMA 2018). Based on the effective maps, the proposed onshore substation and grid connection are Zone AE (100-year floodplain with base flood elevations) (**Figure 3.3.1-1**). The onshore ECR is within Zone AE, Zone X (area with minimal chance flood hazard) and at the landfall Zone VE (coastal zone subject to wave action).

The BL England area is covered under the following FEMA FIRM Panels:

- 34009C0176F
- 34009C0088F
- 34009C0069F
- 34009C0067F

3.3.1.2 Oyster Creek

The effective FEMA maps for the Oyster Creek area are dated 2006, prior to Hurricane Sandy (which occurred in fall 2012). Following Hurricane Sandy, preliminary FIRMs were developed in 2015.

According to the preliminary maps, the proposed onshore substation and grid connection are not within a floodplain (**Figure 3.3.1-2**). Portions of the onshore ECR are within Zone AE (100-year floodplain with base flood elevations), Zone VE (coastal zone subject to wave action) at the landfalls, and within the 500-year floodplain.

The Oyster Creek area is covered under the following FEMA FIRM Panels:

- 34029C0411F
- 34029C0412F
- 34029C0404F
- 34029C0408F
- 34029C0416F
- 34029C0427F

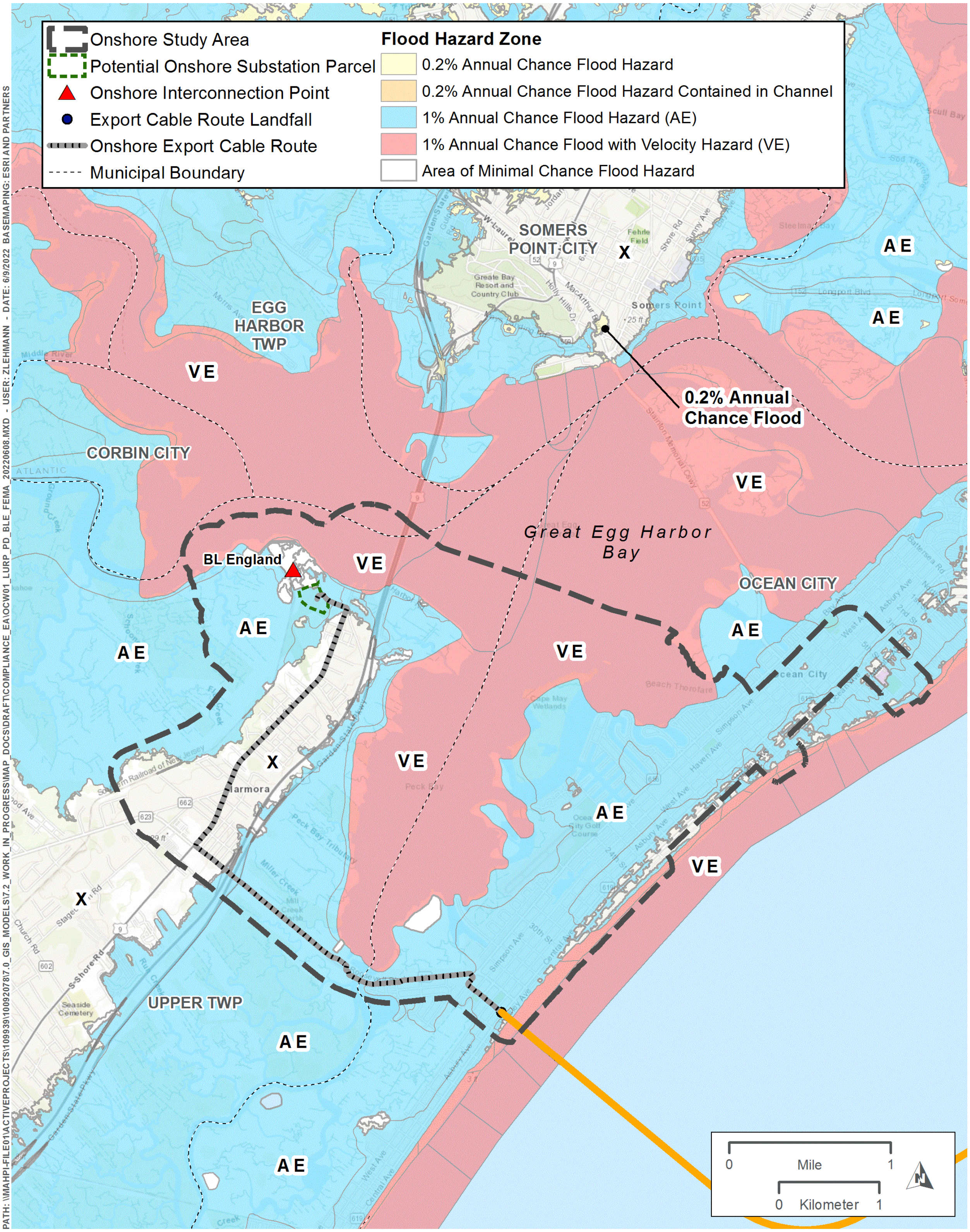

Figure 3.3.1-1. FEMA Floodplain BL England.

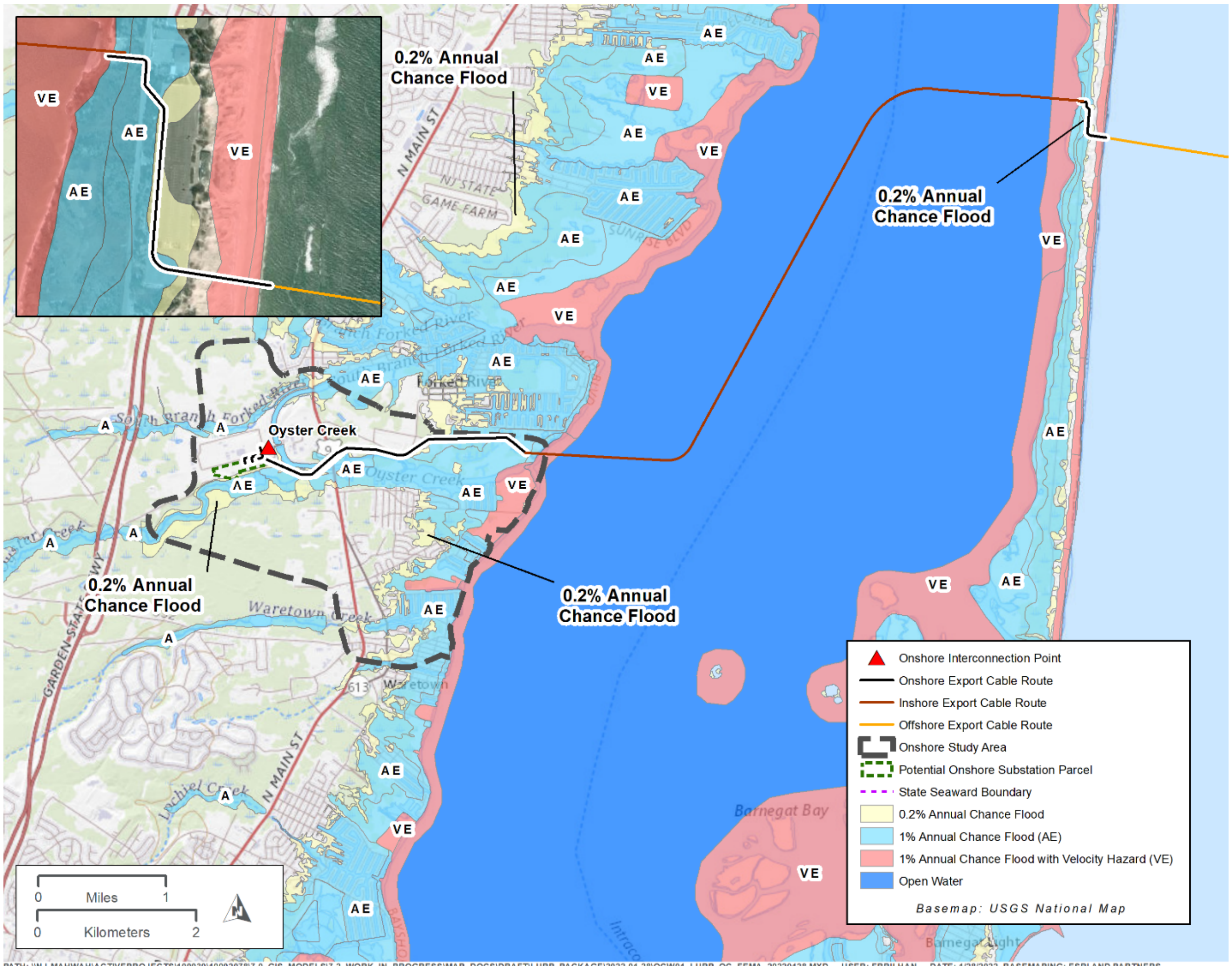

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Figure 3.3.1-2. FEMA Floodplain Oyster Creek.

3.3.2 Riparian Zones

A riparian zone is regulated by the NJDEP under the FHA Control Act Rules (N.J.A.C. 7:13) and is defined as the land and vegetation within and adjacent to a regulated water. The portion of the riparian zone located outside of a regulated water is measured landward from the top of bank. A riparian zone exists along both sides of every regulated water and includes the regulated water itself, except as provided below.

1. In accordance with N.J.A.C. 7:13-2.3(c)1, there is no riparian zone within or along the following:
   i. The Atlantic Ocean;
   ii. New Jersey's barrier island complex;
   iii. Any lawfully existing manmade lagoon;
   iv. Any lawfully existing stormwater management basin or wastewater treatment pond;
   v. Any segment of a regulated water enclosed within a lawfully existing pipe, culvert, or bridge; and
   vi. Any lawfully existing, manmade open channel that was created to convey stormwater, provided the channel is fully lined with manmade impervious material, such as a concrete low-flow channel within a stormwater basin or a ditch completely lined with concrete or asphalt.

Coastal wetlands regulated under the Wetlands Act of 1970 do not have associated riparian zones (N.J.A.C 7:13-2.2(a)2. Where a coastal wetland regulated under the Wetlands Act of 1970 lies within a riparian zone, the riparian zone standards do not apply within the wetland (N.J.A.C 7:13-4.1(c)3(h).

To determine the width of the riparian zone, the regulated water must be evaluated as follows:

1. The width of the riparian zone along any regulated water designated as a Category 1 water, and all upstream tributaries situated within the same HUC-14 watershed, is 300 ft.
2. The width of the riparian zone along the following regulated waters is 150 ft:
    a. Any trout production water and all upstream waters (including tributaries);
    b. Any trout maintenance water and all upstream waters (including tributaries) located within one mile of a trout maintenance water (measured along the length of the regulated water); and
    c. Any segment of a water flowing through an area that contains a threatened or endangered species, and/or present or documented habitat for those species, which is critically dependent on the regulated water for survival, and all upstream waters (including tributaries) located within one mile of such habitat (measured along the length of the regulated water); and
3. For all other regulated waters not identified above, the width of the riparian zone is 50 ft.

3.3.2.1 BL England

The portion of the Project at the BL England landfall does not have a riparian zone because the waterbody is the Atlantic Ocean. On the eastern side of Peck Bay, a riparian zone would not apply as it is part of the barrier island complex. The riparian zones associated with the western side of Peck Bay at the Project crossing are anticipated to be 50 ft wide because Peck Bay does not meet the criteria under 1 and 2 above under the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13).

3.3.2.2 Oyster Creek

The portion of the Project on IBSP does not have riparian zones because IBSP is a barrier island complex. Barnegat Bay is a Category 1 water that would have an associated 300-foot-wide riparian zone at the Holtec Property along the western shoreline of the bay. However, this riparian zone would not apply as the southeastern portion of the Holtec Property is made up of mapped coastal wetlands.

The riparian zones associated the Oyster Creek Discharge Channel, its tributaries and with the manmade ditches on the Holtec Property are anticipated to be 50 ft wide because this area does not meet the criteria under 1 and 2 above under the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13).

3.3.3 Coastal Zone

The entirety of the Project falls within the NJDEP defined Coastal Zone. The Coastal Zone Management (CZM) rules were created to review applications for coastal permits under the Coastal Area Facility Review Act (CAFRA), N.J.S.A. (New Jersey Statutes Annotated) 13:19-1 et seq. (CAFRA permits), the Wetlands Act of 1970, N.J.S.A. 13:9A-1 et seq. (coastal wetlands permits), and the Waterfront Development Law, N.J.S.A. 12:5-3 (waterfront development permits). The rules also provide a basis for recommendations by the Coastal Zone Management Program (CZMP) to the Tidelands Resource Council on applications for riparian grants, leases, and licenses. They address a wide range of land and water types (locations), current and potential land and water uses, and natural, cultural, social and economic resources in the coastal zone. In developing these rules, balances were struck among various conflicting, competing, and contradictory local, state, and national interests in coastal resources and in uses of coastal locations. Any Project activity for which a coastal wetlands permit, waterfront development permit, or federal consistency determination is required, including site preparation and clearing is considered development. Development for an application under CAFRA means the construction, relocation, or enlargement of the footprint of development of any building or structure and all site preparation therefor, the grading, excavation, or filling on beaches and dunes, and shall include residential development, commercial development, industrial development, and public development.

3.3.4 Tidelands

NJDEP regulates lands that are currently and formerly flowed by the mean high tide of a natural waterway. These areas are owned by the State of New Jersey. As the Project is within a coastal region of New Jersey, tidelands are present throughout the Project. A separate Tidelands Utility License Application is being submitted to NJDEP for this Project concurrently with this permit application. Appendix J identifies the portions of the Project within a NJDEP Tidelands Claim Area including lands that are currently and formerly flowed by the mean high tide of a natural waterway.

3.3.5 Pinelands

The New Jersey Pinelands Commission (Pinelands Commission) was granted the authority to preserve the Pinelands through the passage of the National Parks and Recreation Act of 1978 and the New Jersey Pinelands Protection Act in 1979. The Pinelands include the New Jersey designated Pinelands Area and the federally designated Pinelands National Reserve. The entirety of the Project falls outside of the New Jersey Pinelands Area; however, portions of the onshore and inshore ECR fall within the Pinelands National Reserve. The Commission protects the Pinelands through its implementation of the Pinelands Comprehensive Management Plan, which contains the rules that guide land-use, development and natural resource protection programs in the Pinelands. In order to ensure that the development and land use within the Pinelands meet the minimum standards of the Pinelands Comprehensive Management Plan, the Pinelands Commission established Pineland Management Areas (PMAs). Each PMA has goals, objectives, development intensities, and permitted uses that are implemented through local zoning and must conform to the land use standards of the Pinelands (Pinelands Commission 2018). All future land use in PMAs is subject to guidelines and regulations established in the Pinelands Comprehensive Management Plan.

In February 1988, the Pinelands Commission entered into a Memorandum of Agreement with the NJDEP which provides that NJDEP will implement the Pinelands Comprehensive Management Plan in portions of the Pinelands National Reserve located in the coastal zone, with consideration of comments submitted by the Pinelands Commission. In a letter dated December 7, 2021, the Pinelands Commission noted that the Pinelands Comprehensive Management Plan defines the proposed cables as public service infrastructure (Appendix F). The Pinelands Commission indicated that public service infrastructure is a permitted land use in the Parkway Overlay District, Pinelands Regional Growth Management Area, and Pinelands Rural Development Management Area (The Pineland Commission 2021). The Pinelands Commission noted that within the Pineland Forest Management Area, "…the proposed development does not raise an issue that rises to a level that it causes the proposed development to be inconsistent with the intent, policies and objectives of the National Parks and Recreation Act of 1978 creating the Pinelands National Reserve and the Pinelands Protection Act of 1978." (The Pineland Commission 2021).

3.3.5.1 BL England

The proposed BL England facilities are located within the following PMAs as designated by the New Jersey Pinelands Commission: Forest Area with Parkway Overlay and Regional Growth Area (NJDEP GIS 2016). The proposed onshore ECR along Route 9 and at the substation site in Upper Township is located within the Regional Growth Area PMA. Within Regional Growth Areas, public service infrastructure such as the electric transmission cables are permitted (Pinelands Commission 2018). While the onshore ECR crosses a Forest Area PMA, it is at the Garden State Parkway Crossing in Upper Township, which is within the Garden State Parkway Overlay. The Garden State Parkway Overlay allows for the development of public service infrastructure.

3.3.5.2 Oyster Creek

The Oyster Creek facilities are located within the following PMAs: Forest Area, Forest Area Water, and Rural Development Area (NJDEP 2016). Portions of the ECR at IBSP are within a Forest Area PMA and portions within Barnegat Bay are within a Forest Area Water PMA. A portion of the onshore ECR at the Holtec Property is within a Forest Area PMA. The remaining ECR and substation are within a Rural Development Area PMA. The cables are considered public service infrastructure, which is allowed in Rural Development Area PMAs (Pinelands Commission 2018). Based on a letter from the Pinelands Commission in December 2021, the proposed cables are not inconsistent with the Forest Area PMA (Appendix F).

3.4 Vegetation, Wildlife and Threatened and Endangered Species

3.4.1 Vegetation

3.4.1.1 Desktop Review

3.4.1.1.1 BL England

Based on NJDEP's Landscape Project, and land use and land cover data (see **Figure 3.4.1-1**), the substation and majority of the ECR is developed and vegetation communities are limited to fringe areas. A vegetated dune community is found along the Atlantic Ocean. Communities on the beach and along Crook Horn Creek/Peck Bay are dominated by saline low marshes with common reed. Urban development dominates the northwestern portion of the onshore ECR along North Shore Road. The substation area includes mixed forested communities interspersed with urban development. These communities are characteristic of those found throughout the pineland and coastal areas of the state (NJDFW 2017b).

3.4.1.1.2 Oyster Creek

Based on the available 2012 NJDEP land use/land cover wetlands data, (**Figure 3.4.1-2**) the barrier island within ISBP is dominated by several community types including barren beach, vegetated dunes, scrub/shrub wetlands, *Phragmites*-dominated wetlands, and saline low marsh communities. Habitat communities on the mainland are dominated by saline low marsh communities and *Phragmites*-dominated coastal wetlands and along the bay, and upland coniferous forests and forested wetlands (NJDFW 2017b).

Atlantic white cedar swamps are prevalent in the vicinity of the Oyster Creek facilities along the riverine areas. This community is typically dominated by Atlantic white cedar surrounded by hummocks of sphagnum mosses (*Sphagnum* spp.) with wildflowers, grasses, sedges, rushes, and other species also present (Pinelands Reserve Alliance 2018). Coniferous and mixed forest communities are also present in the vicinity of the Oyster Creek facilities. In the Pinelands, these communities are typically dominated by oaks and pines (Pinelands Reserve Alliance 2018).

In 2005, AmerGen published an Environmental Report for the OCGS site. The site is situated along Oyster Creek to the south of the Forked River. It is bisected by Route 9 and extends to Barnegat Bay. The portion of the site to the west of Route 9 contains the power facility and its related infrastructure, while the portion to the east of Route 9 is the former Finninger Farm (a.k.a. Holtec Property. The Holtec Property is largely undeveloped and comprises approximately 650 acres of old field, abandoned orchards, forests, and wetlands. At the time of the study, the old fields were undergoing succession and vegetation ranged from native grasses to pines and small oaks, typical of coastal New Jersey. A large portion of the site, near the mouth of Oyster Creek along Barnegat Bay, consists of wetlands dominated by common reed (Radis and Sutton; as described in AmerGen 2005).

Herpetological Associates conducted site surveys of the former Finninger Farm (a.k.a Holtec Property as part of a proposal to expand the Edwin B. Forsyth National Wildlife Refuge (USFWS 1994). This was one of eight sites surveyed adjacent to Barnegat Bay. The findings of the site surveys documented tidal wetlands, oak/pine pine/oak uplands, and large areas of open fields, which were once part of the farm. This study noted that the tidal area is crossed by canals, contains mounds of dredge spoil, and the predominant vegetation consists of dense growths of common reed, with areas often densely overgrown with coastal shrubs. There was very little cordgrass remaining in this area. Wooded uplands were composed mainly of pitch pine and mixed oaks. The understory was a fairly uniform growth of shrubs. The old fields contained scattered pines and oaks with open sandy areas devoid of most vegetation. Ground cover consisted of grasses and wildflowers. A small Atlantic white cedar swamp was located along the river at the northwest portion of the site. A large, diked area on the western portion of the tract appeared to be a retention basin (USFWS 1994). The vegetation noted in this study includes highbush blueberry (*Vaccinium corymbosum*) which dominated the shrub layer while red maple, Eastern red cedar (*Juniperus virginiana*), and pitch pine (*Pinus rigida*) dominated the tree layer.

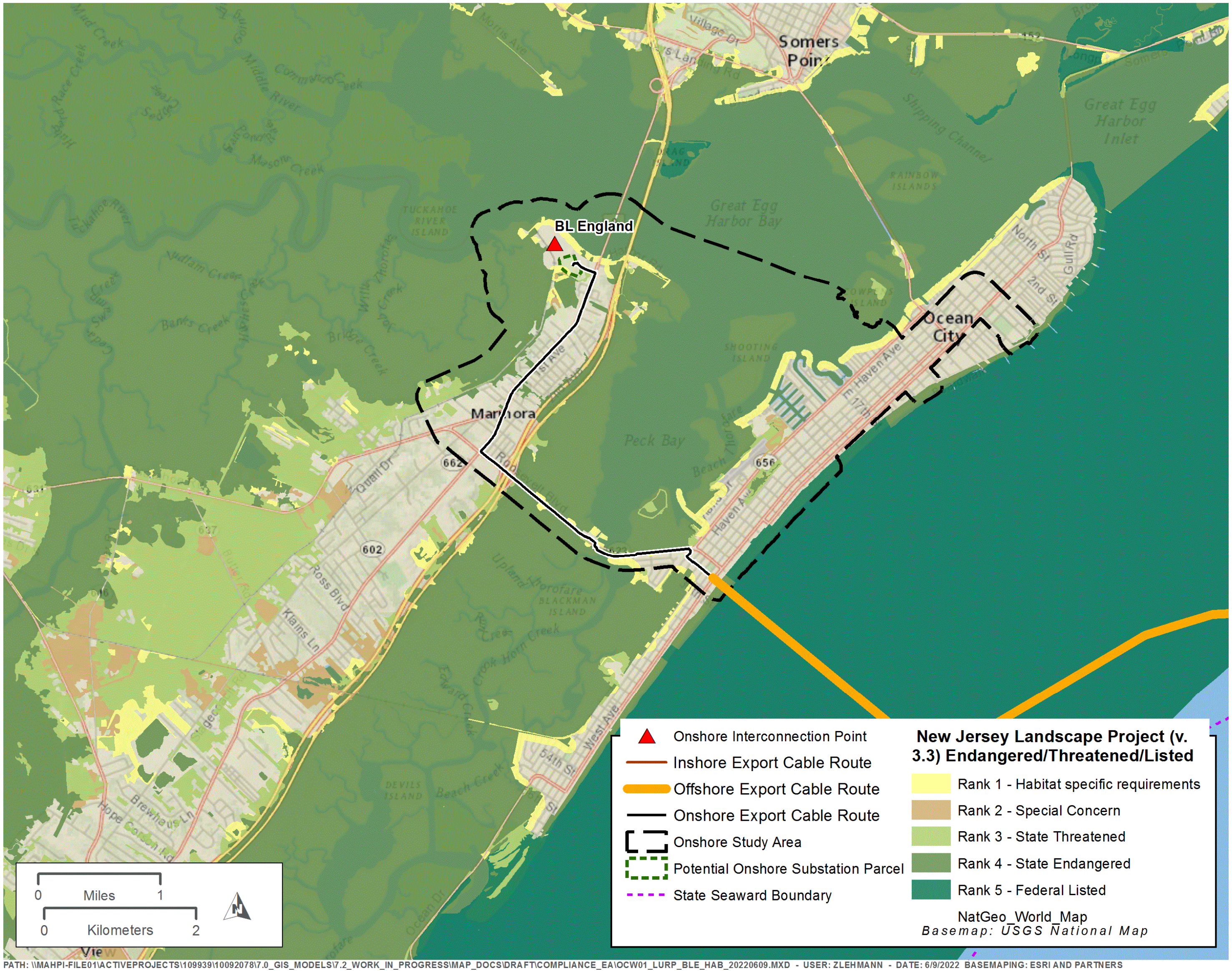
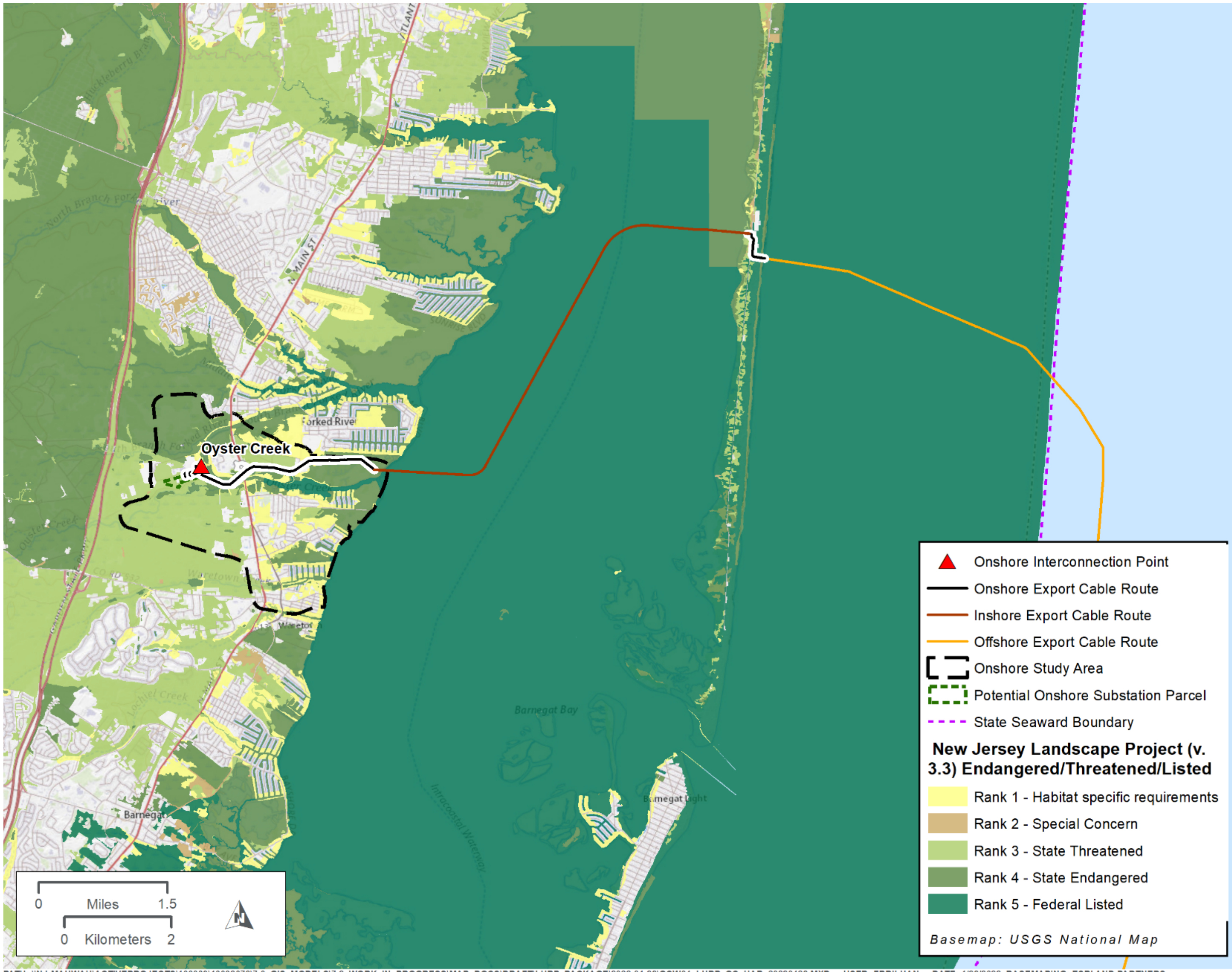


Figure 3.4.1-1. NJDEP Landscape Project Data for BL England.



PATH: \\NJ-MAHWAH\ACTIVEPROJECTS\109939\10092078\7.0_GIS_MODELS\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LURP_PACKAGE\2022-01-28\OCW01_LURP_OC_HAB_20220128.MXD - USER: FBRILHAN - DATE: 1/28/2022 BASEMAPING: ESRI AND PARTNERS

Figure 3.4.1-2. NJDEP Landscape Project Data for Oyster Creek.

3.4.1.2 Habitat Assessment

3.4.1.2.1 BL England

Wetland delineations at the BL England substation and onshore ECR along Roosevelt Boulevard were conducted in 2019. During the site survey, an assessment of the ecological communities was conducted by mapping and classifying the wetlands and deepwater habitat types as defined by Cowardin et al. (1979). The upland communities were mapped based on the observed dominant plant species and size of trees, where applicable. Additionally, incidental wildlife species observations were documented during the site visit.

A summary of the habitats present and dominant plant species are presented below and on **Figures 3.4.1-3 through 3.4.1-6**. Wildlife observations are provided in Section 3.4.2. In addition, use and associated habitat disturbance were noted during site surveys and are discussed below.

BL England Substation

Periodic mowing of roadsides and the former golf course occurs within the proposed BL England substation site. The community types found are described below and depicted on **Figure 3.4.1-3**.

Upland Forest – This habitat type is located along the former golf course and near roadsides. A large, forested area is located south and east of the former golf course. Forested areas within the substation parcel feature a moderate to dense tree canopy with a mix of coniferous and deciduous species, and an open shrub and sapling layer. Trees are generally small (six to ten inches in diameter) with the exception of a few larger pitch pines and red maples. Dominant tree species are red maple (*Acer rubrum)*, pitch pine (*Pinus rigida*), Eastern red cedar (*Juniperus virginiana*)*,* black tupelo (*Nyssa sylvatica*), sweetgum (*Liquidambar styraciflua*), and white pine (*Pinus strobus)*. The shrub and sapling layer consists of northern bayberry (*Myrica pensylvanica)*, multiflora rose (*Rosa multiflora*), red maple, and highbush blueberry (*Vaccinium corymbosum*). The ground cover is a mix of herbs and grasses. Catbrier (*Smilax* spp.), Asian bittersweet (*Celastrus orbiculatus)*, and poison ivy (*Toxicodendron radicans*) are common vines in this habitat.

Upland Meadow – Several areas of open meadow with a mix of grasses and forbs are present on the BL England parcel within the mowed portions of the former golf course and along road shoulders. Dominant vegetation consists of white clover (*Trifolium repens)*, tall crabgrass (*Digitaria* spp.), Timothy grass *Phleum pratense)*, dandelion (*Taraxacum* spp.), bird's foot trefoil (*Lotus corniculatus*), common milkweed (*Asclepias syriaca*), and goldenrod (*solidago sp*.).

Palustrine Forested Wetland – This habitat type is identified as "PF01B" (Palustrine Forested, Broad-Leaved Deciduous Vegetation, Seasonally Saturated) or "PFO1E" (Palustrine Forested, Broad-Leaved Deciduous Vegetation, Seasonally Flooded/Saturated) by NWI and is present on portions of the BL England parcel. The tree canopy consists of red maple, black tupelo, and American holly (*Ilex opaca*). The shrub layer is very dense and consists of northern bayberry, highbush blueberry, and arrow-wood (*Viburnum dentatum*). The herbaceous layer is generally sparse and consists of fowl meadow grass (*Poa palustris*), soft rush (*Juncus effuses*), and marsh mallow (*Althaea officinalis*). Some patches of common reed are present where the tree canopy is sparse.

Emergent Non-tidal Wetland - This habitat type is identified as PEM (Palustrine Emergent) by NWI and is dominated by common reed with some mowed grass areas within the former golf course.

Drainage Swale - This habitat is a manmade swale created in association with the former golf course. Dominant vegetation is maintained mowed grasses.

Emergent Tidal Wetland - This habitat type is identified as "E2EM1Pd" (Estuarine, Intertidal, Emergent and Persistent Vegetation, Irregularly Flooded, Partially Drained/Ditched) by NWI and is present west of the BL England Generating Station parcel adjacent to and west of the railroad tracks. The open waters bordering the parcel and within Great Egg Harbor Bay are mapped as “E1UBL6” (Estuarine, Subtidal, Unconsolidated Bottom, Subtidal, Oligohaline) wetlands.

Dune and Beach – The area east of 35th Street along the Atlantic Ocean is dune and beach habitat. The vegetation in this habitat includes northern bayberry, seaside goldenrod (*Solidago sempervirens*), and American beachgrass (*Ammophila breviligulata*) (**Figure 3.4.1-5**).

Roosevelt Boulevard

Emergent Tidal Wetland – This habitat type is identified as “E2EM1Pd” (Estuarine, Intertidal, Emergent and Persistent Vegetation, Irregularly Flooded, Partially Drained/Ditched) by NWI and is present along both sides of Roosevelt Boulevard (**Figures 3.4.1-4 and 3.4.1-5**). Several tidally influenced ditches run along the roadway. Vegetation consists of saltmeadow cordgrass (*Spartina patens*) with saltmarsh cordgrass (*Spartina alterniflora*) bordering the ditches, and patches of common reed monocultures ten to 12 ft in height. A few groundsel bushes (*Baccharis halimifolia*) are present on the edge of the wetland. Most of the area within the site survey area consists of the periodically maintained road shoulder grading into the common reed-dominated fringe of the tidal marsh.

3.4.1.2.2 Oyster Creek

Wetland delineations at Oyster Creek for the Project were conducted during multiple years over the course of Project refinement. During the wetland delineation site visits, an assessment of the ecological communities was conducted by mapping and classifying the wetlands and deepwater habitat types as defined by Cowardin et al. (1979). The upland communities were mapped based on the observed dominant plant species and size of trees, where applicable. Incidental wildlife species observations were documented during the site visits. In addition, use and any observations of historic or recent habitat disturbance were noted during site surveys.

In the area east of Route 9, there is a large barren area north of Oyster Creek in the eastern portion of the Holtec Property. This area appears to be impacted by all-terrain vehicle (ATV) use and there are dirt bike trails between Oyster Creek and the Oyster Creek tributary east of Route 9. In addition, three deer (hunting) stands were noted. There was no evidence of fires, land clearing, logging or other recent disturbances on the site.

Several weathered concrete headwalls and discarded cast iron pipes remain on the site from the farming operation. Upland ridges of sidecast soil run parallel to the ditches; these ridges are typically 20 ft wide and up to 4 ft above the surrounding ground elevation. Several soil berms previously used as roadways/access are present. With the exception of the sidecast soils and the berms, the site is essentially level. Vegetative succession has been taking place on the site for over 30 years, resulting in a mix of young forest, upland meadows, and extensive non-tidal and tidal emergent wetlands connected by the ditches.

In the area west of Route 9, and the substation, there was no evidence of fires, land clearing, logging or other recent disturbances.

Ecological communities identified at Oyster Creek are depicted on **Figure 3.4.1-7** and wildlife observations are described in Section 3.4.2.

Figure 3.4.1-3. Ecological Communities Map for the BL England Substation Site.

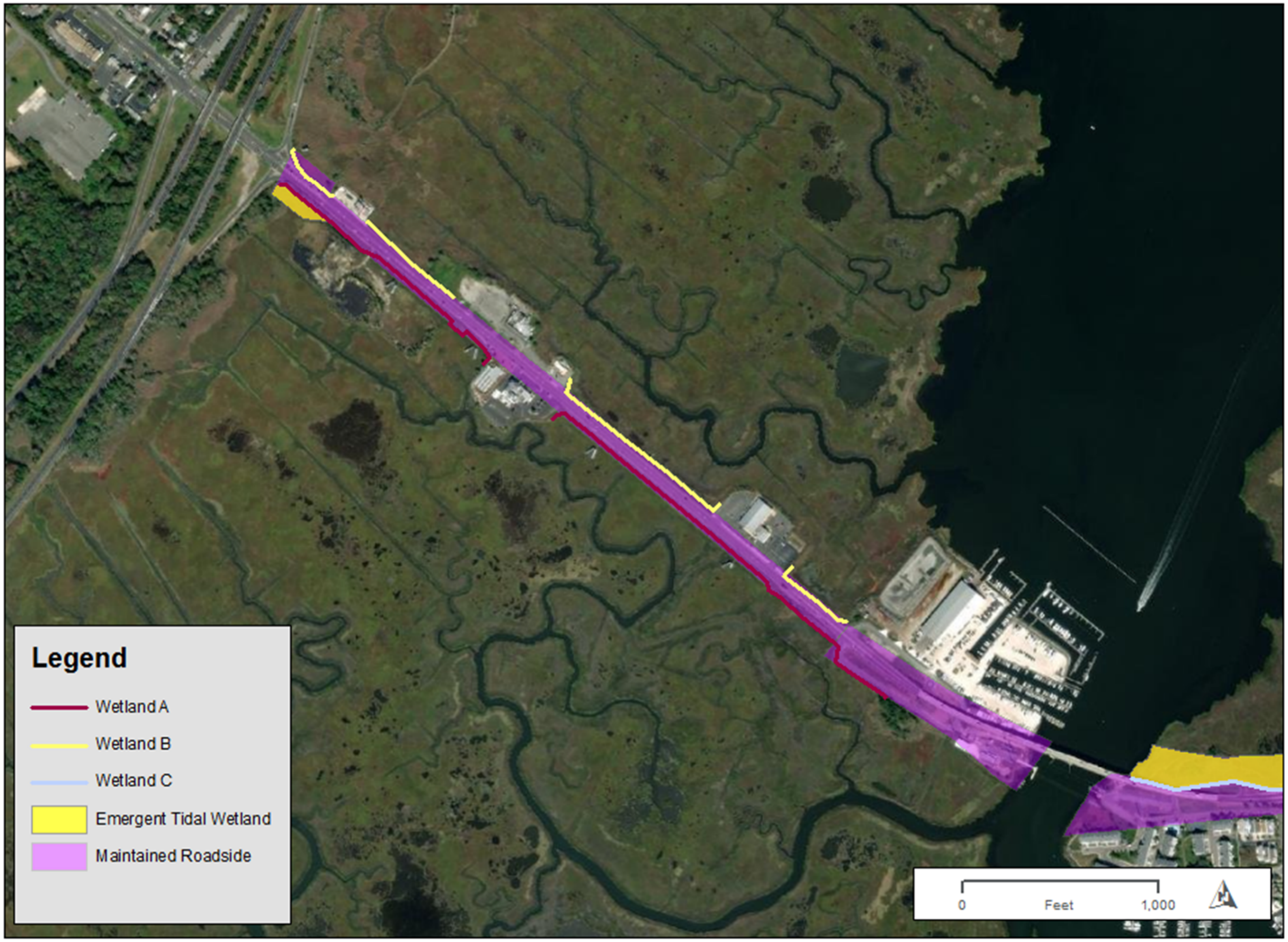


Figure 3.4.1-4. Ecological Communities Map for the Roosevelt Boulevard Wetland Review Area West of Peck Bay.

Figure 3.4.1-5. Ecological Communities Map for the Roosevelt Boulevard Wetland Review Area East of Peck Bay.

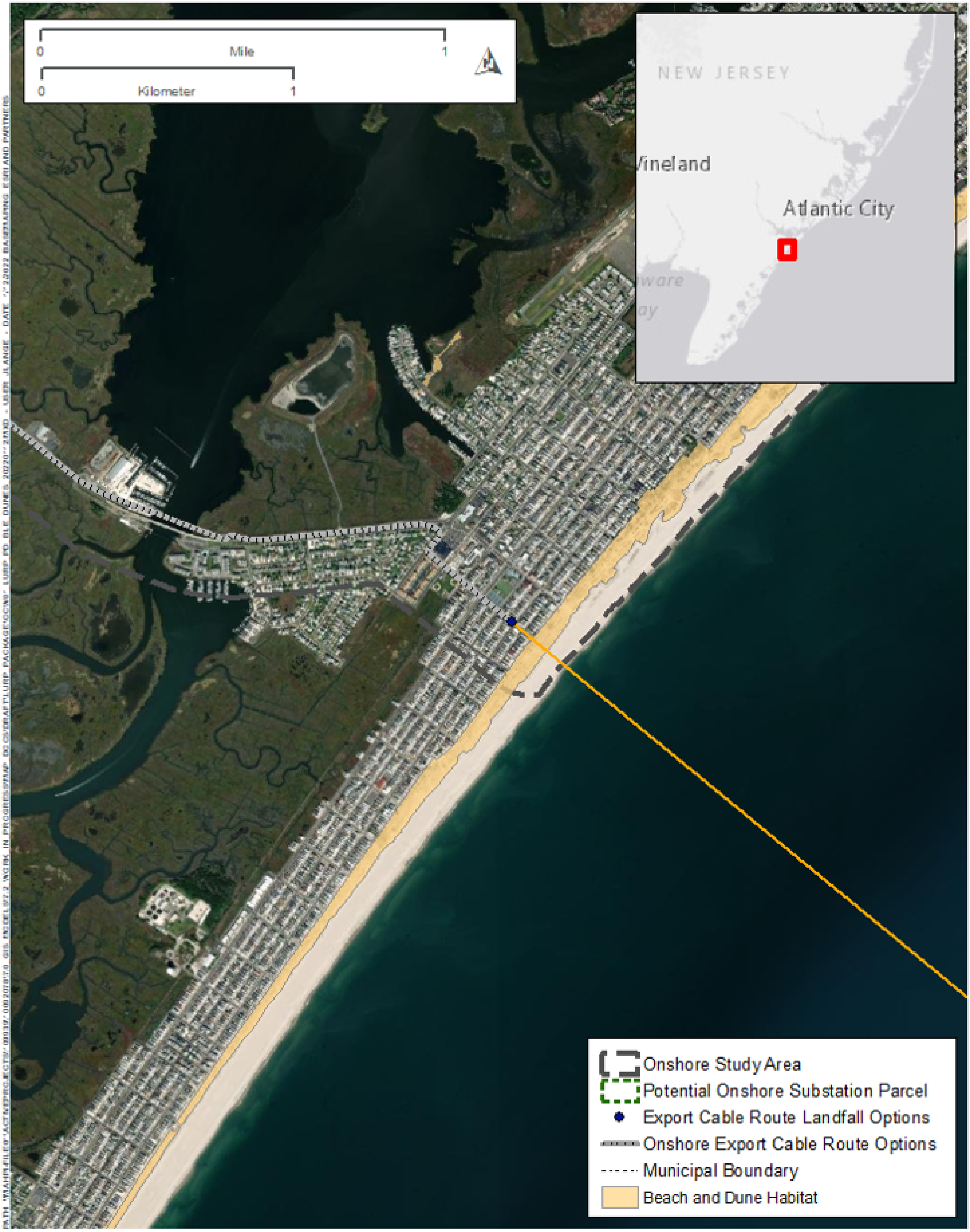


Figure 3.4.1-6. Ecological Communities Map for the Export Cable Route Landfall at BL England.

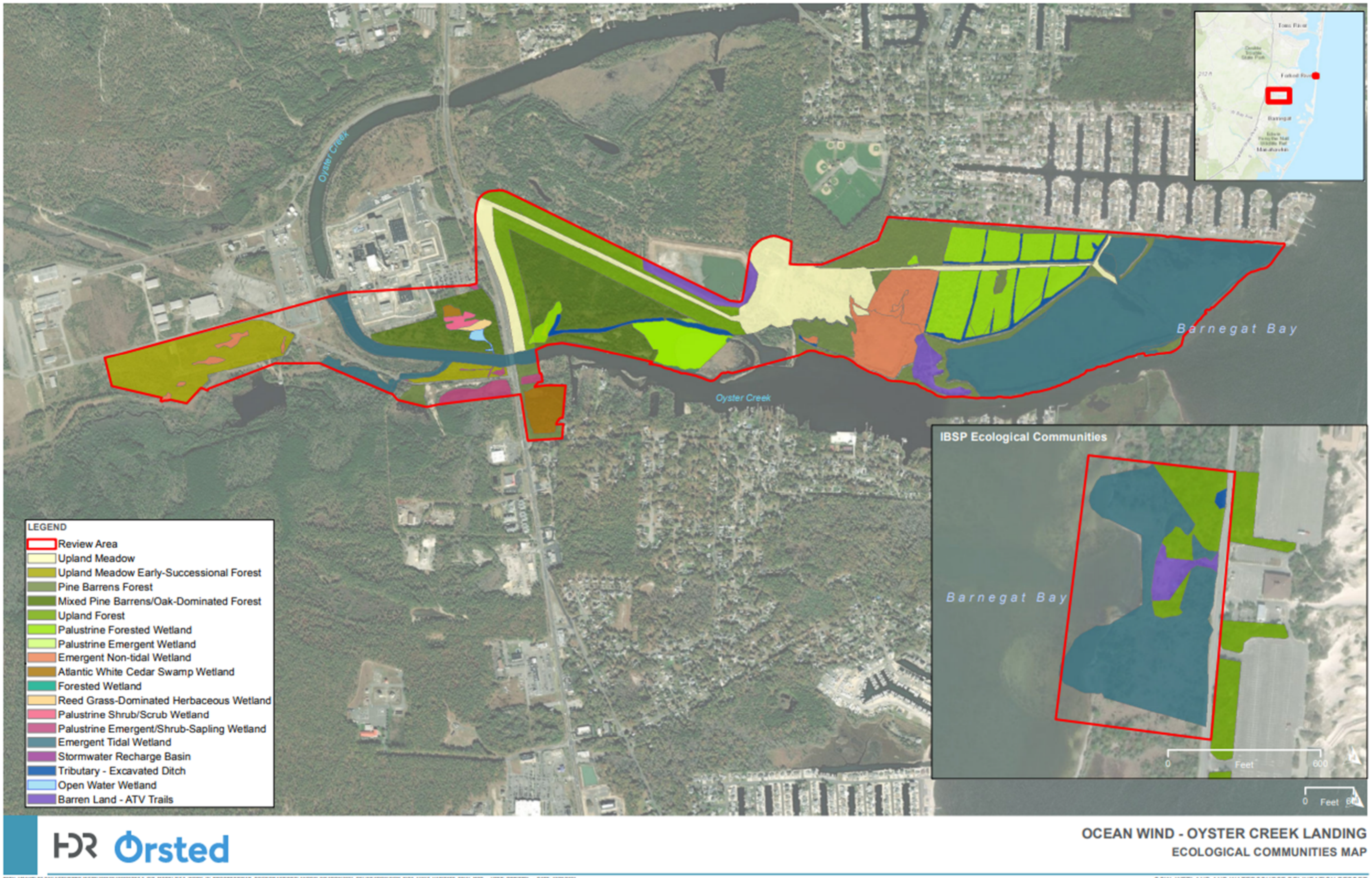


Figure 3.4.1-7. Ecological Communities Map for Oyster Creek and Island Beach State Park.

Oyster Creek Mainland

Upland Meadow – Several areas of open meadow with a mix of grasses, bird's foot trefoil (*Lotus corniculatus*), common milkweed (*Asclepias syriaca*), and goldenrod (*Solidago* spp.) are present on the site. Small, scattered trees (sassafras [*Sassafras albidum]*, black cherry [*Prunus serotina*], and oaks [Quercus spp.]) and shrubs (multiflora rose [*Rosa multiflora])* and blackberry [*Rubus* spp.]) are present in this habitat. Several patches of prickly pear cactus (*Opuntia humifusa*) were found in this habitat. This habitat is present in the recently cleared area along a service road east of and parallel to Route 9, and in the bend area at the east end of the OCGS Site, both located in Block 100, Lot 1.05. Vegetation in this area consists of Russian knapweed (*Rhaponticum repens*), daisy (*Asteraceae* spp.), broadleaf plantain (*Plantago major*), and mugwort (*Artemesia vulgaris*).

Upland Meadow/Early Successional Forest – The substation parcel is dominated by this habitat type. Several areas of open meadow with a mix of grasses, bird's foot trefoil, common milkweed, and goldenrod are present in the upland portions of the substation site. Small, scattered trees (pitch pine, Scotch pine [*Pinus sylvestris*], red cedar [*Juniperus virginiana*], black cherry, and oaks) and shrubs (multiflora rose and blackberry) are present in this habitat.

Pine Barrens Forest – This habitat is present along both sides of the entrance road (located on Block 100, Lot 1.05) to the Holtec Property east of Route 9 and areas south of Discharge Drive (located on Block 41, Lot 43). Forested areas on the site feature a sparse tree canopy, a mix of coniferous and deciduous species, and a moderate to dense shrub and sapling layer. Trees are generally small (six to ten inches in diameter) with the exception of a few larger pitch pines and red maples (*Acer rubrum)*. Dominant tree species are red maple, pitch pine, red cedar, white oak (*Quercus alba*), post oak (*Quercus stellata*), sweetgum (*Liquidambar styraciflua*), black locust (*Robinia pseudoacacia*), and sassafras. The shrub and sapling layer consists of northern bayberry (*Myrica pensylvanica)*, multiflora rose, red maple, and oaks. The ground cover is a mix of herbs and grasses, including Deptford pink (*Dianthus armeria*), wild bergamot (*Monarda fistulosa*), panicum (*Panicum* spp.), beardgrass (*Bothriochloa* spp.), and Japanese stiltgrass (*Microstegium vimineum*). Virginia creeper (*Parthenocissus quinquefolia*), Asian bittersweet (*Celastrus orbiculatus)*, wisteria (*Wisteria sinensis*), and Eastern poison ivy (*Toxicodendron radicans*) are common vines in this habitat.

Mixed Pine Barrens/Oak-Dominated Forest – This habitat type is present in the upland portions of the site survey area. The forest is generally sparse with a weak tree canopy; dominant trees are pitch pine and bear oak (*Quercus ilicifolia)*. Less common trees are black cherry, and very dense stands of northern bayberry up to eight ft in height are present. Sweet fern (*Comptonia peregrina*) is common in the shrub layer. Two lady's slipper orchid (*Cypripedium acaule*) plants were observed in the upland forest west of Route 9.

Upland Forest – This habitat type is present in the upland portions of the site survey area along the access road to the Holtec Property and east of Route 9. Forested areas on the site feature a weak tree canopy, a mix of coniferous and deciduous species, and a very dense shrub and sapling layer. Trees are generally small (six to ten inches in diameter) with the exception of a few larger pitch pines and red maples. Dominant tree species are red maple, pitch pine, red cedar, white oak, post oak, sweetgum, black locust, and sassafras. The shrub and sapling layer consists of northern bayberry, multiflora rose, red maple, and oaks. The ground cover is a mix of herbs and grasses, including Deptford pink, wild bergamot, panicum (*Panicum* spp.), beardgrass, and Japanese stiltgrass. Virginia creeper, Asian bittersweet, and poison ivy are common vines in this habitat.

Palustrine Forested Wetland – This habitat type was found east of Route 9. Vegetation in this habitat type consists of a sparse red maple and black gum forest. The tree canopy consists of red maple, black gum, and American holly (*Ilex opaca*). The shrub layer is very dense in most areas and consists of northern bayberry, sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), arrow-wood (*Viburnum dentatum*), palustrine rose (*Rosa palustris*), and catbrier (*Smilax* spp.). The herbaceous layer is generally sparse and consists of tussock sedge (*Carex stricta*), swamp loosestrife (*Decodon verticillatus*), sensitive fern

(*Onoclea sensibilis*), cinnamon fern (*Osmundastrum cinnamomeum*), netted chain fern (Woodwardia areolata), and sphagnum moss (*Sphagnum* spp.). Some patches of common reed (*Phragmites australis*) are present where the tree canopy is sparse.

Palustrine Emergent Wetland – This habitat type is identified as PEM (Palustrine Emergent) by NWI and is found in portions of wetlands east of Route 9. The soils were saturated to the surface and the vegetation dominated by sphagnum moss (*Sphagnum* sp.), tussock sedge, common reed, and swamp loosestrife.

Emergent Non - Tidal Wetlands – This habitat type is identified as "E2EM1P" (Estuarine, Intertidal, Emergent/Persistent Vegetation, Irregularly Flooded) and "PEM1B" (Palustrine, Emergent, Persistent Vegetation, Seasonally Saturated) by NWI and is present north of the main berm within the Holtec Property. Portions of this habitat are inundated or seasonally flooded with a mud and silt substrate. Dominant vegetation consists of a mix of sedges and grasses, common reed, swamp milkweed (*Asclepias incarnate*), hemp dogbane (*Apocynum cannabinum*), netted chain fern, and duckweed (*Lemnoideae* spp.) in inundated areas. Two blooming specimens of green-fringed orchid (*Platanthera lacera*) were observed in this habitat north of the ATV disturbed area.

This habitat type was also found within the substation parcel. Portions of this habitat are inundated or seasonally flooded with a sand and silt substrate. Dominant vegetation consists of a mix of sedges and grasses, common reed, hemp dogbane, and fall panic grass (*Panicum dichotomiflorum*).

Atlantic White Cedar Swamp – This habitat type is present west of Route 9 and north of the discharge channel, and east of Route 9 south of the discharge channel. The habitat features a very dense stand of Atlantic white cedar (*Chamaecyparis thyoides*) with a sparse shrub layer dominated by sweet pepperbush and a sparse ground cover dominated by cinnamon fern (*Osmunda cinnemomea*). The stand of Atlantic white cedar appeared to be fairly even aged with most trees 6 to 10 inches in diameter, and a few trees up to 15 inches in diameter.

Reed Grass-Dominated Herbaceous Wetland – This habitat is present in the wetland west of Route 9 and north of the discharge channel. Vegetation is dominated by common reed with a few red maple saplings. Birds observed in this habitat consisted of gray catbird, rufous-sided towhee, and blue-gray gnatcatcher (*Polioptila caerulea*).

Palustrine Scrub/Shrub Wetland – This habitat is present in the wetland west of Route 9 and north of the discharge channel. Vegetation consists of red maple saplings, highbush blueberry, and sweet pepperbush. Soils consisted of a deep peat layer.

Palustrine Emergent/Shrub-Sapling Wetland – This habitat type is east and west of Route 9, south of the discharge channel. The sparse tree canopy consists of red maple saplings. The shrub layer is very dense and consists of northern bayberry, sweet pepperbush, highbush blueberry, arrow-wood, maleberry (*Lyonia ligustrina*), and catbrier. The herbaceous layer is generally sparse and consists of tussock sedge, swamp loosestrife, and sensitive fern. Dense patches of common reed are present where the tree canopy is sparse.

Emergent Tidal Wetlands – This habitat type is identified as "E2EM1Pd" (Estuarine, Intertidal, Emergent, Persistent, Irregularly Flooded, Partially Drained/Ditched) by NWI. This habitat type is present in wetlands in the easternmost portion of the study area along Barnegat Bay and Oyster Creek south of the main berm. A tidally influenced ditch runs along the southerly side of the berm. Vegetation consists of a very dense common reed monoculture ten to 12 ft in height. A few groundsel bushes (*Baccharis halimifolia*) are present on the edge of the berm and ditch. Several small open water areas within are mapped by NWI as "E1UBL" (Estuarine, Subtidal, Unconsolidated Bottom) wetlands. Wetlands extend south and east to the parcel boundary, which are the northern shoreline of Oyster Creek and the western shoreline of Barnegat Bay. Along the northern shoreline of Oyster Creek, vegetation consists of mainly common reed with intermittent patches of smooth cordgrass (*Spartina alterniflora*) at lower elevations. The parcel's eastern boundary along Barnegat Bay consists of a small sandy beach in an area behind a dilapidated wooden bulkhead.

Stormwater Recharge Basin – The dominant plant species observed within this wetland type was panic grass.

Tributary – Excavated Ditch – This habitat type is east of Route 9, was delineated as the Oyster Creek Tributary, and is identified as "E1UBL" (Estuarine, Intertidal, Unconsolidated Bottom) by NWI. The linear ditch is visible on aerial photographs.

There is a network of excavated ditches on the site east of Route 9. The banks of the ditches are vegetated with a very dense growth of highbush blueberry, swamp azalea (*Rhododendron viscosum*), sweet pepperbush, and catbrier. Common reed is also present along the edge of some of the ditches. The ditches are best described as "R3UBHx" (Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded, Excavated) wetlands.

Open Water Wetland – This habitat type is present in the southern portion of the wetland complex west of Route 9 and is a large ponded open water area that drains south to Oyster Creek. There was a dense growth of blooming white water lily (*Nymphaea alba)*.

Barren Land- ATV Trails – There is a large barren upland area on the Holtec Property north of Oyster Creek in the eastern portion of the site survey area. This area appears to be impacted by ATV use.

Island Beach State Park

Upland Forest – Forested areas within the IBSP site survey area are dense upland maritime forest dominated by red cedar and American holly. A very dense growth of catbrier was present throughout the forested areas, and poison ivy was also common. Multiflora rose and northern bayberry were common in the clearings. Prickly pear cactus was a common groundcover in the clearings and along the roadsides. Some English ivy (*Hedera helix*) and privet (*Ligustrum vulgare*) were present in the areas east of Shore Road between the road and the auxiliary lot of Swimming Area #2.

Emergent Tidal Wetlands – Vegetation in this habitat type is identified as "E2EM1Pd" (Estuarine, Intertidal, Emergent, Persistent, Irregularly Flooded, Partially Drained/Ditched) by NWI. Vegetation in the wetlands bordering Barnegat Bay is dominated by dense stands of common reed. Some areas near the road include poison ivy, arrow-wood and highbush blueberry.

Excavated Area – An area west of Shore Road was delineated as excavated area due to a berm on the west side that separates it from surrounding areas. Vegetation in this area was dominated by red cedars, catbriar, common reed, and arrow-wood.

Barren Land – The area delineated as barren land west of Shore Road is an active maintenance and storage yard for IBSP.

Dune and Beach – The area east of the auxiliary lot of Swimming Area #2 along the Atlantic Ocean is dune and beach habitat. The vegetation in this habitat includes northern bayberry (*Morella pensylvanica*), eastern red cedar, seaside goldenrod (*Solidago sempervirens*), and American beachgrass (*Ammophila breviligulata*).

3.4.2 Wildlife

The vegetation communities in the Project Area described in Section 3.4.1 provide a wide range of habitats available for many terrestrial species. All wildlife observations made in association with the wetland delineations and habitat assessment field studies were recorded. Birds were identified by song and/or direct observation; mammals were identified by direct observation and/or tracks. Fish, reptiles, and amphibians were identified by direct observation. The wildlife observed during site surveys are summarized below.

Ocean Wind 1 conducted an avian and bat assessment associated with onshore and offshore Project activities (Appendix G). This section provides an overview of the birds that were noted during field surveys for the onshore portions of the Project. Threatened and endangered birds and bats are listed in Section 3.4.6 and discussed in Appendix G.

3.4.2.1 BL England

3.4.2.1.1 BL England Substation

Fish – There were no fish species observed during the site surveys.

Amphibians –Green frogs (*Rana clamitans*) were observed in or proximate to wetlands during the site surveys. No toads or salamanders were observed; the lack of ground cover (fallen trees, bark, or deep leaf litter) may limit the site's attractiveness to some amphibians.

Reptiles – Parts of one turtle shell, possibly a box turtle, were observed near the railroad grade on the BL England substation parcel. No lizards or snakes were observed; the lack of ground cover (fallen trees, bark, or deep leaf litter) may limit the site's attractiveness to some reptiles.

Birds – A total of 17 species of birds were observed during the September 2019 site surveys; 12 of which were common passerine species. Raptors observed include turkey vultures (*Cathartes aura*), kestrel (*Falco sparverius*), and peregrine falcon (*Falco peregrinus; s*tate endangered*).* Dominant passerine bird species present were the gray catbird (*Dumetella carolinensis*), cardinal (*Cardinalis cardinalis*), mourning dove (*Zenaida macroura*), and black-capped chickadee (*Poecile atricapillus*). Snowy egrets (*Egretta thula; s*tate Special Concern Breeding*)*, great egrets (*Ardea alba*), ring-billed gull (*Larus delawarensis*) and laughing gull (*Leucophaeus atricilla*) were observed flying over Great Egg Harbor Bay.

Mammals – Mammals observed included white-tailed deer (*Odocoileus virginianus*) grazing on the golf course, gray squirrels (*Sciurus carolinensis*), and chipmunks (*Tamias striatus*). Raccoon (*Procyon lotor*) tracks were observed in the mud bordering the ditches and small ponds. No large animal burrows were observed.

3.4.2.1.2 Roosevelt Boulevard

There were no fish, amphibians, reptiles, or mammal species observed along Roosevelt Boulevard during the site survey. There are numerous osprey nesting platforms in the salt marshes along Roosevelt Boulevard. There was no evidence of heron or egret rookeries or potential nesting areas. Northern harrier (*Circus hudsonius;* state endangered)*,* snowy egret, great egret, and osprey (*Pandion haliaetus*) were observed near Roosevelt Boulevard.

3.4.2.2 Oyster Creek

3.4.2.2.1 Mainland

Fish – Small forage fish (mummichogs (*Fundulus heteroclitus*) and mosquito fish (*Gambusia affinis*)) were observed in the ditches and shallow ponds during the site surveys. Banded killifish (*Fundulus diaphanus)* were observed in inundated areas of the wetland west of Route 9 and in the excavated ditch east of Route 9 during the site surveys.

Amphibians – Bull frogs (*Lithobates catesbeianus*), green frogs (*Rana clamitans*), and pickerel frogs (*Lithobates palustris*) were observed in or proximate to the wetlands. No toads or salamanders were observed.

Reptiles – Box turtles (*Terrapene carolina carolina*)) and snapping turtles (*Chelydra serpentine*) were observed during site surveys. One garter snake (*Thamnophis sirtalis*) was observed. No lizards were observed. Several mammal-excavated turtle nests were found; generally, on the weakly vegetated ridges of excavated soils adjacent to the ditches. One adult male box turtle (*Terrapene carolina carolina*) was found within emergent non-tidal wetlands. Snapping turtles (*Chelydra serpentina*) were observed within the excavated ditch/tributary on the site.

Birds – A total of 29 species of birds were observed during the site surveys; 24 of which were common passerine species. A bald eagle (*Haliaeetus leucocephalus*) was seen, and turkey vultures (*Cathartes aura*) were observed soaring over the site. Dominant passerine bird species were the gray catbird (*Dumetella carolinensis*), robin (*Turdus migratorius*), prairie warbler (*Setophaga discolor*), Carolina chickadee (*Parus caroliniensis*), and black-capped chickadee (*Poecile atricapillus*). Canada geese (*Branta Canadensis*), great egrets (*Ardea alba*), and common terns (*Sterna hirundo*) were observed over Oyster Creek, and green-backed herons (*Butorides virescens*) were observed along the ditches and ponds. Laughing gulls (*Lanus atricilla*), and common terns (*Sterna hirundo*) were observed by the Oyster Creek Tributary. Prairie warblers and field sparrows (*Spizella pusilla*) were observed in upland forest areas. Birds observed in the Pine Barrens forest consisted of gray catbird, rufous-sided towhee (*Pipilo erythrophthalmus*), and blue-gray gnatcatcher (*Polioptila caerulea*). Birds observed in the mixed Pine Barrens/Oak-dominated forested areas were gray catbird, blue jay (*Cyanocitta cristata*), and prairie warbler. Birds observed in palustrine forested wetland included the rufous-sided towhee and eastern phoebe (*Sayornis phoebe*). Birds observed in reed-grass dominated herbaceous wetlands consisted of gray catbird, rufous-sided towhee, and blue-gray gnatcatcher (*Polioptila caerulea*). Birds observed in palustrine scrub/shrub wetlands were the barn swallow (*Hirundo rustica*), red-winged blackbird (*Agelaius phoeniceus*), and cardinal (*Cardinalis cardinalis*). Birds observed in palustrine emergent/shrub-sapling wetland consisted of yellow warbler (*Dendroica petechia*) and yellowthroat (*Geothypis trichas*). Birds observed in the stormwater recharge basin habitat consisted of wild turkey (*Meleagris gallopavo*), yellow warbler, and yellowthroat. Green herons (*Buteroides striatus*) were observed in the excavated ditch/tributary.

***Mammals* –** Mammals observed included white-tailed deer (*Odocoileus virginianus*), gray squirrels (*Sciurus carolinensis*), and chipmunks (*Marmotini* spp.). Opossum (*Didelphis virginiana*) and raccoon (*Procyon lotor*) tracks were observed in the mud bordering the ditches and small ponds. White-tailed deer (*Odocoileus virginianus*) tracks were observed in the palustrine forested wetland. No large animal burrows were observed during the site surveys. No structures, large dead trees, or trees with cavities or exfoliating bark that could provide roosting habitat for bats were observed.

3.4.2.2.2 Island Beach State Park

Birds observed during the site surveys were limited to year-round resident species common to coastal environments. Species observed consisted of Carolina wren (*Thryothorus ludovicianus*), robin (*Turdus migratorius*), blue jay (*Cyanocitta cristata*), goldfinch (*Spinus tristus*), Northern harrier (*Circus cyaneus*), herring gull (*Larus argentatus*), black-capped chickadee (*Parus atricapillus*), and gray catbird (*Dumetella carolinensis*). No mammals were observed during the site surveys; droppings of Eastern cottontails (*Sylvilagus floridanus*) were observed. No live reptiles or amphibians were observed during the site surveys. One box turtle (*Terrapene carolina carolina*) shell was observed within the existing maintenance area.

3.4.3 Finfish and Essential Fish Habitat

The Project is within marine waters in the Atlantic Ocean and estuarine waters under Crook Horn Creek/Peck Bay and Barnegat Bay. These areas of marine and estuarine waters have a very diverse fish assemblage that can be classified according to habitat requirements and location. This discussion is based on review of existing available literature that supports the characterization of the distribution, abundance and composition of finfish and marine communities. Finfish community assemblage and abundance is largely dependent on environmental characteristics including but not limited to factors such as depth, salinity, substrate, currents, season, and temperature. The community is made up of pelagic, demersal, and highly migratory species. Pelagic species spend the majority of their lives within the water column, migrating to different depths based on temperature and light penetration. Demersal species spend the majority of their lives at or near the bottom.

Highly migratory species travel long distances and often cross domestic and international boundaries. Diadromous fish spend a portion of their life cycle in freshwater and a portion in saltwater. Diadromous and marine fish species are managed and protected by NOAA Fisheries and the New Jersey Division of Fish and Wildlife (NJDFW). **Table 3.4.3-1** below contains a summary of the major fish and invertebrate species found in the waterbodies the Project will be installed within, habitat association, and federal and state-management status. Fish species that are state or federally listed as threatened or endangered are discussed in **Section 3.4.6**.

Table 3.4.3-1. Major Fish and Invertebrate Species Potentially Occurring in the Project Area.

Common Name	Scientific Name	Essential Fish Habitat (EFH)[1]	Highly Migratory Species	Listing Status[2]	Commercial/ Recreational Importance[3]	Habitat Association
Alewife	*Alosa pseudoharengus*				X[1]	Pelagic
American conger	*Conger oceanicus*					Demersal/Structure Oriented
American lobster	*Homarus americanus*				X[1]	Benthic
American eel	*Anguilla rostrata*				X[1]	Demersal/Structure Oriented
American gizzard shad	*Dorosoma cepedianum*					Pelagic
Atlantic angel shark	*Squatina dumerili*	L,J,A	X			Pelagic
Atlantic butterfish	*Peprilus triacanthus*	L,J,A			X	Demersal/Pelagic
Atlantic cod	*Gadus morhua*	A			X[1]	Demersal/Structure Oriented
Atlantic croaker	*Micropogonias undulatus*					Demersal
Atlantic herring	*Clupea harengus*	L,J,A			X	Pelagic
Atlantic mackerel	*Scomber scombrus*	E,L,J			X	Pelagic
Atlantic menhaden	*Brevoortia tyrannus*				X	Pelagic
Atlantic needlefish	*Strongylura marina*					Pelagic
American shad	*Alosa sapidissima*				X[1]	Pelagic
Atlantic sharpnose shark	*Rhizopriondon terraenovae*	A	X			Pelagic
Atlantic silverside	*Menidia menidia*					Pelagic
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*			Endangered		Demersal
Basking shark	*Cetorhinus maximus*	A	X			Pelagic
Bay anchovy	*Anchoa mitchilli*					Pelagic
Black drum	*Pogonias cromis*				X[1]	Demersal
Black sea bass	*Centropristis striata*	L,J,A			X[1]	Pelagic/Structure Oriented
Blue crab	*Callinectes sapidus*				X	Benthic
Blue shark	*Prionace glauca*	E,L,J,A	X			Pelagic
Blueback herring	*Alosa aestivalis*				X[1]	Pelagic
Bluefin tuna	*Thunnus thynnus*	J,A	X		X	Pelagic
Bluefish	*Pomatomus saltatrix*	E,L,J,A			X[1]	Pelagic
Bluntnose stingray	*Dasyatis say*					Demersal

Common Name	Scientific Name	Essential Fish Habitat (EFH)[1]	Highly Migratory Species	Listing Status[2]	Commercial/ Recreational Importance[3]	Habitat Association
Broad-striped anchovy	*Anchoa hepsetus*					Pelagic
Clearnose skate	*Raja eglanteria*					Demersal
Cobia	*Rachycentron canadum*	E,L,J,A			X[1]	Pelagic
Common thresher shark	*Alopias vulpinus*	E,L,J,A	X			Pelagic
Cownose ray	*Rhinoptera bonasus*					Demersal
Crevalle jack	*Caranx hippos*					Pelagic/Structure Oriented
Cunner	*Tautogolabrus adspersus*					Demersal/Pelagic
Cusk	*Brosme brosme*			Candidate Species		Demersal
Dusky shark	*Carcharhinus obscurus*	E,L,J,A	X			Pelagic
Hard clam	*Mercenaria mercenaria*				X[1]	Benthic
Haddock	*Melanogrammus aeglefinus*				X[1]	Demersal
Hickory shad	*Alosa mediocris*					Pelagic
Hogchoker	*Trinectes maculatus*					Demersal
Horseshoe crab	*Limulidae*					Benthic
Inland silverside	*Menidia beryllina*					Pelagic
Jonah crab	*Cancer borealis*				X[1]	Benthic
King mackerel	*Scomberomorus cavalla*	E,L,J,A			X[1]	Pelagic
Lined seahorse	*Hippocampus erectus*					Demersal/Structure Oriented
Little sculpin	*Myoxocephalus aenaeus*					Demersal/Structure Oriented
Little skate	*Raja erinacea*				X	Demersal
Long finned squid	*Loligo pealeii*	J,A			X	Pelagic
Lookdown	*Selene vomer*					Demersal/Pelagic
Monkfish	*Lophius americanus*	E,L,J,A			X	Demersal
Mummichog	*Fundulus heteroclitus*					Demersal/Pelagic
Naked goby	*Gobiosoma bosc*					Demersal
Northern kingfish	*Menticirrhus saxatilis*				X	Demersal
Northern pipefish	*Syngnathus fuscus*					Demersal/Structure Oriented
Northern puffer	*Sphoeroides maculatus*					Demersal

Common Name	Scientific Name	Essential Fish Habitat (EFH)[1]	Highly Migratory Species	Listing Status[2]	Commercial/ Recreational Importance[3]	Habitat Association
Northern sand lance	*Ammodytes dubius*				X	Demersal
Northern seahorse	*Hippocampus erectus*					Demersal
Northern searobin	*Prionotus carolinus*				X	Demersal
Northern stargazer	*Astroscopus guttatus*					Demersal
Ocean quahog	*Artica islandica*	J,A			X	Demersal
Oyster toadfish	*Opsanus tau*					Demersal
Pollock	*Pollachius virens*				X[1]	Demersal/Structure Oriented
Red hake	*Urophycis chuss*	E,L,J,A				Demersal
Redfish	*Sebastes fasciatus*				X[1]	Demersal
Sand tiger shark	*Carcharias Taurus*	E,LJ	X			Pelagic
Sandbar shark	*Carcharhinus plumbeus*	L,J,A	X			Pelagic
Scalloped hammerhead shark	*Sphyrna lewini*		X			Pelagic
Scup	*Stenotomus chrysops*	J,A			X	Demersal
Sea scallop	*Placopecten magellanicus*	E,L,J,A			X	Benthic
Sheepshead minnow	*Cyprinodon variegatus*					Pelagic
Short-finned squid	*Illex illecebrosus*					Pelagic
Shortfin mako shark	*Isurus oxyrinchus*	L,J,A	X		X	Pelagic
Shortnose sturgeon	*Acipenser brevirostrum*			Endangered		Demersal
Silver hake	*Merluccius bilinearis*				X	Demersal
Skilletfish	*Gobiesox strumosus*					Demersal
Skipjack tuna	*Katsuwonus pelamis*	J,A	X			Pelagic
Smallmouth flounder	*Etropus microstomus*					Demersal
Smoothhound shark	*Mustelus canis*	E,L,J,A				Demersal
Southern rock crab	*Cancer irroratus*					Benthic
Spanish mackerel	*Scomberomorus maculatus*	E,L,J,A				Pelagic
Spiny dogfish	*Squalus acanthias*	J,A			X	Demersal
Spot	*Leiostomus xanthurus*					Demersal
Spotfin killifish	*Fundulus luciae*					Pelagic

Common Name	Scientific Name	Essential Fish Habitat (EFH)[1]	Highly Migratory Species	Listing Status[2]	Commercial/ Recreational Importance[3]	Habitat Association
Spotted hake	*Urophycis regia*					Demersal
Striped bass	*Morone saxatilis*				X	Pelagic/Structure Oriented
Striped killifish	*Fundulus majalis*					Pelagic
Striped searobin	*Prionotus evolans*					Demersal
Summer flounder	*Paralichthys dentatus*	E,L,J,A			X[1]	Demersal
Surfclam	*Spisula solidissima*	J,A				Benthic
Swordfish	*Xiphias gladius*	J	X		X	Pelagic
Tautog	*Tautoga onitis*				X[1]	Demersal/Structure Oriented
Three-spined stickleback	*Gasterosteus aculeatus*					Demersal
Tiger shark	*Galeocerdo cuvieri*	J,A	X			Pelagic
Weakfish	*Cynoscion regalis*				X[1]	Pelagic
White mullet	*Mugil curema*					Pelagic
White perch	*Morone americana*					Pelagic
White shark	*Carcharodon carcharias*	E,LJ,A	X			Pelagic
Whiting	*Merluccius bilnearis*	E,L,J,A				Demersal
Windowpane flounder	*Scophthalmus aquosus*	E,L,J,A				Demersal
Winter flounder	*Pseudopleuronectes americanus*	E,L,J,A			X[1]	Demersal
Winter skate	*Leucoraja ocellata*				X	Demersal
Witch flounder	*Glyptocephalus cynoglossus*	E,L			X	Demersal
Yellowfin tuna	*Thunnus albacares*	J	X			Pelagic
Yellowtail flounder	*Limanda ferruginea*	E,L,J,A			X	Demersal

Note: [1] - EFH denotes life stage; E = Eggs, L = Larval, J = Juvenile, A = Adult. For more information on EFH, see Appendix H

[2] – Under the Federal Endangered Species Act (ESA)

[3] - Commercial/Recreational State Managed Species

Sources: Vasslides and Able 2008, Guida *et al.* 2017, Able *et al.* 2013, 2014, and 2015, Geo-Marine, Inc. 2010, NOAA Fisheries 2018d, NJDEP 2018b, NJDEP 2018c

3.4.3.1 Offshore Export Cable Routes

The offshore ECRs are within an open ocean/marine environment with unique characteristics influencing the fish community. Fish and invertebrate collection data representative of the offshore ECRs were reviewed and a summary of species collected in these studies by season is provided in **Table 3.4.3-2.** These studies encompassed multiple seasons and were grouped into cold (winter/spring) and warm seasons (summer/fall).

Table 3.4.3-2. Taxa in seasonal trawl survey catches between 2003 and 2016 in cold (winter/spring) and warm (summer/fall) seasons.

Common Name	Scientific Name	Winter/Spring	Summer/Fall
Atlantic croaker	*Micropogonias undulatus*[1,2]		X
Atlantic herring	*Clupea harengus*[1]	X	X
Atlantic mackerel	*Scomber scombrus*[1]	X	X
Bay anchovy	*Anchoa mitchilli*[1,2]		X
Black sea bass	*Centropristis striatus*[2]		X
Bluefish	*Pomatomus saltatrix*[2]		X
Bullnose ray	*Myliobatis freminvillii*[1]		X
Butterfish	*Peprilus triacanthus*[1,2]		X
Clearnose skate	*Raja eglanteria*[1]		X
Fourspot flounder	*Paralichthys oblongus*[2]		X
Gulf stream flounder	*Citharichthys arctifrons*[2]		X
Horseshoe crab	*Limulidae*[1]	X	X
Little skate	*Leucoraja erinacea*[1]	X	
Longfin Squid	*Doryteuthis pealeii*[1]	X	
Northern puffer	*Sphoeroides maculatus* [2]		X
Northern sand lance	*Ammodytes dubius*[1]	X	X
Northern seahorse	*Hippocampus erectus*[2]		X
Northern searobin	*Prionotus carolinus*[1,2]	X	X
Red hake	*Urophycis chuss*[2]		X
Roughtail stingray	*Dasyatis centroura*[1]		X
Round herring	*Spratelloides gracilis*[1]		X
Scup	*Stenotomus chrysops*[1,2]		X
Sea scallop	*Placopecten magellanicus*[1]	X	X
Silver hake	*Merluccius bilinearis*[1,2]	X	X
Smallmouth flounder	*Etropus microstomus*[2]		X
Smooth dogfish	*Mustelus canis*[1]		X
Southern rock crab	*Cancer irroratus*[1]	X	X
Spiny dogfish	*Squalus acanthias*[1]	X	X
Spot	*Leiostomus xanthurus*[1]		X
Spotted hake	*Urophycis regia*[1,2]	X	X
Striped searobin	*Prionotus evolans*[2]		X
Summer flounder	*Paralichthys dentatus*[1]	X	X
Weakfish	*Cynoscion regalis*[1]		X
Windowpane flounder	*Scophthalmus aquosus*[1]	X	X
Winter skate	*Leucoraja ocellata*[1]	X	X

[1] - Guida *et al.* 2017, [2] - Vasslides and Able 2008

Fish studies within the offshore ECRs included Vasslides and Able (2008) and Wilber *et al.* (2003). These studies report species assemblage across coastal beaches and the surf zone along with the pelagic zone specific to shoreface sand ridges on the inner continental shelf. The Vasslides and Able (2008) study summarized otter trawl and beam trawl collections conducted across various habitat types of the southern New Jersey coast. Beam-trawl samples in mid- and late-summer 1991-1995 were conducted at eight stations along a transect line between Little Egg Inlet using a two-meter beam trawl. Otter trawl samples in mid-summer 1997-2006 were conducted from 2 to 7 miles off the coast of Little Egg Inlet in the vicinity of Beach Haven Ridge during four replicate tows in the inlet station. The study concluded that shoreface sand ridges are important habitats for fish species including families *Paralichthyidae* (large-tooth flounders), *Triglidae* (sea robins), *Gobiidae* (gobies), *Serranidae* (groupers/sea bass), *Engraulidae* (anchovies), *Stromateidae* (butterfish), and *Sciaenidae* (drums/croakers).

Seasonal nearshore bottom trawl surveys have been conducted since 2007 by the Virginia Institute of Marine Science as part of the Northeast Area Monitoring and Assessment Program (NEAMAP) to support single and multispecies stock assessments in the Mid-Atlantic (Bonzek *et al*. 2017). The bottom trawl survey takes place across 17 regions from Cape Hatteras, North Carolina to Rhode Island Sound near the Massachusetts state waters. Three of these regions cover the New Jersey nearshore waters from Monmouth to Cape May County. Surveys off the coast of New Jersey target water depths up to 60 ft within 10 miles from shore. Within these three regions, seasonal trends in species abundance and occurrence are noticeable. NEAMAP results showed distinct seasonal variation in species assemblage and abundance. During spring trawling surveys, the most abundant species included alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), bay anchovy (*Anchoa mitchilli*), blueback herring, butterfish (*Peprilus triacanthus*), scup and silver hake (*Merluccius bilinearis*) along with clearnose (*Raja eglanteria*) and little skates (*Leucoraja erinacea*). During fall trawling surveys, these species were mostly absent from collections and a different assemblage was found to be most abundant and included bluefish (*Pomatomus saltatrix*), kingfish (*Menticirrhus saxatilis*), and weakfish (*Cynoscion regalis*).

NMFS has conducted annual bottom trawl surveys since 1999 during the winter (1999-2007), spring and fall (1999-2019) at depths that ranged from 50 to 190 ft. During the 2007 winter trawl survey, abundant species included spiny dogfish, yellowtail flounder (*Limanda ferruginea*), winter flounder (*Pseudopleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), summer flounder (*Paralichthys dentatus*), Atlantic herring, and little skate (NMFS 2007). Spring (NMFS 2019) and fall species assemblages were similar to the NEAMAP surveys with the addition of abundant collections of longfin squid in the fall (NMFS 2018).

The NJDEP has conducted the NJ Ocean Trawl Program annually for over 30 years to document the occurrence, distribution, and relative abundance of marine recreational and non-recreational fish species inhabiting the nearshore coastal waters of New Jersey. Seasonal trends were similar to those seen in Virginia Institute of Marine Science and NMFS surveys. Winter collections have been dominated by Atlantic herring, blueback herring, little skate, silver hake, and spiny dogfish. Spring collections were similar to winter with the addition of large numbers of bay anchovy. Summer collections were also dominated by bay anchovy, with additional high abundances of butterfish, longfin squid, northern searobin (*Prionotus carolinus*), scup, and striped anchovy (*Anchoa hepsetus*). Fall collections were dominated by bay anchovy but also had collections of longfin squid, scup, and butterfish (NJDEP 2019).

3.4.3.2 Estuarine Waters of Great Egg Harbor and Peck Bay

The estuarine waters of Great Egg Harbor and Peck Bay also contain a very diverse fish community that can tolerate unique habitat characteristics of inshore waters. These characteristics include but are not limited to shallow water depths, lower salinities, differing wave and current action, and different benthic habitat, including SAV beds.

Fish communities have been extensively studied within estuarine waters, in particular within Barnegat Bay, Little Egg Harbor, and Great Egg Harbor. Akers (2015) focuses on species assemblages found within the Great Egg Harbor River near the BL England Generating Station that were surveyed in 2014 and 2015. Fisheries surveys were conducted using otter trawls; species and abundance data are presented, along with spatial analysis of the 32 net tows conducted in the Great Egg Harbor River and 8 tows in the upper Tuckahoe River. Data from a 1998-1999 study using electrofishing and seining, conducted by University of Maryland, is compared with the current study for species abundance among sample sites. At the three sampling locations closest to the BL England Generating Station at Great Egg Harbor, the dominant species collected included white perch (*Morone americana*), hogchoker (*Trinectes maculatus*), and brown bullhead (*Ameiurus nebulosus*).

3.4.3.3 Estuarine Waters of Barnegat Bay

The estuarine waters of Barnegat Bay also contain a very diverse fish community that can tolerate unique habitat characteristics of inshore waters. These characteristics include but are not limited to shallow water depths, lower salinities, differing wave and current action, and different benthic habitat, including SAV beds.

Three studies directly related to the estuarine waters of Barnegat Bay are Able *et al.* (2013, 2014, and 2015), Zampella *et al.* (2006), and Valenti *et al.* (2017). In these studies, a variety of habitats for fish and crabs including marsh creeks, SAV beds, and open water in Barnegat Bay were sampled extensively with otter trawl collections, plankton nets, and gill nets. Sampling locations included Forked River and Oyster Creek whose results were compared to historical data from the late 1970s and early 1980s. Findings concluded that historical and recent data yielded similar results in terms of species diversity for cool water migrant species (those species with general northern sub-boreal cool water affinities that move into the Mid-Atlantic during fall and winter months), but a change in the occurrence of warm water migrants (those that have warm-temperate sub-tropical affinities with centers of distribution to the south, but that may migrate along shore to occupy Mid-Atlantic-Bight waters during the warm summer months). Resident and cool-water migrant species (e.g., silver hake) were less abundant and had been replaced by warm-water migrants such as northern kingfish and black drum (*Pogonias cromis*). A prime example of a warm water migrant that is now so abundant that it is harvested in commercial and recreational fisheries is Atlantic croaker (*Micropogonias undulatus*). Additionally, species such as bay anchovies (*Anchoa mitchilli*) and Atlantic silverside (*Menidia menidia*) exhibited a substantially higher abundance during summer and fall months. A summary of identified species is provided in **Table 3.4.3-3**.

Table 3.4.3-3. Species Composition in Barnegat Bay Sampling Gear During 2012-2014.

Species		Sampling Method[1]		
Scientific Name	Common Name	Plankton Net	Otter Trawl	Gill Net
Alosa mediocris	Hickory shad		X	X
Alosa pseudoharengus	Alewife		X	
Alosa sp			X	
Ammodytes sp		X		
Anchoa hepsetus	Broad-striped anchovy	X	X	
Anchoa mitchilli	Bay anchovy	X	X	
Anchoa sp		X	X	
Anguilla rostrata	American eel	X	X	
Apeltes quadracus	Fourspine stickleback	X	X	
Archosargus probatocephalus	Southern sheeps head		X	
Astroscopus guttatus	Northern stargazer		X	
Bairdiella chrysoura	American silver perch	X	X	X

Species		Sampling Method[1]		
Scientific Name	Common Name	Plankton Net	Otter Trawl	Gill Net
Blenniidae sp		X		
Brevoortia tyrannus	Atlantic menhaden	X	X	X
Caranx crysos	Blue runner		X	
Caranx hippos	Crevalle jack		X	
Carcharhinus plumbeus	Sandbar shark			X
Centropristis striata	Black sea bass	X	X	
Chaetodon ocellatus	Spotfin butterfly fish		X	
Chasmodes bosquianus	Striped blenny	X	X	
Chilomycterus schoepfi	Striped burrfish	X	X	
Clupea harengus	Atlantic herring	X	X	
Clupeidae sp		X	X	
Clupeiformes sp		X	X	
Conger oceanicus	American conger	X	X	
Ctenogobius boleosoma	Darter goby	X		
Cynoscion regalis	Weakfish	X	X	X
Cyprinodon variegatus	Sheepshead minnow		X	
Dactylopterus volitans	Flying gurnard		X	
Dasyatis say	Bluntnose stingray		X	X
Dorosoma cepedianum	American gizzard shad			X
Elops saurus	Ladyfish	X		
Enchelyopus cimbrius	Fourbeard rockling	X		
Engraulidae sp		X		
Engraulis eurystole	Silver anchovy	X		
Etropus microstomus	Smallmouth flounder	X	X	
Eucinostomus argenteus	Spotfin mojarra		X	
Fundulus heteroclitus	Mummichog	X	X	
Fundulus luciae	Spotfin killifish	X	X	
Fundulus majalis	Striped killifish	X	X	
Fundulus sp		X	X	
Gadus morhua	Atlantic cod	X	X	
Gasterosteus aculeatus	Three-spined stickleback		X	
Gobiesox strumosus	Skilletfish	X	X	
Gobiidae sp		X		
Gobionellus oceanicus	Highfin goby	X		
Gobiosoma bosc	Naked goby	X	X	
Gobiosoma ginsburgi	Seaboard goby	X	X	
Gobiosoma sp		X	X	
Hippocampus erectus	Lined seahorse	X	X	
Hyporhamphus meeki	American halfbeak	X		
Hypsoblennius hentz	Feather Blenny	X	X	
Ictalurus punctatus	Channel catfish		X	
Lagodon rhomboides	Pinfish	X	X	

Species		Sampling Method[1]		
Scientific Name	Common Name	Plankton Net	Otter Trawl	Gill Net
Leiostomus xanthurus	Spot	X	X	X
Lepomis gibbosus	Pumpkinseed sunfish		X	
Lepomis macrochirus	Bluegill sunfish		X	
Lucania parva	Rainwater killifish	X	X	
Lutjanus griseus	Mangrove snapper		X	
Menidia beryllina	Inland silverside	X	X	
Menidia menidia	Atlantic silverside	X	X	
Menidia sp		X	X	
Menticirrhus saxatilis	Northern kingfish	X	X	X
Microgobius thalassinus	Green goby	X	X	
Micropogonias undulatus	Atlantic croaker	X	X	X
Morone americana	White perch		X	X
Morone saxatilis	Striped bass		X	X
Morone sp			X	
Mugil cephalus	Flathead grey mullet	X	X	
Mugil curema	White mullet	X	X	
Mugil sp				X
Mustelus canis	Smooth dogfish		X	X
Mycteroperca microlepis	Gag grouper		X	
Myliobatis freminvillii	Bullnose ray			X
Myoxocephalus aenaeus	Little sculpin	X		
Myrophis punctatus	Speckled worm eel	X		
Ophichthus cruentifer	Margined snake eel	X		
Opisthonema oglinum	Atlantic thread herring	X		X
Opsanus tau	Oyster toadfish	X	X	
Paralichthys dentatus	Summer flounder	X	X	X
Peprilus sp		X	X	
Peprilus triacanthus	American butterfish	X	X	
Perca flavescens	Yellow perch		X	
Pholis gunnellus	Rock gunnel	X		
Pleuronectes sp		X		
Pogonias cromis	Black drum	X	X	X
Pollachius virens	Pollock		X	
Pomatomus saltatrix	Bluefish	X	X	X
Prionotus carolinus	Northern searobin	X	X	
Prionotus evolans	Striped searobin	X		
Pseudopleuronectes americanus	Winter flounder	X	X	
Raja erinacea	Little skate		X	
Rhinoptera bonasus	Cownose ray			X
Sciaenidae sp		X	X	
Scophthalmus aquosus	Windowpane flounder	X	X	
Selene setapinnis	Atlantic moonfish		X	
Selene vomer	Lookdown		X	

Species		Sampling Method[1]		
Scientific Name	**Common Name**	**Plankton Net**	**Otter Trawl**	**Gill Net**
Sphoeroides maculatus	Northern puffer	X	X	
Stenotomus chrysops	Scup		X	
Strongylura marina	Atlantic needlefish	X	X	X
Symphurus plagiusa	Blackcheek tonguefish	X	X	
Syngnathus fuscus	Northern pipefish	X	X	
Synodus foetens	Inshore lizardfish		X	
Tautoga onitis	Tautog	X	X	
Tautogolabrus adspersus	Cunner	X	X	
Trinectes maculatus	Hogchoker	X	X	X
Tylosurus acus	Pike fish	X		
Urophycis regia	Spotted Hake	X	X	

Source: Able et al. 2013, 2014, 2015
[1]*X Indicates species' presence*

The Wilber et al. (2003) study occurred off the coast of Monmouth and Ocean County. The surf zone fish community along 9.3 miles (15 km) of northern New Jersey was sampled every two weeks by beach seine in the late summer and early fall of 1995-1999 as part of monitoring of a beach nourishment. Fifty-seven species representing 30 families were collected during the study, where 90 percent of each sampling period's catch was composed of five taxa or less. These included Atlantic silverside (*Menidia menidia*), rough silverside (*Membras martinica*), bluefish (*Pomatomus saltatrix*), bay anchovies (*Anchoa mitchilli*), and striped anchovies (*Anchoa hepsetus*) (Wilber et al. 2003).

3.4.4 Marine Mammals

This section describes marine mammal species that may occur within the state seaward boundary (**Figure 3.4.4-1**) of the Project Area, which includes the portions of the offshore ECR that fall within New Jersey state waters including the portion of the corridor within Barnegat Bay. Summary information on threatened or endangered marine mammals protected under the Federal Endangered Species Act (ESA) are presented in this section. Several marine mammal species are also listed as endangered under the New Jersey Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP). The information contained in this section was obtained from literature review, agency consultations, and ongoing site investigations. Information reviewed included published scientific literature; reports prepared by government agencies, academic institutions, and non-governmental organizations; protected species observer (PSO) daily reports from ongoing site investigation surveys; National Environmental Policy Act (NEPA) documents; biological opinions issued on actions in or near the Project Area; and regulatory documents associated with Marine Mammal Protection Act (MMPA) authorizations.

All marine mammals are protected under the MMPA (16 U.S.C. §§ 1361 et seq.).

Several studies of marine mammal occurrence and distribution have been conducted in or near the Project Area. The NJDEP funded the New Jersey Ecological Baseline Studies (EBS) from January 2008 through December 2009: surveys conducted by Geo-Marine, Inc. employed visual line-transect (aerial and shipboard) methods and passive acoustic monitoring (PAM) to estimate the abundance and density of marine mammals from the shoreline to around 20 nm (37 km) off the coast of New Jersey between Stone Harbor and Seaside Park (NJDEP 2010b) (**Figure 3.4.4-1, Figure 3.4.4-2, Figure 3.4.4-3**). Shipboard surveys were conducted once per month between January 2008 and December 2009. Aerial surveys were conducted once per month following the shipboard surveys between February and May 2008, and twice monthly (when possible) between January and June 2009 (NJDEP 2010b).

In addition, the Atlantic Marine Assessment Program for Protected Species (AMAPPS), which is an ongoing program that started in 2010, coordinates data collection and analysis to assess the abundance, distribution, ecology and behavior of marine mammals in the U.S. Atlantic. Although the majority of AMAPPS survey effort is focused on offshore areas beyond the 328 ft (100 m) isobath, a portion of the survey effort was conducted in Wind Energy Areas (WEAs) off the coast of New Jersey (Northeast Fisheries Science Center [NEFSC] & Southeast Fisheries Science Center [SEFSC] 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2018, 2019, 2020) (**Figure 3.4.4-4**). Palka et al. (2017) derived abundance and density estimates for 15 marine mammal taxa (including pinnipeds) using AMAPPS survey data collected in the New Jersey WEA from 2011 to 2013.

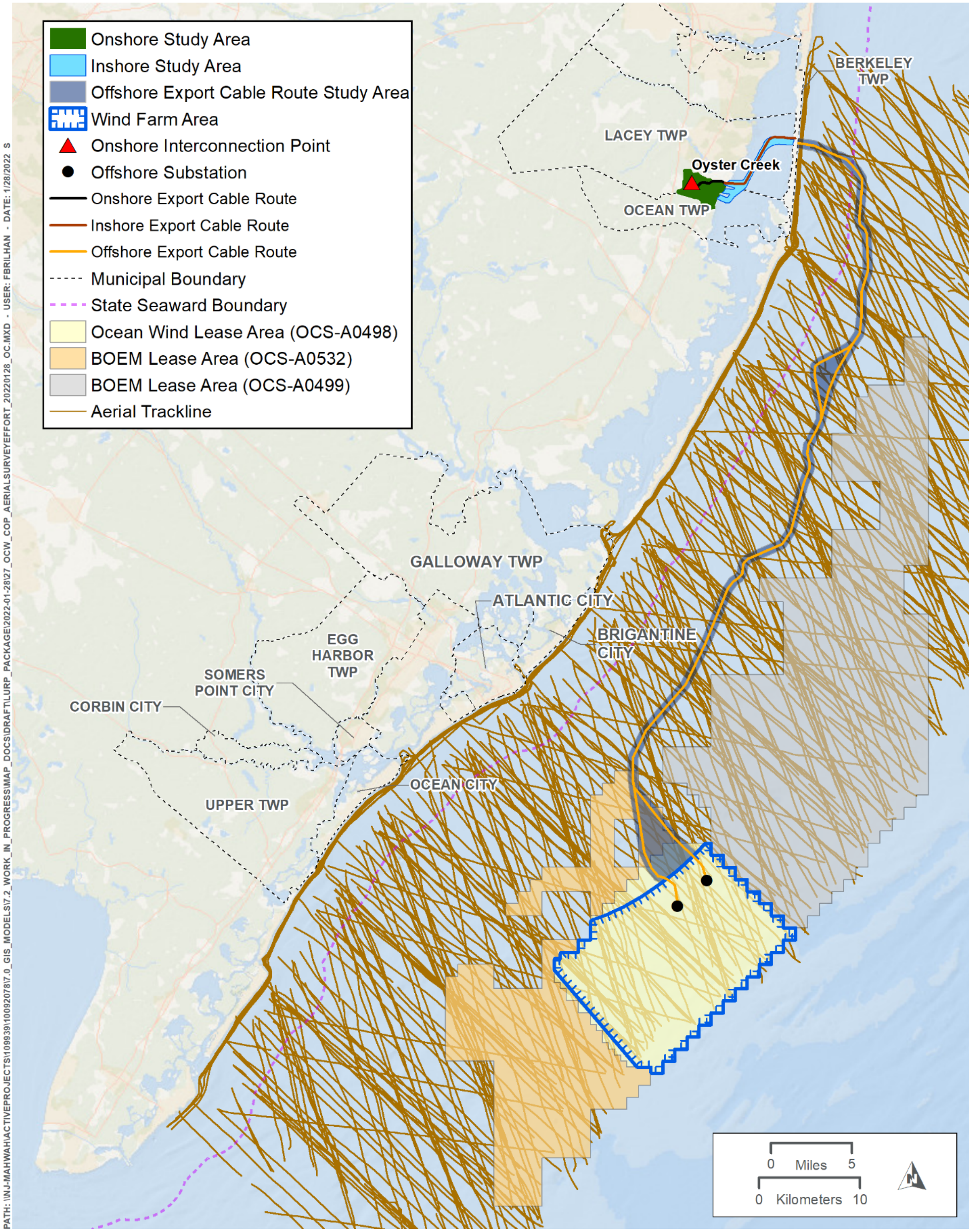


Figure 3.4.4-1- Aerial Survey Effort for NJDEP (2010b) Surveys from December 2008 through January 2009, in Relation to the Project Area.

Note: Aerial surveys were conducted once per month following the shipboard surveys between February and May 2008, and twice monthly (when possible) between January and June 2009.

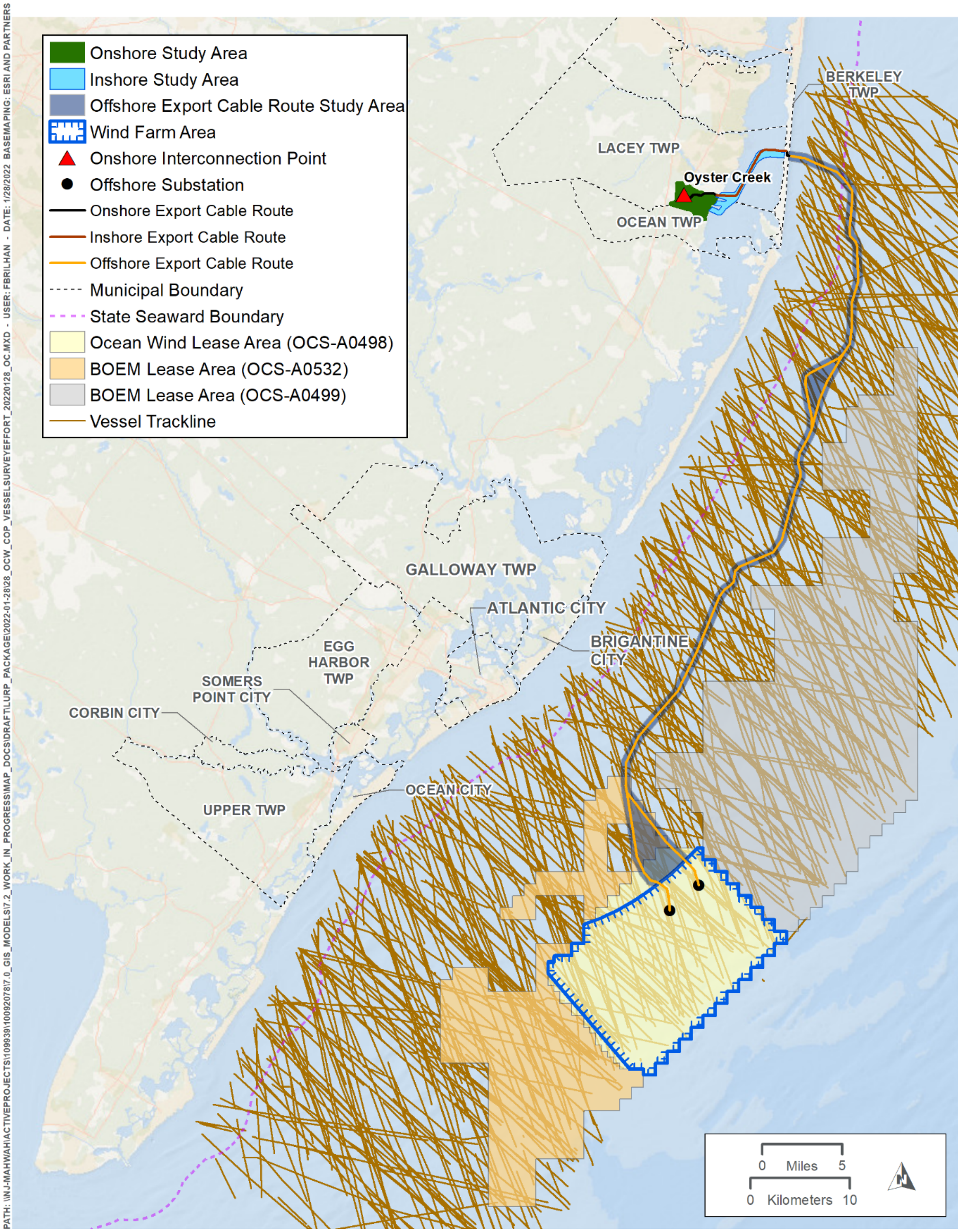


Figure 3.4.4-2 - Shipboard Survey Effort for NJDEP (2010b) Surveys, Conducted once per Month from December 2008 through January 2009 in Relation to the Project Area.

PATH: \\NJ-MAHWAH\ACTIVEPROJECTS\10993910092078\7.0_GIS_MODELS\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LURP_PACKAGE\2022-01-28\29_OCW_COP_MARINEMAMMAL_20220128_OC.MXD - USER: FBRILHAN - DATE: 1/28/2022

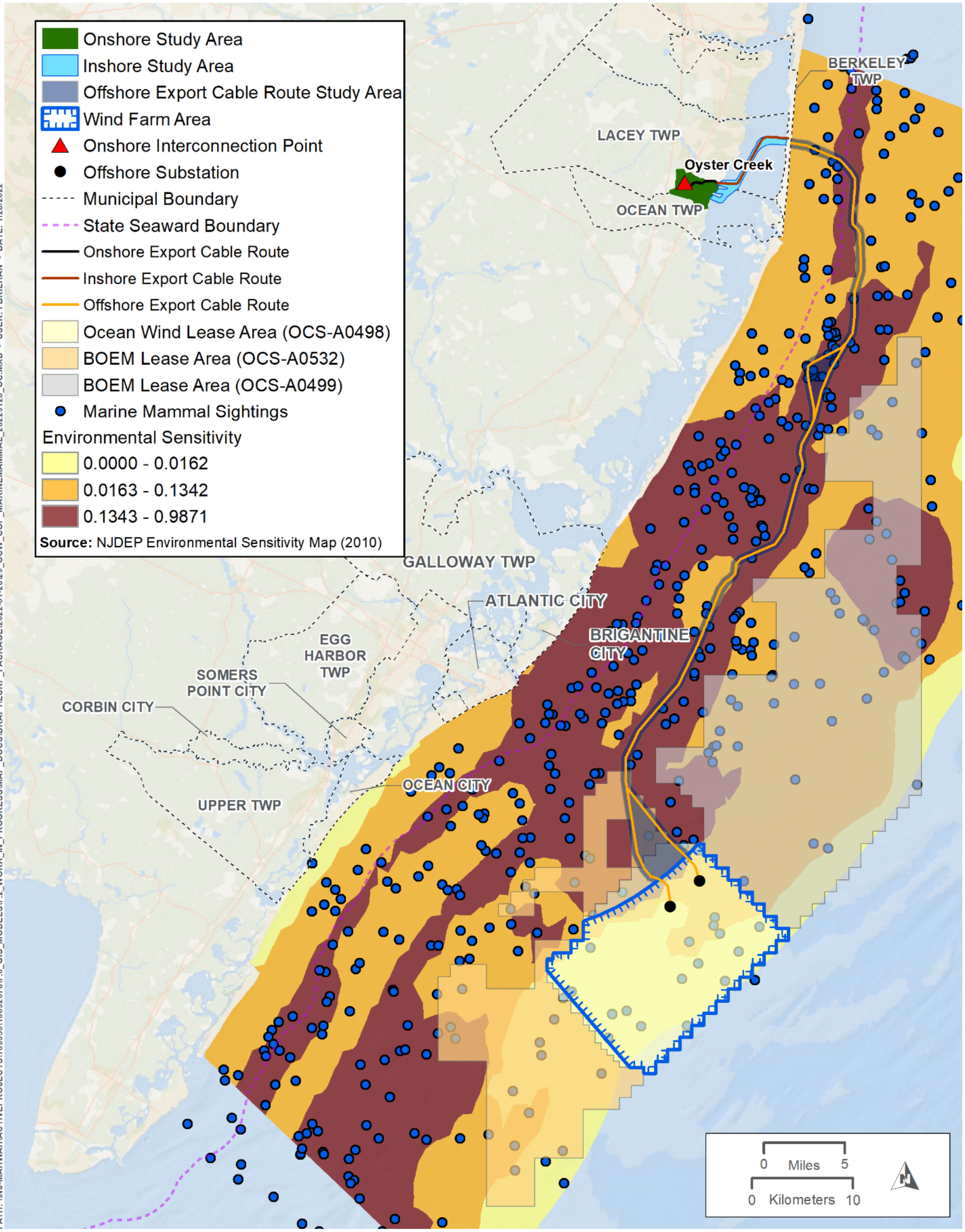


Figure 3.4.4-3 - Marine Mammal Sightings and Density Data Collected during NJDEP (2010b) Surveys, in Relation to the Project Area.

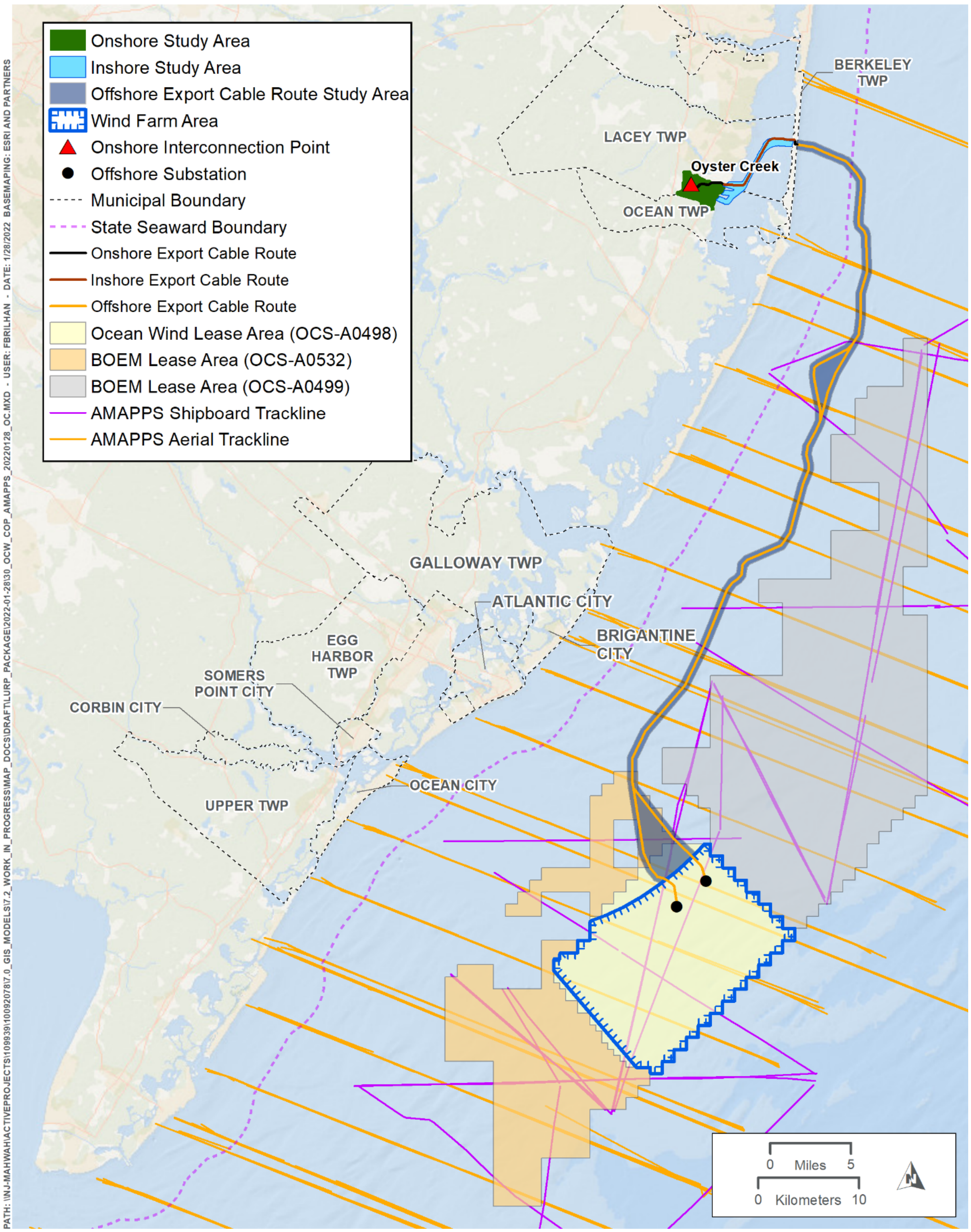


Figure 3.4.4-4 - Spatial coverage of AMAPPS vessel and aerial surveys offshore of New Jersey from 2010-2016 shown in relation to the Project Area.

Note: Effort data from 2015 not pictured. Data was accessed from http://seamap.env.duke.edu/dataset/1288 on 4 June 2018.

As part of Ocean Wind 1's HRG and geotechnical surveys conducted in the Lease Area in 2017, vessel-based monitoring for marine mammals was conducted in conjunction with survey activities as specified in the project Incidental Harassment Authorization (IHA) issued by NMFS in June 2017. In summer of 2017 (June-August), an HRG and geotechnical survey was conducted off the coast of New Jersey (Alpine 2017b). During vessel-based monitoring, 26 opportunistic visual sightings occurred of three cetacean and two sea turtle species (Alpine 2017b). During winter geotechnical surveys, five cetacean species were observed including a North Atlantic Right Whale (NARW). All PAM detections were clicks unidentified to species, and detections were not localized (Smultea Environmental Sciences 2018). Marine mammal species that have been documented, or are likely to occur, in the Project Area (including the WFA and ECR areas) are listed in **Table 3.4.4-1.** Several offshore species are not expected to occur in state waters. Although these offshore species are noted in **Table 3.4.4-1** they are not discussed further in this application as they are the subject of separate NEPA analysis, MMPA permitting and ESA consultations. All state-listed offshore species are included in this application. State and federally listed marine mammals are discussed in Section 3.4.6. The remainder of this section provides a discussion of non-endangered and non-threatened marine mammals.

Table 3.4.4-1. Marine mammal species that have been documented, or are likely to occur, in the Project Area and their status, population estimate, abundance, and seasonal occurrence.

	Species (Scientific Name)	Stock, as Designated by NMFS	Best Population Estimate in SAR[a]	Strategic Status Under MMPA[b]	ESA Status	Critical Habitat in the vicinity of the Project Area	Occurrence within Project Area[c]	Seasonal Occurrence within Project Area
Low-Frequency Cetaceans (7 hertz [Hz] to 35 kilohertz [kHz])	North Atlantic Right Whale (*Eubalaena glacialis*)[d]	Western North Atlantic	368	Strategic	Endangered	Cape Cod Bay, Stellwagen Bank, and the Great South Channel and calving areas off Cape Canaveral, Florida to Cape Fear, North Carolina	Regular	Year-round
	Humpback Whale (*Megaptera novaeangliae*) [d]	Gulf of Maine	1,396	None	Delisted	N/A	Regular	Spring, Summer, Fall (possibly year-round)
	Fin Whale (*Balaenoptera physalus*) [d]	Western North Atlantic	6,802	Strategic	Endangered	N/A	Regular	Spring, Summer, Fall (possibly year-round)
	Blue Whale (*Balaenoptera musculus*) [d]	Western North Atlantic	402[e]	Strategic	Endangered	N/A	Not expected	Spring, Summer
	Sei Whale (*Balaenoptera borealis*) [d]	Nova Scotia	6,292	Strategic	Endangered	N/A	Rare	Spring, Summer
	Minke Whale (*Balaenoptera acutorostrata*)	Canadian East Coast	21,968	None	None	N/A	Common	Spring, Summer and Winter (possibly year-round)
Mid-Frequency Cetaceans (150 Hz to 160 kHz)	Sperm Whale (*Physeter macrocephalus*) [d,e]	North Atlantic	4,349[f]	Strategic	Endangered	N/A	Uncommon	Spring, Summer, Fall
	Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*) [g]	Western North Atlantic	93,233	None	None	N/A	Regular	Winter

	Species (Scientific Name)	Stock, as Designated by NMFS	Best Population Estimate in SAR[a]	Strategic Status Under MMPA[b]	ESA Status	Critical Habitat in the vicinity of the Project Area	Occurrence within Project Area[c]	Seasonal Occurrence within Project Area
	Risso's Dolphin *(Grampus griseus)* [g]	Western North Atlantic	35,493[f]	None	None	N/A	Uncommon	Year-round
	Short-finned Pilot Whale *(Globicephala macrorhynchus)* [g]	Western North Atlantic	28,924	Strategic	None	N/A	Uncommon	Year-round
	Long-finned Pilot Whale *(Globicephala melas)* [g]	Western North Atlantic	39,215	Strategic	None	N/A	Rare	Year-round
	Striped Dolphin *(Stenella coeruleoalba)* [g]	Western North Atlantic	67,036	None	None	N/A	Rare	Fall, Winter (possibly year-round)
	Atlantic Spotted Dolphin *(Stenella frontalis)* [g]	Western North Atlantic	39,921	None	None	N/A	Uncommon	Summer, Fall
	Common Dolphin *(Delphinus delphis)*	Western North Atlantic	172,974	None	None	N/A	Regular	Fall, Winter (possibly year-round)
	Common Bottlenose Dolphin *(Tursiops truncatus)* [e]	Western North Atlantic, Northern Migratory Coastal	6,639	Strategic	None	N/A	Regular	Year-round (most frequently in Spring and Summer)
	Common Bottlenose Dolphin *(Tursiops truncatus)*[f]	Western North Atlantic, Offshore	62,851	None	None	N/A	Regular	Year-round (most frequently in Spring and Summer)
High-Frequency Cetaceans (275 Hz to 160 kHz)	Harbor Porpoise *(Phocoena phocoena)*	Gulf of Maine-Bay of Fundy	95,543	None	None	N/A	Regular	Winter (possibly during Spring and Summer)

	Species (Scientific Name)	Stock, as Designated by NMFS	Best Population Estimate in SAR[a]	Strategic Status Under MMPA[b]	ESA Status	Critical Habitat in the vicinity of the Project Area	Occurrence within Project Area[c]	Seasonal Occurrence within Project Area
Phocid Pinnipeds (50 Hz to 86 kHz)	Harbor Seal *(Phoca vitulina)*[f]	Western North Atlantic	61,336	None	None	N/A	Regular	Spring, Fall, Winter
	Gray Seal *(Halichoerus grypus)*[f]	Western North Atlantic	27,300	None	None	N/A	Regular	Spring, Fall
	Harp Seal *(Pagophilus groenlandicus)*	Western North Atlantic	76 million	None	None	N/A	Rare	Spring, Winter
	Hooded seal (*Cystophora cristata*)	Western North Atlantic	Unknown	None	None	N/A	Not Expected	Spring, Winter

[a]Best population estimates reported in the 2020 Stock Assessment Report (SAR) and most recently updated 2020 Draft SAR (Hayes *et al.* 2020; NMFS 2020).

[b]The MMPA defines a "strategic" stock as a marine mammal stock (a) for which the level of direct human-caused mortality exceeds the potential biological removal level; (b) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or (c) which is listed as a threatened or endangered species under the ESA, or (d) is designated as depleted.

[c]Occurrence in the Offshore Survey Corridor was derived from sightings and information in NJDEP 2010b; NEFSC & SEFSC 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2018, 2019, 2020; Roberts *et al.* 2016; Palka *et al.* 2017; and Hayes *et al.* 2020, 2021. The species known to occur in the Project Area and vicinity, and expected to occur in the survey area, are addressed based on their reported occurrence of rare to regular (i.e., common).

[d]Listed as endangered under the New Jersey Division of Fish and Wildlife's ENSP: NJDEP Division of Fish & Wildlife - State Endangered and Threatened Species.

[e]The minimum population estimate is reported as the best population estimate in the most recently updated 2020 Draft SAR (NMFS 2020b).

[f]Density models (Palka *et al.* 2017) predicted that typically deep-water species such as Risso's dolphins and sperm whales are present at very low densities in offshore edges of several wind energy study areas that are either close to the continental shelf break or extend into deeper waters.

[f]Palka *et al.* (2017) pooled the Offshore and Northern Migratory Coastal Stocks of bottlenose dolphin in a single density estimate; likewise gray, harbor and unidentified seals were pooled in a single estimate.

[g]Although this species may occur in the WFA, due to its primarily offshore distribution it is unlikely to occur within state waters and is therefore not discussed further in this application. Seasonal abundance estimates for marine mammals, derived from density models in the New Jersey Wind Energy Study Area. From: Supplement to Final Report BOEM 2017-071, Atlantic Marine Assessment Program for Protected Species: 2010-2014 Appendix G (Palka *et al.* 2017). Seasons are depicted as follows: Spring (March - May); Summer (June - August); Fall (September - November); Winter (December - February).

3.4.4.1 Pinnipeds

Four species of pinnipeds have the potential to occur in the coastal waters of New Jersey: harbor seals *(Phoca vitulina)*, gray seals *(Halichoerus grypus)*, hooded seals *(Cystophora cristata)*, and harp seals *(Pagophilus groenlandicus)* (NJDFW 2009), although harbor and gray seals are the most likely to occur in the Project Area. Abundance estimates for these species in the Project Area have been pooled (Palka *et al.* 2017) so, for the purpose of this analysis, these species will be treated as a single group, "phocid pinnipeds."

Harbor seals are the dominant pinniped species in the Project Area. They are year-round inhabitants of the coastal waters of eastern Canada and Maine, occur seasonally along mid-Atlantic shores from September through late May (Hayes *et al*. 2020), but are typically observed in New Jersey between November and April. The three major haul-out (resting) sites in New Jersey are 1) Great Bay, which is at the border between Ocean and Atlantic Counties (and the largest haul out south of Long Island, NY), 2) Barnegat Inlet/Barnegat Lighthouse, and 3) Sandy Hook (Slocum *et al.* 2005, Slocum and Davenport 2009, NJDEP 2010b, CWFNJ 2018).

One harbor seal was recorded during NJDEP EBS in shallow waters east of Little Egg Inlet in June. Other unidentified pinnipeds recorded near Ocean City in April were likely also harbor seals, but species could not be confirmed (NJDEP 2010b). An unidentified seal was observed in the spring 2013 aerial AMAPPS survey (NEFSC & SEFSC 2013).

Little is known about the habitat use and foraging grounds of harbor and gray seals in mid-Atlantic waters. Individuals of both species were captured and instrumented with telemetry tags from 2012-2015 as part of the AMAPPS effort, and spatially explicit at-sea density models were developed for seals sighted during aerial surveys (Palka *et al.* 2017). However, all animals were captured in Maine and Massachusetts, and results did not pertain to the Project Area.

Historically, harbor seals were observed only sporadically south of New Jersey, but in recent years this species has been seen regularly as far south as North Carolina, and regular seasonal haul-out sites of up to 40-60 animals have been documented on the eastern shore of Virginia and the Chesapeake Bay (Rees *et al.* 2016). Gray seals were considered locally extinct in U.S. waters prior to the 1980s due to human exploitation, but in recent decades have been recolonizing their former range from Maine to New Jersey (Wood *et al.* 2011). Population trends for harbor seals are not available, but gray seal abundance is likely increasing, and both species are extending the seasonal intervals in which they inhabit mid-Atlantic waters (Hayes *et al.* 2020).

In March 2019, Ocean Wind 1 conducted aerial surveys for seals along the New Jersey coastline from Sandy Hook to Great Bay, New Jersey, with a focus on three known haul-out sites: Sandy Hook, Barnegat Bay, and Great Bay (Appendix G). This timeframe was selected to coincide with the maximum number of seals expected to be hauled out (Slocum 2009). Aerial surveys with a visual observer aboard were conducted on March 9, but no seals were observed. On March 17 a high-resolution aerial digital survey of the three haul-out sites was conducted. Surveys were flown using a 1974 Cessna U206F, flying at an altitude of approximately 1,000 ft. In total, 45 seals were detected in the digital images: six in the Sandy Hook area, five in the Barnegat Light area, and 34 in the Fish Island-Great Bay area. The majority of the seals detected were in the water, with very few hauled out, making species identification difficult. Only seven of the 45 seals were identified to species, of which all were identified as probable harbor seals. In addition to the aerial survey data, results from a ground-based haul-out count survey conducted by the Rutgers University Marine Field Station at the Great Bay site from March 5-14 indicated a maximum of 145 harbor seals at this site on March 14. No corresponding ground- or vessel-based count data were available for the Barnegat Bay or Sandy Hook sites.

The best abundance estimates for harbor seals in the Western North Atlantic stock (U.S. and Canada) is 75,834 (**Table 3.4.4-1**) (Hayes *et al.* 2020). NOAA SARs denote the population sizes of gray seals species as “unknown”, because systematic surveys have not been conducted within the U.S.; however, they report that estimates based on surveys at pupping areas north of the U.S. have resulted in Canadian population estimates of 424,300 gray seals in 2016 (Hayes *et al.* 2020). The minimum number of pups born at U.S. breeding colonies (*n*=6,308) were used to approximate the total size of the gray seal population in U.S. waters. Although there is some uncertainly in the abundance numbers, this approach estimates the U.S. gray seal population at 27,131, putting the combined Western North Atlantic stock population at 451,431 (Hayes *et al.* 2020).

Pinniped stranding records for the New Jersey coast were reported by NMFS for the years 2011-2015. These records included a total of 32 harbor seals (five of which were pups), 35 gray seals (14 of which were pups), and 22 harp seals (none of which were pups) (Hayes *et al.* 2020). Since July 2018, increased numbers of gray seal and harbor seal mortalities have been recorded across Maine, New Hampshire, and Massachusetts (NOAA Fisheries 2020). This event has been declared an unusual mortality event (UME) by NMFS and encompasses 3,152 seal strandings from Maine to Virginia (NOAA Fisheries 2020). Off New Jersey, 172 seals have stranded between July 2018 and March 2020 (NOAA Fisheries 2020). Phocine distemper virus was the predominant pathogen found in the deceased seals upon completion of full or partial necropsies, and based on this finding, has been attributed as the cause of the UME.

3.4.4.2 Cetaceans

3.4.4.2.1 Common Dolphin

The Western North Atlantic stock of the common dolphin (*Delphinus delphis*) is distributed from Massachusetts to the South Carolina/Georgia border but are less common south of Cape Hatteras (Hayes *et al.* 2020). Common dolphins were only recorded in the EBS in fall and winter (late November through mid-March) and accounted for a majority of the dolphins recorded in the winter (NJDEP 2010b). During the EBS these dolphins were observed in water depths of 33 to 102 ft (10 to 31 m) and 2 to 20 nm (3 to 37 km) from shore, which suggests they occur much closer to shore than earlier reports suggest. These dolphins are expected to occur within the Project Area.

A winter abundance estimate of 82 individuals was generated for this species in the Project Area, but this estimate might be high (NJDEP 2010b). Common dolphins were observed in the wind planning areas offshore of New Jersey in spring surveys (2012 and 2014), fall surveys (2016), winter/spring surveys (2015), summer surveys (2017), and winter AMAPPS surveys (2017-2018; NEFSC & SEFSC 2012, 2014, 2015, 2016, 2018, 2019; Smultea Environmental Sciences 2018). They were not present during the summer 2017 survey (Alpine 2017b).

Seasonal abundance estimates generated by Palka *et al.* (2017) showed that common dolphins were more abundant during the fall off New Jersey than the spring and summer.

3.4.4.2.2 Bottlenose Dolphin

Bottlenose dolphins (*Tursiops truncatus*) occur in estuarine, coastal, continental shelf, and offshore waters of the western North Atlantic Ocean. Bottlenose dolphin in the Project Area could belong to either the Western North Atlantic Offshore Stock or the Western North Atlantic Northern Migratory Coastal Stock. During warm water months, dolphins in the Northern Migratory Coastal Stock occupy coastal waters from the shoreline to approximately the 65.6 ft (20-m) isobath between Assateague, Virginia, and Long Island, New York (Garrison *et al.* 2017).

Bottlenose dolphins were the most frequently sighted marine mammals during EBS surveys. They were sighted in all seasons, but most frequently in spring and summer (NJDEP 2010b). Results of the EBS suggest bottlenose dolphins occur off New Jersey from the beginning of March until around mid-October (NJDEP 2010b). Fewer bottlenose dolphins were observed in the fall in comparison with other seasons, since fall is potentially a transitional period when bottlenose dolphins move south of the survey area (NJDEP 2010b).

Bottlenose dolphins were observed off New Jersey during the 2017 winter AMAPPS surveys (NEFSC & SEFSC 2018)

EBS results also indicate that nearshore waters are important to bottlenose dolphins, but distribution is not thought to be limited to a particular depth or distance from shore. Bottlenose dolphins were sighted within 0.16 nm (0.3 km) of the shore, with peak densities from the shore to 3 nm (5.5 km) off Atlantic City and Little Egg Inlet in the spring, but further offshore of Barnegat Light and Barnegat Bay in the summer. However, several bottlenose dolphin sightings were also recorded in deeper waters (112 ft [34 m]) and farther offshore (maximum 21 nm [38 km] from shore).

Seasonal abundance estimates for bottlenose dolphins off New Jersey showed they are more prevalent in the summer, followed by spring and fall, with the lowest densities during the winter (Palka *et al.* 2017).

3.4.4.2.3 Harbor Porpoise

Harbor porpoises (*Phocoena phocoena*) in the western Atlantic belong to the Gulf of Maine-Bay of Fundy stock (Hayes *et al.* 2020). Their distribution in the western North Atlantic is seasonal, concentrated in the northern Gulf of Maine during summer (July to September); widely dispersed between Maine and New Jersey during fall (October-December) and spring (April-June) with lower densities north and south of this area; distributed from New Jersey to North Carolina in the winter (January-March) in intermediate densities and lower densities off New York to New Brunswick, Canada (Westgate *et al.* 1998 as cited in NJDEP 2010b; Hayes *et al.* 2020). More than 90 percent of the harbor porpoise sightings recorded in the EBS occurred during winter (mainly February and March) and few sightings were recorded in April, May, and July. No harbor porpoises were observed during the fall survey; however, conditions were not optimal to sight this species and they are likely to occur in New Jersey waters throughout the fall.

Harbor porpoises were observed in the spring 2013 and 2014, and summer 2017 and 2019 aerial AMAPPS surveys (NEFSC & SEFSC 2013, 2014, 2018, 2020). Seasonal abundance estimates generated for harbor porpoise off New Jersey showed the highest densities during the spring, with very low numbers in the fall and no estimate during the summer and winter (Hayes *et al.* 2020).

3.4.4.2.4 Minke Whale

Minke whales (*Balaenoptera acutorostrata*) were observed during EBS surveys (NJDEP 2010b), and during winter, spring, and summer AMAPPS surveys (NEFSC & SEFSC 2013, 2015, 2018). Seasonal abundance estimates calculated for minke whales in waters off New Jersey showed moderate numbers during the spring, and low numbers during the summer and fall in the waters off New Jersey (Palka *et al.* 2017).

Since 2011, 13 minke whale strandings have occurred in New Jersey. In January 2017, a UME (UME Number 65) was declared for this species, with 102 total strandings from Maine to South Carolina due to entanglement and infectious disease (NOAA Fisheries 2021c). Preliminary results of necropsy examinations indicate evidence of human interactions or infectious disease; however, these results are not conclusive (NOAA Fisheries 2021c).

3.4.5 Benthic Resources

This section describes the existing benthic resources in the New Jersey state waters of the offshore ECR in the Atlantic Ocean and estuarine waters of Peck Bay and Barnegat Bay. Benthic Resources include flora and fauna such as SAV and invertebrates. Data used to describe these resources came from various entities spanning decades of studies. Primary resources included the Mid-Atlantic Ocean Data Portal description of benthic habitat, an Assessment of Ecological Status of Benthic Communities in New Jersey Marine Coastal Waters (Ramey, Kennish, & Petrecca 2011), NJDEP's Ocean/Wind Power Ecological Baseline Studies (NJDEP 2010b), and studies conducted by Ocean Wind 1. Data consist of both grab samples and imagery that span spring, summer, and fall across multiple years. These data allow for the characterization of species community composition, abundance, and diversity.

Surfclam fisheries have experienced declines in commercial landings in New Jersey from 1980 through 2016 and landings in New Jersey are at an all-time low as catches that are composed of relatively small clams are not favored by processors (Northeast Fisheries Science Center [NEFSC] 2016). One potential explanation of this is the warm water intrusion on the Mid-Atlantic shelf. Over the last decade, these warmer waters may have caused mortality in larger surfclams off the New Jersey coast and effectively shifted the population northward as indicated by the increase in New York surfclam biomass. Southern areas (Delmarva Peninsula and New Jersey) have experienced declines in surfclam biomass during recent years due primarily to poor recruitment and slow growth rates associated with warm water conditions (Weinberg 2005).

From 1988 to 2019, NJDEP's Bureau of Shellfisheries conducted an annual inventory of New Jersey's inshore (within 3 nautical miles of shore) surfclam stock. Sampling was conducted from Shark River Inlet to Cape Map Inlet between the months of June and August using a commercial hydraulic clam dredge to measure abundance at each station. Sampling of these inshore waters has shown a downward trend of the estimated standing stock from a maximum of 26.3 million bushels recorded in 1997 to just 325,020 bushels recorded in 2014 (most recent report available). Additionally, mean shell lengths have steadily increased which is reflective of poor recruitment during this time period. From 2010 through 2014, inshore surfclam harvest in New Jersey's designated "approved waters" has been practically non-existent with only 2,944 industry bushels of surfclams harvested from 2010 through 2014 (NJ Bureau of Shellfisheries 2015). Data on the adult/harvestable clams in state waters from 2009 through 2019 indicates that the total bushels harvested per 5 minute sampling effort has decreased from an average of approximately 2 bushels in 2009 to 0.03 bushels in 2019 (NJ Bureau of Shellfisheries 2019). Recruitment data from 2015 through 2019 provided by the NJDEP's Bureau of Marine Fisheries has shown a similar trend when compared to data collected during the first 5 years of survey conducted from 1988 through 1992 for surfclam recruitment.

Furthermore, based on Vessel Monitoring System (VMS) and Vessel Trip Report (VTR) (NOAA Fisheries n.d.), the vast majority of vessel movement for the surfclam/ocean quahog harvest occurs outside of state waters and not along the proposed export cable route.

Based on the aforementioned data and trends of surfclam stock inventory and recruitment, the areas of the ECR within state waters do not show significant commercially harvestable quantities of surfclams or areas important for recruitment of surfclam stocks. Therefore, no impacts to surfclam areas are expected.

3.4.5.1 Atlantic Ocean

The Mid-Atlantic Ocean Data Portal and the Nature Conservancy (Greene et al. 2010) have characterized species, habitats, and ecosystems of the offshore ECR within New Jersey state waters of the Atlantic Ocean. According to these sources, the benthic habitat within New Jersey state waters of the Atlantic is made up of substrate ranging from fine (0.005-0.010 in) (0.125-0.25 mm) to coarse (0.02-0.039 in) (0.5-1 mm) sands.

Offshore benthic habitat of New Jersey has been studied by various entities. Byrnes and Hammer (2001) conducted a study to evaluate the feasibility of sand borrowing and documented a sandy benthic habitat dominated by polychaete worms and Atlantic nut clams. Boesch (1979) categorized offshore benthic habitat a few miles offshore of Atlantic City as inner shelf coarse substrate with dynamic, uniformly coarse sand containing a benthic community dependent on changes in subtle bottom topography, particularly ridges and swales. Communities were dominated by mollusks (*Tellina agilis*), crustaceans (*Tanaissus liljeborgi*), polychaetes, and sand dollars (*Echinarachnius parma*).

Geo-Marine, Inc. reviewed available data for benthic invertebrate (epifauna) taxa that occur along the New Jersey inner shelf (NJDEP 2010b), which includes the New Jersey state waters of the offshore ECR. Common macrofauna within the Project Area include species from several taxa including echinoderms (e.g., sea stars, sea urchins, and sand dollars), cnidarians (e.g., sea anemones and corals), mollusks (e.g., bivalves, cephalopods, and gastropods), bryozoans, sponges, amphipods, and crustaceans (NJDEP 2010b). The Project Area also contains sand dollars and surfclams with various other epifauna (e.g., rock crabs, hermit crabs, cancer crabs, horseshoe crabs, spider crabs, and lobsters) found throughout the area (NJDEP 2010b). Within the near-shore area of New Jersey waters, common crustaceans include hermit crabs (*Pagurus spp.*), Atlantic rock crab (*Cancer irrotatus*) and sevenspine bay shrimp (*Crangon septemspinosa*) (NJDEP 2010b). A summary is provided in **Table 3.4.5-1**.

Table 3.4.5-1. Summary of common benthic invertebrate species that inhabit the Project Area.

Common Name	Scientific Name
Echinoderms	
N/A	*Cidaris abyssicola*
Purple-spined sea urchin	*Arbacia punctulata*
Northern sea urchin	*Strongylocentrotus droebachiensis*
Common sand dollar	*Echinarachnius parma*
Five-slotted sand dollar	*Mellita quinquiesperforata*
N/A	*Schizaster orbignyanus*
Sea potato	*Echinocardium cordatum*
Cnidarians	
Deeplet sea anemone	*Bolocera tuediae*
North American tube anemone	*Ceriantheopsis americanus*
Northern cerianthid	*Cerianthus borealis*
Lined sea anemone	*Edwardsiella lineata*
Plumose anemone	*Metridium senile*
Mollusks	
Atlantic surfclam	*Spisula solidissima*
Long-finned squid	*Loligo pealei*
Short-finned squid	*Illex illecebrosus*
Common octopus	*Octopus vulgaris*
Whelks	*Busycon* spp.
Northern moon snail	*Euspira heros*
Shark eye	*Nevirita duplicata*
Bryozoans	
N/A	*Bowerbankia imbricata*
N/A	*Bugula fulva*
N/A	*Nolella stipata*
Crustaceans	
Hermit crabs	*Pagurus* spp.
Atlantic rock crab	*Cancer irroratus*
Sevenspine bay shrimp	*Crangon septemspinosa*
American horseshoe crab[9]	*Limulus polyphemus*
Lady crab	*Ovalipes ocellatus*
Spider crab	*Libinia emarginata*

[9] Horseshoe crabs spend winter 20 to 60 ft deep on the continental shelf (ASMFC 2013).

Source: NJDEP 2010b

The USEPA's National Coastal Assessment program is the most spatially and temporally comprehensive survey conducted on New Jersey benthic communities (Ramey, Kennish, and Petrecca 2011). The sampling program was designed to take into account episodic natural upwelling, offshore wastewater discharges, and state management zones. Samples were collected with a Van Veen grab from Sandy Hook to Cape May at 153 stations along the Atlantic Coastline in August and September 2007 and 2009. In total over 110,000 individuals belonging to 273 species/taxa were identified. In a review of 19 studies on benthic soft-sediment fauna, Ramey, Kennish, and Petrecca (2011) identified 540 benthic macrofaunal species/taxa in New Jersey Coastal Waters (Ramey, Kennish, and Petrecca 2011). Dominant taxonomic groups included polychaete andoligochaete worms (*Prionospio pygmaeus*, *Tharyx* sp. A, *Aricidea catherinae, Grania longiducta, Peosidrilus coeloprostatus*), amphipods (*Protohaustorius deichmannae*), and the bivalve *Nucula proxima*.

3.4.5.2 Peck Bay Shellfish

The coastal/inland bays were mapped as part of the Distribution of Shellfish Resources in Relation to the New Jersey Intracoastal Waterway (U.S. Department of the Interior 1963). Mapping is on the state website and includes the Crook Horn Creek/Peck Bay, the area mapped as high and moderate commercial value. NJDEP conducts a shellfish inventory program which collects data on the distribution and abundance of shellfish species. This robust dataset includes data on New Jersey coastal bays from 1983. Shellfish abundance varies based on water quality, hydrodynamics and large storm events such as Hurricane Sandy. NJDEP has published shellfish distribution maps that describe shellfish density by species for hard clams, surfclams, mussels, and oysters. The maps have not been updated and in some cases date back to 1984. NJDEP Division of Land Use Regulation regulates these areas as shellfish habitat. **Figure 3.4.5-1** depicts hard clams in Crook Horn Creek/Peck Bay at the BL England onshore ECR crossing.

In 1984, the NJDEP also mapped shellfish and oyster beds in the Great Egg Harbor River. More recent surveys of Great Egg Harbor shellfish beds are not readily available. However, Psuty and Silveira (2009) describe the mixing of fluvial silts and coastal sands as creating soft bottom habitat, optimal for shellfish.

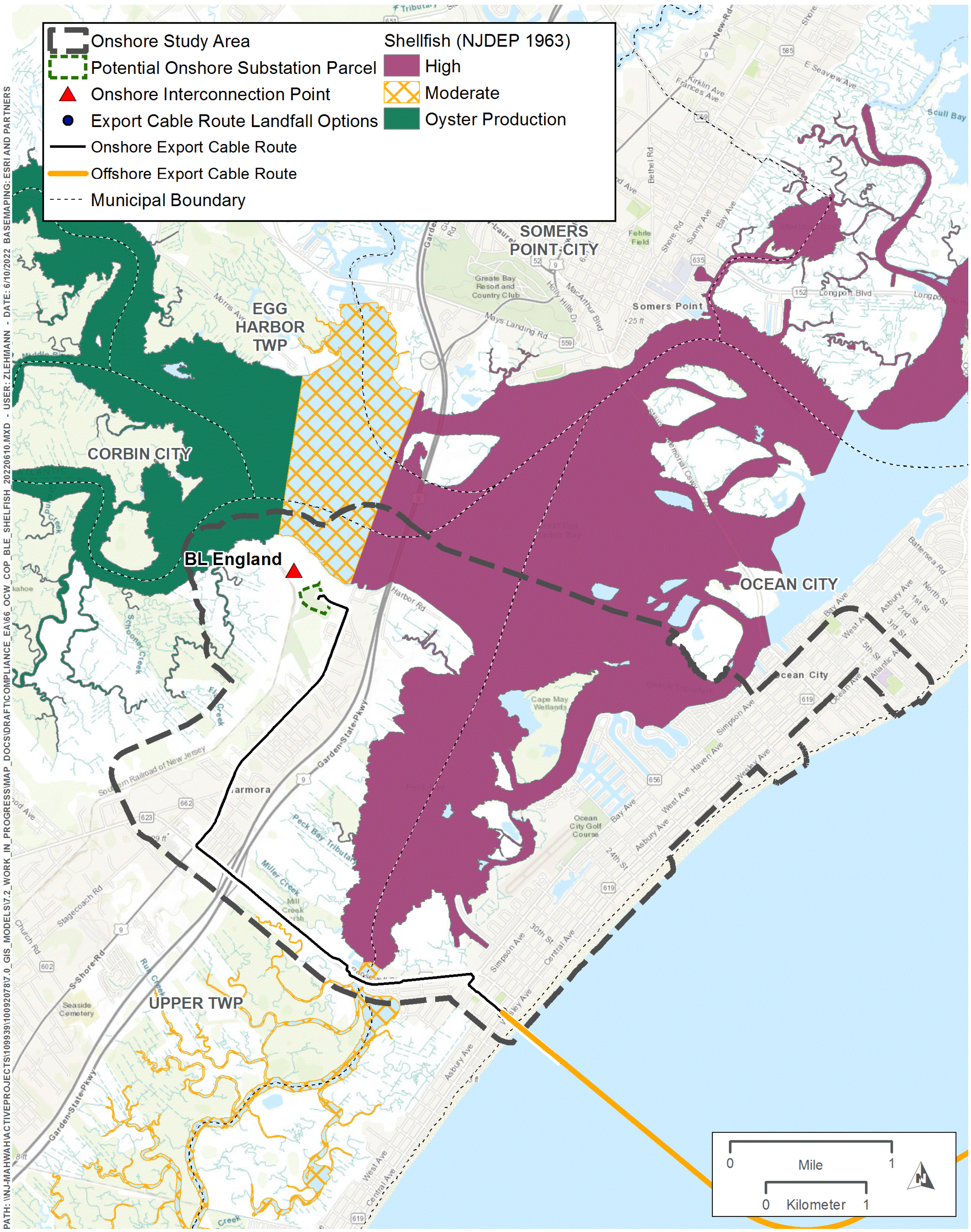


Figure 3.4.5-1. Mapping of Hard Clams by NJDEP in Great Egg Harbor Bay around BL England.

3.4.5.3 Barnegat Bay Shellfish

Benthic communities in back bays such as Barnegat Bay differ from that of the open ocean because these areas are protected from wave action and currents found in the open ocean. Reduced wave and current action influence substrate sediment type, which, along with other environmental factors such as water quality, dictate benthic communities. The Mid-Atlantic Ocean Data Portal and the Nature Conservancy(Greene *et al.* 2010) have characterized species, habitats, and ecosystems of the Barnegat Bay estuary. According to these sources, the majority of the benthic habitat within Barnegat Bay is made up of very fine (0.002 - 0.005 in) (0.06 - 0.125 mm) and fine (0.005-0.010) (0.125 - 0.25 mm) sands at depths of less than 32.8 ft (10 m).

Taghon *et al.* (2017) studied the benthic community of Barnegat Bay using Van Veen grab samples that were analyzed to the lowest practical taxonomic unit (species in most cases). The benthic surveys were conductedin 2012, 2013 and 2014. During each survey, 97 stations were randomly selected in Barnegat Bay - Little Egg Harbor estuary. Taghon *et al.* (2017) found that benthic invertebrates were abundant, and the community was, in general, highly diverse. Spatial variability based on sediment size was observed. These data were then compared, where possible, to historical data collected from 1965 to 2010 and show few changes in abundance and species composition. A list of species collected can be found below in **Table 3.4.5-2**.

Table 3.4.5-2. Benthic species identified in Barnegat Bay.

Species	Taxonomic Class
Acteocina canaliculata	Gastropoda
Ameritella agilis	Bivalvia
Ampelisca spp.	Malacostraca
Astyris lunata	Gastropoda
Bittiolum alternatum	Gastropoda
Clymenella torquate	Polychaeta
Cyathura polita	Malacostraca
Elasmopus levis	Malacostraca
Glycera americana	Polychaeta
Glycera dibranchiate	Polychaeta
Goniadidae	Polychaeta
Microdeutopus gryllotalpa	Malacostraca
Mulinia lateralis	Bivalvia
Pectinaria gouldii	Polychaeta
Sabaco elongatus	Polychaeta
Turbonilla interrupta	Gastropoda

Source: Taghon et. al., 2017

The coastal/inland bays were mapped as part of the Distribution of Shellfish Resources in Relation to the New Jersey Intracoastal Waterway (U.S. Department of the Interior, 1963). Mapping is on the state website and has Barnegat Bay mapped as high and moderate commercial value near the Oyster Creek facilities. NJDEP conducts a shellfish inventory program which collects data on the distribution and abundance of shellfish species. This robust dataset includes data on New Jersey coastal bays from 1983. Shellfish abundance varies based on water quality, hydrodynamics and large storm events such as Hurricane Sandy. NJDEP has published shellfish distribution maps that describe shellfish density by species for hard clams, surfclams, mussels, and oysters. The maps have not been updated and in some cases date back to 1984. NJDEP Division of Land Use Regulation regulates these areas as shellfish habitat. The NJDEP updated the 1985/86 Barnegat Bay stock assessment by conducting a new survey in Barnegat Bay in 2012 to assess the impact of storm events (Hurricane Sandy) on the species distribution and abundance. The NJDEP mapped the hard clam

(*Mercenaria mercenaria*) distribution as "moderate" in the portions of Barnegat Bay around Oyster Creek and Forked River. Overall, results indicated a significant decrease in hard clam abundance when compared to abundance of the 1985/86 survey. Hurricane Sandy was not found to have a significant effect on hard clam abundance. **Figure 3.4.5-2** depicts shellfish habitat in Barnegat Bay around Oyster Creek.

Versar (2008) conducted a comprehensive analysis of surfclam data collected by NJDEP over a 19-year period from 1988 to 2006. This data shows variable densities over the years but tended to show higher densities closer to Manasquan Inlet and Barnegat Inlet (**Figure 3.4.5-3**). From a historical perspective, some areas between Manasquan Inlet and Barnegat Inlet showed densities that were relatively high (>5.7 bushels/100m^2).

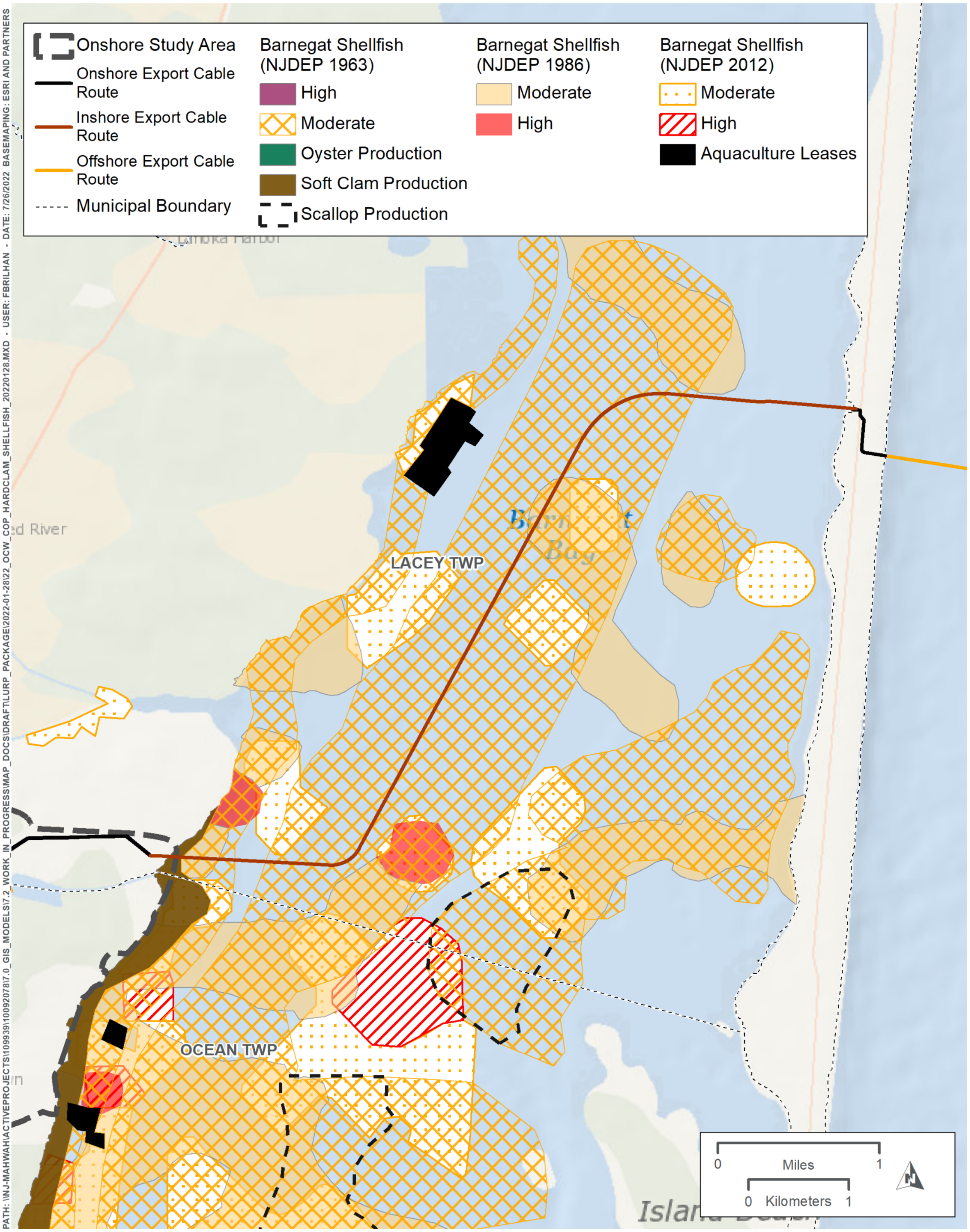


Figure 3.4.5-2. Shellfish Habitat Mapping by NJDEP in Barnegat Bay around Oyster Creek.

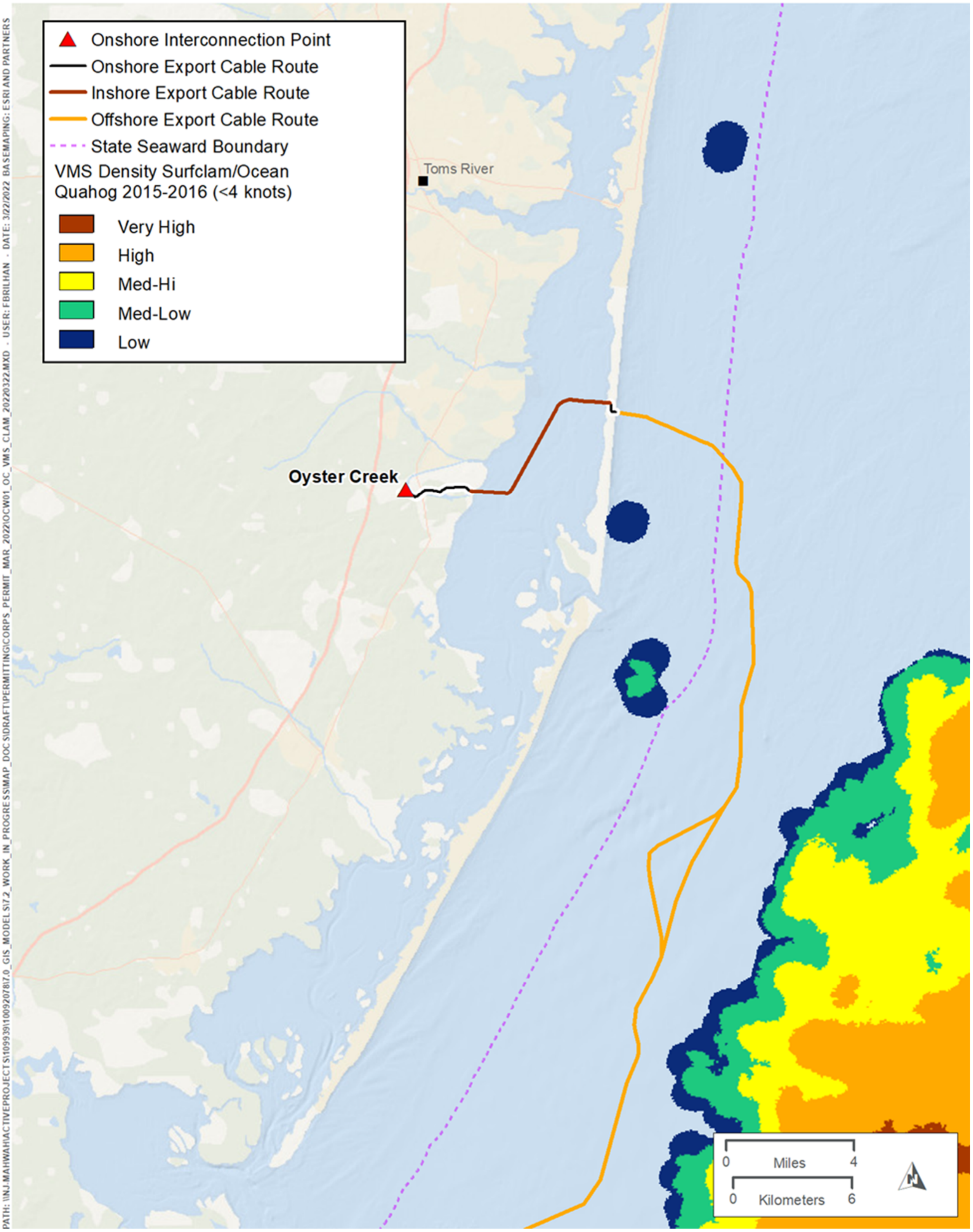


Figure 3.4.5-3. NMFS VMS data - surfclam/ocean quahog (<4 knots) commercial fishing density (Source: MARCO n.d.) (left – 2015-2016; right – 2012-2014).

A summary of shellfish potentially found in Barnegat Bay and other coastal estuaries in New Jersey is provided in **Table 3.4.5-3**.

Table 3.4.5-3. Typical Barnegat Bay shellfish.

Common name	Scientific name
Bivalves	
Hard clam or northern quahog	*Mercenaria mercenaria*
Soft shell clam	*Mya arenaria*
Atlantic jackknife clam or razor clam	*Ensis directus*
Sout tagelus	*Tagelus plebeius*
Ark clam	*Arcidae* sp.
Atlantic surfclam	*Spisula solidissima*
Little surfclam or dwarf surfclam	*Mulinia lateralis*
Eastern oyster	*Crassostrea virginica*
Blue mussel	*Mytilus edulis*
Atlantic ribbed mussel	*Geukensia demissa*
Bay scallops	*Aequipecten irradians*
Crustaceans	
Blue Crab	*Callinectes sapidus*
Black-fingered mud crab	*Panoeius herbstii*
Green crab	*Carcinus maenas*
Rock crab	*Cancer irroratus*
Common spider crab	*Libinia emarginata*
Lady crab	*Ovalipes ocellatus*
Chinese mitten crab	*Eriocheir sinensis*
Marsh fiddler crab	*Uca pugnax*
Atlantic sand crab	*Emerita talpoida*
Ghost crab	*Ocypode quadrata*
Long-armed hermit crab	*Pagurus lonicarpus*
Daggerblade grass shrimp	*Palaemonetes pugio*
Sand shrimp	*Crangon septemspinosa*
American lobster	*Hormarus americanus*
Bay barnacle	*Balanus improvisus*
Mollusks	
Mud dog whelk / Eastern mud snail	*Llyassoma obsolete*
Northern moon snail	*Euspira heros*
Atlantic moon snail	*Polinices duplicatus*
Atlantic oyster drill	*Urosalpinx cinerea*
Atlantic slipper shell	*Credpidula fornicate*
Gastropods	
Knobbed whelk	*Busycon carica*
Channelled whelk	*Busycotypus canaliculatus*

Source: Barnegat Bay Shellfish 2013

3.4.5.4 Submerged Aquatic Vegetation

SAV along the New Jersey coast has been studied by various public and private entities over the last 40 years. The coastal areas south of Little Egg Harbor have been less extensively studied. The NJDEP has mapped SAV habitat along the New Jersey coast from Sandy Hook to Cape May. The majority of this mapping took place from 1979 to 1987, with a 2011 update to Little Egg Harbor Bay (NJDEP 2018a; **Figure 3.4.5-4**). Submerged vegetation habitat is regulated as a special area under N.J.A.C. 7:7-9.6 and consists of water areas supporting or documented as previously supporting rooted, submerged vascular plants such as widgeon grass (*Ruppia maritime)* and eel grass (*Zostera marina*). NJDEP stipulates that historical SAV areas must be considered current SAV habitat and are subject to NJDEP regulation.

3.4.5.4.1 BL England

In fall of 2019 Ocean Wind 1 conducted aerial SAV mapping surveys in Great Egg Harbor, including the area that the onshore ECR will cross at Crook Horn Creek/Peck Bay. The survey was conducted to incorporate methodologies from previous studies (Lathrop and Haag 2011) and existing agency guidelines (Colarusso and Verkade 2016) with the main goal to inform project design and quantify potential areas of impacts. The survey was conducted via aerial photography in October 2019 over the proposed inshore ECR in Great Egg Harbor. The proposed Project route does not cross into the Great Egg Harbor other than HDD that will occur at the Crook Horn Creek/Peck Bay crossing at Roosevelt Boulevard Bridge. Therefore, the SAV survey was limited to a Phase 1 survey.

3.4.5.4.2 Oyster Creek

SAV serves several functions in estuarine ecosystems in New Jersey like that of Barnegat Bay. SAV provides a substantial amount of primary production for the Barnegat Bay estuary, and serves as critically important spawning, nursery, and feeding habitat for benthic and finfish communities. SAV also stabilizes the benthic habitat by attenuating waves and currents and minimizing substrate erosion. In the coastal waters and back bays of New Jersey, SAV species diversity peaks in the late spring and is highly dependent on solar radiation and water temperature. Dominant vascular and algal species within Barnegat Bay include *Ulva lactuca, Gracilaria tikvahiae, Codium fragile, Zostera marina, Ceramium fastigiatum,* and *Agardhiella subulata* (Kennish *et al.* 2001).

Additional research has been conducted that can supplement NJDEP data and provide an updated map of SAV habitat particularly in Barnegat Bay. Lathrop *et al.* (2004) and Lathrop and Haag (2011) extensively studied the locations of seagrasses in Barnegat Bay. The study compares past SAV distribution maps (Good *et al.* 1978, Macomber and Allen 1979, and McLain and McHale 1997) to current findings and indicates drastic declines in SAV coverage within the Barnegat Bay and around Oyster Creek over a period of 25 years. Lathrop's findings note an approximately 60 percent decline in seagrass density from 2003 to 2009 based on the use of aerial imaging to assess seagrass habitat in Barnegat Bay. Boat based surveys were also conducted and incorporated into the dataset for the 2009 study. Habitat maps were created based on the two survey years, showing the changes in seagrass biomass between the two years. Lathrop (2001) incorporated several mapped studies of SAV in Barnegat Bay from the 1960s to 1990s to create a prediction model for the distribution of future seagrass habitat throughout the Bay. In 2009, Rutgers University conducted aerial mapping studies of the seagrasses in Barnegat Bay (Lathrop and Haag 2011; **Figure 3.4.5-5**).

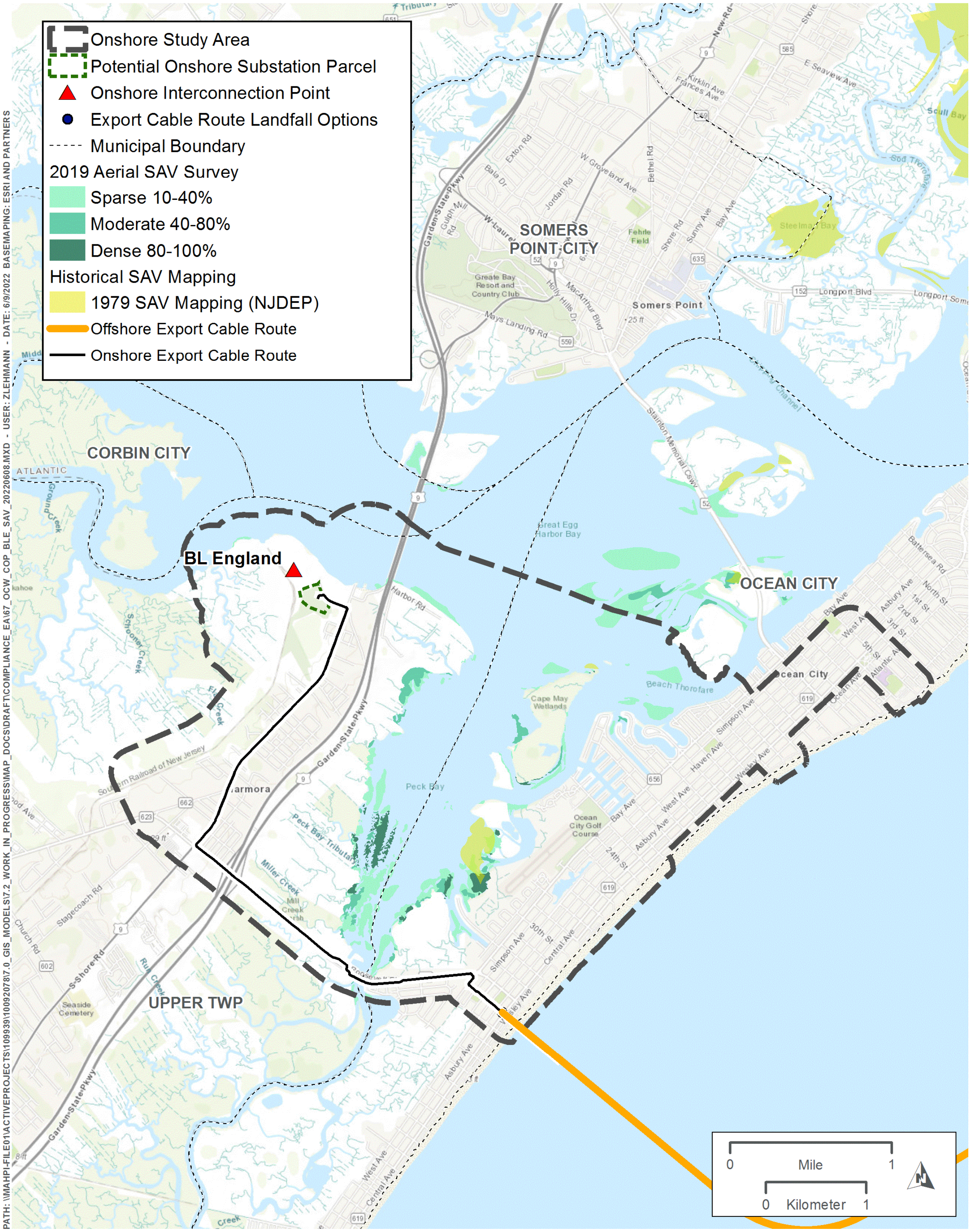


Figure 3.4.5-4. Aerial SAV mapping by NJDEP (1979 and 1985) and Ocean Wind 1 (2019) in Great Egg Harbor around BL England.

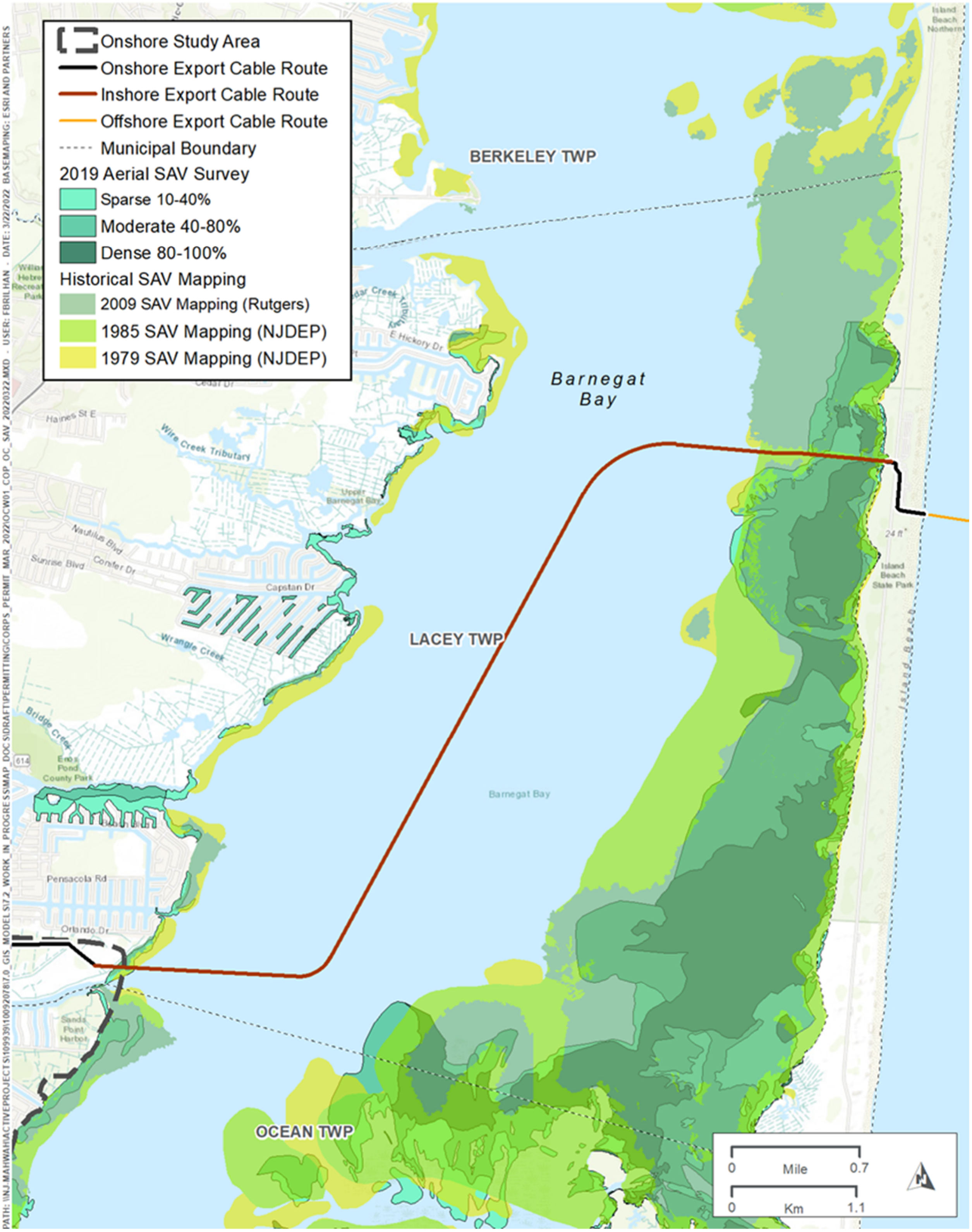


Figure 3.4.5-5. Aerial SAV mapping by Rutgers (Lathrop and Haag 2011), NJDEP (1979 and 1985), and Ocean Wind 1 (2019) in Barnegat Bay around Oyster Creek.

In fall of 2019 Ocean Wind 1 conducted aerial SAV mapping surveys in Barnegat Bay. The survey was conducted to incorporate methodologies from previous studies (Lathrop and Haag 2011) and existing agency guidelines (Colarusso and Verkade 2016) with the main goal to inform project design and quantify potential areas of impacts. The survey was conducted via aerial photography in October 2019 over the proposed inshore ECR in Barnegat Bay. The areas of SAV documented in the Phase 1 Survey were used to inform the more intensive Phase 2 Survey effort in the Oyster Creek area (Appendix L).

A Phase 2 in-water drop camera SAV survey was conducted in October 2020 and included a field reconnaissance of Barnegat Bay where sea bottom disturbance is anticipated to occur. The Phase 2 SAV survey was conducted to identify the presence, extent, density, and species composition of SAV beds within the proposed ECRs at potential landfall locations. The inshore reconnaissance area surveyed in 2020 included transects parallel to the shoreline as well as 164 ft (50 m) on either side of the indicative cable routes (Appendix L). Survey protocols were coordinated with NJDEP, BOEM and NMFS. SAV was documented in 41.7 percent of the survey locations. Of the three potential landfall areas on the western shoreline of the bay, the Holtec Property had the lowest percent cover of SAV, with SAV present at only a single survey station close to the shoreline. Based on review of the photographs collected during the field survey and the SAV samples collected, observed SAV consisted almost entirely of eelgrass (*Zostera marina*) with the exception of a single location at the Holtec Property which contained widgeon grass (*Ruppia maritima*). A second Phase 2 SAV survey was conducted in October 2021 in a prior channel on the western side of IBSP. This channel became the proposed cable alignment route to limit SAV disturbance. Survey locations included the center of the channel, shallow flats adjacent to the channel, and the channel edge. SAV presence was limited to the adjacent flats and on the channel edge, with SAV species consisting of both widgeon grass and eel grass. No species of SAV were identified within the center of the channel. This channel is now the proposed cable alignment route to limit SAV disturbance. Results of the SAV aerial survey conducted in 2019 are shown on **Figure 3.4.5-5.**

Additional surveys are ongoing to assess SAV at the landfalls and associated approaches within Barnegat Bay. Ocean Wind 1 anticipates conducting two separate pre-construction SAV surveys and several post-construction surveys. Below is a general description of the SAV surveys Ocean Wind 1 anticipates conducting to fully characterize baseline SAV conditions, detect any impacts, and monitor recovery.

- SAV delineation: The first SAV survey (planned for this summer, 2022) will involve in-water video collection to further refine the delineations of the SAV beds near the Project areas (2019 aerial imagery) (Tier 1 in the Colarusso and Verkade 2016 guidelines). The aim of this underwater imagery survey will be to document percent cover of SAV, species identification (likely all eel grass), and delineate the edges of the SAV beds in relation to the current Project design options. The results of this survey will inform the final Project design to avoid and minimize impacts to SAV (e.g., confirmation of the final alignment on the western side of the Bay, establishing designated anchoring/mooring locations for construction vessels).
- SAV characterization: Within six months before cable installation begins (within the growing season), a focused pre-construction SAV survey will be conducted to characterize the SAV condition (e.g., shoot density, etc.) within the established potential area of impact associated with the project. This survey will be repeated immediately post construction and annually to document any impacts to SAV resulting from the Project and to monitor recovery.

3.4.6 Threatened and Endangered Species

Species protection under the federal ESA and the New Jersey ENSP, and their habitats potentially impacted by construction and operation of the proposed Project were evaluated. Ocean Wind 1 conducted site- and species-specific endangered species habitat surveys to determine the location and extent of these resources so they can be avoided or mitigated during construction, operations and maintenance. Readily available data was also reviewed to identify threatened or endangered species that may occur within the workspace for the Project. The Project site specific habitat assessment surveys were conducted and coordinated with NJDEP, USFWS, USACE and NOAA.

Threatened and endangered species information is provided by the USFWS Information for Planning and Consultation (IPaC) and the New Jersey Natural Heritage Program Landscape Project database. These databases generate lists of federally and state protected species potentially occurring within a particular area. Species identified using these tools are outlined in **Table 3.4.6-1**. IPAC and National Heritage Program (NHP) responses are included in Appendix F.

3.4.6.1 Terrestrial Threatened and Endangered Species

Federal and state endangered and threatened wildlife species with potential to occur within the onshore Project Area are listed in **Table 3.4.6-1** and **3.4.6-2** below.

HDR's certified bog turtle surveyor conducted a bog turtle (*Clemys muhlenbergii*) site survey on April 29, 2021, in the BL England area. No bog turtles were identified. Appendix G provides the signed certification in accordance with N.J.A.C. 7:7A Appendix C and D.

In addition to those listed species in **Table 3.4.6-1** and **3.4.6-2** below, special concern species of birds, reptiles, amphibians, mammals, and invertebrates are also monitored by the NJDEP. Special concern species that could potentially occur in the onshore areas include, but are not limited to, spotted turtle (*Clemmys guttata*), the eastern box turtle (*Terrapene carolina carolina)* and the bird species listed in **Table 3.4.6-3**. Additionally, the monarch butterfly (*Donaus plexippus plexippus)* has been listed as a candidate species by the USFWS and has the potential to occur within the Project Area.

Table 3.4.6-1. Federal and state endangered and threatened species with potential to occur within the BL England Project Area.

Species Common	Species Scientific	Status
Mammals		
Northern long-eared bat	*Myotis septentrionalis*	FT
Birds		
Bald eagle	*Haliaeetus leucocephalus*	SE
Barred owl	*Strix varia*	ST
Cattle egret	*Bubulcus ibis*	ST
Osprey	*Pandion haliaetus*	ST
Black skimmer	*Rynchops niger*	SE
Black-crowned night heron	*Nycticorax nycticorax*	ST
Eastern black rail	*Laterallus jamaicensis*	FT, SE
Least tern	*Sternula antillarum*	SE
Northern harrier	*Circus cyaneus*	SE
Peregrine falcon	*Falco peregrinus*	SE
Piping plover	*Charadrius melodus*	FT, SE

Species Common	Species Scientific	Status
Red knot	*Calidris canutus rufa*	FT, SE
Yellow-crowned night heron	*Nyctanassa violacea*	ST
Fish		
Atlantic sturgeon	*Acipenser oxyrinchus*	FE, SE

Status: FT - Federally Threatened, FE - Federally Endangered, SE - State Endangered, ST - State Threatened

Table 3.4.6-2. Federal and state endangered and threatened species with potential to occur within the Oyster Creek Project Area.

Species Common	Species Scientific	Status
Mammals		
Bobcat	*Lynx rufus*	SE
Northern long-eared bat	*Myotis septentrionalis*	FT
Birds		
Bald eagle	*Haliaeetus leucocephalus*	SE
Barred owl	*Strix varia*	ST
Eastern black rail	*Laterallus jamaicensis*	FT, SE
Osprey	*Pandion haliaetus*	ST
Black skimmer	*Rynchops niger*	SE
Black-crowned night heron	*Nycticorax nycticorax*	ST
Grasshopper sparrow	*Ammodramus savannarum*	ST
Least tern	*Sternula antillarum*	SE
Northern harrier	*Circus cyaneus*	SE
Peregrine falcon	*Falco peregrinus*	SE
Red knot	*Calidris canutus rufa*	FT, SE
Roseate tern	*Sterna dougallii dougallii*	FE, SE
Yellow-crowned night heron	*Nyctanassa violacea*	ST
Reptiles		
Northern pine snake	*Pituophis melanoleucus melanoleucus*	ST
Timber rattlesnake	*Crotalus horridus horridus*	SE
Amphibians		
Pine barrens treefrog	*Hyla andersonii*	ST

Status: FT - Federally Threatened, FE - Federally Endangered, SE - State Endangered, ST - State Threatened

As part of the South Jersey Regional Rail Study (Gannett Fleming 2002), field surveys were conducted along a corridor beginning from Mays Landing to Atlantic City to determine the absence or presence of habitat suitable for rare, threatened, and/or endangered species based on USFWS and NJDEP Natural Heritage Program's county lists. It was determined that the following federally protected species could have suitable habitat within the Oyster Creek Project Area: swamp pink (*Helonias bullata*), Knieskern's beaked-rush (*Rhynchospora knieskernii*), American chaffseed (*Schwalbea Americana*), sensitive joint-vetch (*Aeschynomene virginica*), and bog turtle (*Clemys muhlenbergii*). The following state protected species could have suitable habitat within the

Project Areas: red milkweed (*Asclepias rubra*), wood turtle (*Clemmys insculpta*), rare skipper (*Problema bulenta*), and northern pine snake.

Species-specific site surveys for swamp pink and Knieskern's beaked rush have been conducted in coordination with USFWS in areas of potentially suitable habitat. No specimens of either species were observed, and Project facilities have been sited to minimize impacts to potentially sensitive habitats for these vegetation species (Appendix G).

The coastal habitats on the barrier island/peninsula include a Natural Heritage Priority Site (i.e., Island Beach Macrosite) and support populations of state-listed endangered and species of concern plant species. Seaside sandplant (*Honckenya peploides var. robusta*), sea-beach knotweed (*Polygonum glaucum*), seabeach sedge (*Carex silicea*), and sickle-leaf golden-aster (*Pityopsis falcate*) are known to be present at IBSP.

In addition to those listed species in **Table 3.4.6-2**, special concern species of birds, reptiles, amphibians, mammals, and invertebrates are also monitored by the NJDEP. Terrestrial special concern species that could potentially occur in these areas include but are not limited to spotted turtle (*Clemmys guttata*), the eastern box turtle (*Terrapene carolina carolina),* and bird species in **Table 3.4.6-3**. Additionally, the monarch butterfly (*Donaus plexippus plexippus)* has been listed as a candidate species by the USFWS and has the potential to occur within the Project Areas.

3.4.6.1.1 Northern Long-eared Bat

The northern long-eared bat (NLEB) is an insectivorous bat that hibernates in caves, mines, and other locations (possibly talus slopes) in winter and spends the remainder of the year in forested habitats. The species' range includes most of the eastern and mid-western United States and southern Canada. Due to impacts from the fungal disease white-nose syndrome, the species has declined by 90-100 percent in most locations where the disease has occurred, and declines are expected to continue as white-nose syndrome spreads throughout the remainder of the species' range (USFWS 2016). As a result, the northern long-eared bat was listed as Threatened under the ESA in 2015 with a 4(d) rule. In the areas of the country affected by white nose syndrome, the 4(d) rule prohibits incidental take that may occur from tree removal activities within 150 ft of a known occupied maternity roost during the pup season (June 1 through July 31) or within 0.25 mile of a hibernation site, year-round (USFWS 2016). The USFWS Information for Planning and Consultation (IPAC) report does not indicate any hibernaculum within 0.25 mile or maternity roosts within 150 ft of the Project. No timing restrictions are currently required for projects located >0.25 mile from a NLEB hibernaculum and >150 ft from a known maternity roost. The onshore export cable corridors are not likely to provide suitable foraging or roosting habitat due to existing levels of disturbance.

3.4.6.1.2 Bobcat

The bobcat is a medium sized cat that is typically found in coniferous and mixed forests in the north (NJDFW 2021a). They create dens in thick vegetation, under root masses or in rock crevices and prey on mice, rabbits, squirrels, turkeys and songbirds. Bobcats occur in all 48 contiguous states except Delaware. Deforestation and development in the late 19th and early 20th Century led to its decline in the northeast, and it was listed as endangered in New Jersey in 1991. Sightings in northern New Jersey have increased since 1991, due in part to the release of bobcats there that were captured in Maine, but very few sightings have been reported in central and southern New Jersey (NJDFW 2021a). Northwestern New Jersey is less densely developed than coastal New Jersey, and includes extensive forested habitats, wetlands, agricultural lands and rocky outcrops and cliffs, which likely contributes to the establishment of bobcat populations in that part of New Jersey (Matos 2020). Roads have been shown to be a major barrier to bobcat movement (Tigas et al.; Lyren 2001; Riley et al. 2003; Riley 2006). Habitat loss and fragmentation, changes in land use, barriers to movement and auto collisions likely limit the species spread currently (NJDFW 2021a). In addition, collared bobcats have been caught in traps used by licensed trappers (Matos 2020). No signs of bobcat were noted during field surveys. While the Oyster Creek workspace includes some undeveloped forested areas, it is surrounded by dense development and is separated by highways from undeveloped areas to the west. Further, the Project Area contains dirt bike trails that are impacted by ATV use between Oyster Creek and the tributary east of Route 9, which would deter bobcats from the area.

3.4.6.1.3 Bird Species

Tables 3.4.6-3 and 3.4.6-4 list birds identified through the USFWS IPaC database and NHP response that are neither New Jersey nor federally listed as endangered or threatened but are identified as state Special Concern (SC) or federal Birds of Conservation Concern (BCC) that have the potential to pass through the Project Areas. These species are assessed in the bird and bat risk assessment in Appendix G. For species listed under the ESA and the Bald and Golden Eagle Protection Act, exposure was assessed individually.

Table 3.4.6-3. State and federal listed birds that have the potential to pass through the BL England Project Area.

Common Name	Scientific Name	NJ Status*	Federal Status*
American Oystercatcher	*Haematopus palliates*	SC - Breeding + Non-breeding	BCC
Snowy Egret	*Egretta thula*	SC – Breeding	BCC
Great Blue Heron	*Ardea herodias*	SC – Breeding	-
Tricolored Heron	*Egretta tricolor*	SC - Breeding + Non-breeding	-
Little Blue Heron	*Egretta caerulea*	SC - Breeding + Non-breeding	-
Glossy Ibis	*Plegadis falcinellus*	SC – Breeding	-
Wood Thrush**	*Hylocichla mustelina*	SC – Breeding	BCC
Common Tern	*Sterna hirundo*	SC – Breeding	-
Gull-billed Tern	*Gelochelidon nilotica*	SC - Breeding + Non-breeding	BCC

Source: NJDEP 2012 and USFWS IPaC database (USFWS 2021).

* E = Endangered, T = Threatened, SC = Special Concern, BCC = Birds of Conservation Concern

** Bird species included because they are within 1 mile of Riparian Zone Width Determination. Birds without this notation were provided as on-site or in the vicinity (within ¼ mile) in NHP response 12/2021.

Table 3.4.6-4. State and federal listed birds that have the potential to pass through the Oyster Creek Project Area.

Common Name	Scientific Name	NJ Status*	Federal Status*
American Oystercatcher	*Haematopus palliates*	SC - Breeding + Non-breeding	BCC
Cooper's Hawk	*Accipiter cooperii*	SC - Breeding	-
Snowy Egret	*Egretta thula*	SC - Breeding	BCC
Tricolored Heron	*Egretta tricolor*	SC - Breeding + Non-breeding	-
Little Blue Heron	*Egretta caerulea*	SC - Breeding + Non-breeding	-
Glossy Ibis	*Plegadis falcinellus*	SC - Breeding	-

Common Name	Scientific Name	NJ Status*	Federal Status*
Black-throated Blue Warbler**	*Dendroica caerulescens*	SC - Breeding	-
Black-throated Green Warbler**	*Dendroica virens*	SC - Breeding	-
Northern Parula**	*Parula americana*	SC - Breeding	-
Worm-eating Warbler**	*Helmitheros vermivorum*	SC - Breeding	BCC
Wood Thrush**	*Hylocichla mustelina*	SC - Breeding	BCC
Veery**	*Catharus fuscescens*	SC - Breeding	-
Common Tern	*Sterna hirundo*	SC - Breeding	-
Gull-billed Tern	*Gelochelidon nilotica*	SC - Breeding + Non-breeding	BCC

Source: NJDEP 2012 and USFWS IPaC database (USFWS 2021).

* E = Endangered, T = Threatened, SC = Special Concern, BCC = Birds of Conservation Concern

** Bird species included because they are within 1 mile of Riparian Zone Width Determination. Birds without this notation were provided as on-site or in the vicinity (within ¼ mile) in NHP response 12/2021.

3.4.6.1.4 Northern Pine Snake

No northern pine snakes were observed during the site surveys. Beans and Niles state “Pine snakes in New Jersey require dry pine-oak forest types growing on very infertile sandy soils.” Northern Pine snake nearly always occupy dry upland forests dominated by pines and require forest openings, with level, well-drained sandy soils and little shrub cover for nesting and hibernation sites (CWFNJ 2021a). This habitat type is limited on the site to open or weakly vegetated areas between Oyster Creek and the Oyster Creek tributary. The majority of the soils found in the Oyster Creek Project Area consist of saturated, poorly-drained soils with fragmented sandy soil habitat that would not be preferable for the Northern pine snake. Further, the Project site contains dirt bike trails that are impacted by ATV use between Oyster Creek and the tributary east of Route 9, which has been documented as having harmful effects on Northern pine snakes (CWFNJ 2021a). Northern pine snake would likely preferentially use undeveloped portions of Ocean County to the west rather than the Oyster Creek Project site.

3.4.6.1.5 Timber Rattlesnake

In New Jersey, timber rattlesnakes are found in the mountainous portions of Warren, Sussex Passaic, Morris and Bergen County. In southern New Jersey they are found in the Pinelands region and nearby portions of Cumberland, Ocean, Burlington and Atlantic Counties. In southern New Jersey, populations are typically found in habitat consisting of pitch pine, short-leaf pine (*Pinus echinata*), scrub oak (*Quercus ilicifolia*), blackjack oak (*Quercus marilandica*) and blueberry (*Vaccinium* spp.) (NJDFW 2021b). Timber rattlesnakes typically den along streams in white cedar swamps, using crevices of tree roots to access underground cavities just about the groundwater line (CWFNJ 2021b). Threats to timber rattlesnake include illegal collecting, development causing habitat loss, and habitat disturbance. The timber rattlesnake was listed as an endangered species in New Jersey in 1979 (NJDFW 2021b). No timber rattlesnakes were observed during site surveys. Potential timber rattlesnake den habitat is limited to the Atlantic white cedar swamp south of Oyster Creek and east of Route 9. This habitat is small and fragmented from development along Bay Parkway and Route 9. Timber rattlesnake would likely preferentially use undeveloped portions of Ocean County to the west rather than the Oyster Creek Project site.

3.4.6.1.6 Pine Barrens Treefrog

No Pine Barrens treefrogs were observed or heard during the site survey. Beans and Niles state "Structural characteristics of preferred habitats include an open canopy, a dense shrub layer, and heavy ground cover." The Pine Barrens treefrog requires specialized acidic habitats, such as Atlantic white cedar swamps and pitch pine lowlands that are carpeted with dense mats of sphagnum moss. The Pine Barrens treefrog was listed as an endangered species in New Jersey in 1979 due to its restricted range, declining population, habitat loss, and pollution of breeding ponds (CWFNJ 2021c). Pine barrens treefrog would likely preferentially use undeveloped portions of Ocean County to the west rather than the Oyster Creek site for breeding.

3.4.6.2 Threatened and Endangered Fish

Two federally and state-listed endangered fish species may occur off the New Jersey coast: shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus).* A further description of these species is provided below. Additionally, species that are candidates for listing are also listed in **Table 3.4.6-5**.

Table 3.4.6-5. Mid-Atlantic Threatened and Endangered Fish Species.

Species (Scientific Name)	Endangered Species Act Status	New Jersey Status
Shortnose sturgeon (*Acipenser brevirostrum*)	New York Bight distinct population segment (DPS) - FE	SE
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)	New York Bight DPS - FE	SE
Oceanic whitetip shark (*Caracharinus longimanus*)	FT	NL
Giant manta ray (*Manta birostris*)	FT	NL
Alewife (*Alosa pseudoharengus*)	FSC	NL
Blueback herring (*Alosa aestevalis*)	FSC	NL
Cusk (*Brosme brosme*)	FCS	NL

Status: FT - Federally Threatened, FE - Federally Endangered, FSC – Federal Species of Concern, FCS – Federal Candidate Species, SE - State Endangered, NL – Not Listed

3.4.6.2.1 Shortnose Sturgeon

Shortnose sturgeon is an anadromous fish species that migrates far upstream into freshwater rivers to spawn in the spring. Once they mature, males spawn every 1 to 2 years while females spawn every 3 to 5 years. Females can produce up to 200,000 eggs per year. The species spends relatively little time in marine waters, with the majority of their lives being spent in the estuarine waters. When they do enter ocean waters, they generally stay close to shore. Historically, the species was found in coastal rivers along the entire east coast of North America. Because of threats such as habitat degradation, water pollution, dredging, water withdrawals, fishery bycatch and habitat impediments (e.g., dams), the species is now listed as endangered throughout the entire population range. Within the Mid-Atlantic Region, shortnose sturgeon are found in the in the Delaware and Hudson River estuaries (NOAA Fisheries 2018d). Because of preference for estuarine and river habitat, the species is not expected to be found in the Atlantic ECR and unlikely to be found in the estuaries of Barnegat Bay and Great Egg Harbor (offshore export cable corridors) as they are not listed by NOAA Fisheries as one of the 42 ecosystems where they are known to occur (NMFS 2010).

3.4.6.2.2 Atlantic Sturgeon

Atlantic sturgeon is an anadromous fish species that lives in rivers and coastal waters along the entire east coast from Canada to Florida. The species hatches in freshwaters and migrates to the ocean as juveniles.

Once reaching maturity, Atlantic sturgeon migrate back up rivers to spawn in the spring with males spawning almost every year and females every two to three years. Distribution and abundance vary by season as they are found in shallow coastal waters during the summer months and move to deeper waters in winter and early spring (Dunton et al. 2010).

Historically, the species was found in great abundance, but due to overfishing and habitat loss, populations have drastically declined. Other threats include vessel strikes, fishery bycatch, habitat degradation, poor water quality, and habitat impediments. Currently, four distinct population segments (DPSs) are listed as Endangered, including the New York Bight DPS.

On April 6, 2012, NMFS divided U.S. populations of Atlantic sturgeon into five “species” or DPSs. However, based on genetic data and tracking and tagging data, sturgeon from any of these DPSs and Canada can occur anywhere in the geographic range of the subspecies. Eyler et al. (2009) reported that Atlantic sturgeon tagged off New Jersey have been recaptured in Long Island Sound, off Maryland, Delaware, New Hampshire, and North Carolina. Consequently, the sturgeon that occur in the Project Area may represent any of the five DPS of this species.

Atlantic sturgeon have been captured in several sampling programs off the New Jersey coast (Dunton et al. 2010, Erickson et al. 2011, Eyler et al. 2009, Stein et al. 2004). Dunton et al. (2010) analyzed data from surveys covering the northwest Atlantic Ocean from Cape Hatteras (North Carolina) to the Gulf of Maine conducted by five agencies. The catch per unit of effort (CPUE) for Atlantic sturgeon off New Jersey, from New York Harbor south to the entrance of Delaware Bay (Delaware), was second only to CPUE from the entrance of New York harbor to Montauk Point (New York). Supplemental information on Atlantic sturgeon is contained in Appendix G.

3.4.6.2.3 Oceanic Whitetip Shark

The oceanic whitetip shark can be found throughout the world’s oceans in tropical and sub-tropical waters. The species is generally found on the Outer Continental Shelf (OCS) and around oceanic islands in water depths greater than 600 ft. They are most commonly found near the surface in waters above 68°F (20°C). The shark is considered a top predator and is opportunistic, feeding on bony fishes and cephalopods, such as squid, sportfish, seabirds, other sharks and rays, and marine mammals. The long-lived species can survive for up to 36 years, maturing between 6 and 9 years of age, depending on geographic location. Evidence suggests that this species is experiencing a decline in abundance across the world due to bycatch in pelagic longlines, purse seines and gillnets along with harvest for international trade (NOAA Fisheries 2019b). The species would be unlikely to be found in the Project Area as water depths are too shallow to accommodate the life history requirements. Therefore, this species is not discussed further.

3.4.6.2.4 Giant Manta Ray

The giant manta ray is the world’s largest ray and can be found worldwide in tropical, subtropical, and temperate waters in the United States as far north as New Jersey during summer months. Giant manta rays are commonly found along the U.S. East Coast in waters between 66.2 and 71.6°F (19 and 22°C). The species is a filter feeder that feeds on zooplankton. Migration occurs throughout the East Coast waters following these zooplankton, along with tidal patterns, seasonal upwellings, seawater temperature, and possibly mating behavior. They are slow-growing, long-lived, and have the lowest fecundity of all elasmobranchs, typically giving birth to only one pup every two to three years. While the species has been documented to live up to 40 years, little is known about their growth and development. The species has seen its populations decline across the globe due to commercial fishing as both a targeted species and as bycatch. The rays are also valued for their gill rakers, which are traded internationally (NOAA Fisheries 2019a). The species would be unlikely to occur within the Project Area as water temperatures are likely at the lower range of its tolerance. Additionally, the rays frequently feed in waters at depths of 656 to 1,312 ft (200 to 400 m) (NOAA Fisheries 2019a), depths much greater than waters found within the Project Area. Therefore, this species is not discussed further.

3.4.6.2.5 Alewife

Alewife is an anadromous fish species native to the Atlantic coast and its tributaries that migrate from the ocean to freshwater to spawn. The species may spend its entire life in fresh water. Alewife begin spawning when water temperatures reach 51°F and females produce 60,000 to 350,000 eggs that hatch within 3-6 days (USFWS 2018c). Juveniles remain in tidal freshwater nursery areas in spring and early summer and move downstream to more saline waters in the fall (Atlantic States Marine Fisheries Commission [ASMFC] 2018). Alewife populations have seen declines throughout much of their range due to blocked access to spawning grounds and habitat degradation caused by dams and culverts (NOAA Fisheries 2018a). Alewife is a species of concern throughout its entire range under the ESA. In August 2017, a status review for alewife was initiated by NOAA Fisheries to determine if listing alewife under the ESA as endangered or threatened is necessary. However, on June 19, 2019, NOAA Fisheries issued a determination that listing under the ESA was not warranted. Therefore, they are no longer a candidate species for ESA, but they remain a species of concern.

3.4.6.2.6 Blueback Herring

Blueback herring is an anadromous species native to the east coast of North America, with a range from the lower parts of Cape Breton Rivers in Nova Scotia, Canada, and south to the St. John's River in Florida. Spawning occurs in fast moving, shallow water in the main stem of river tributaries. Juveniles normally remain in the same watershed throughout the summer and fall and then migrate to sea once waters reach a lower temperature (ASMFC 2018). Blueback herring have experienced population declines due to habitat impediments such as dams; habitat degradation and loss; and commercial and recreational fishing (NOAA Fisheries 2018b). Blueback herring is a species of concern throughout its entire range under the ESA. In August 2017, a status review for blueback herring was initiated by NOAA Fisheries to determine if listing blueback herring under the ESA as endangered or threatened is necessary. However, on June 19, 2019 NOAA issued a determination that listing under the ESA was not warranted. Therefore, they are no longer a candidate species for ESA, but they remain a species of concern.

3.4.6.2.7 Cusk

Cusk is a deep, cooler water species found in rocky, hard bottom areas to a depth of approximately 328 ft (100 m). The general range of cusk is from the northwest Atlantic Ocean from New Jersey to the Strait of Belle Isle in Canada. They are occasionally found on mud bottoms but rarely on smooth, clean sand (Dultz 2013). Cusk spawn in spring and early summer, with females releasing up to 2 million eggs. The planktonic young remain in coastal, shallow water environments until they reach a length of about 2 inches (50 mm) and then become benthic. Cusk is a relatively slow-growing and late-maturing species, reaching a maximum age greater than 14 years. Because this species has nearly identical habitats with Atlantic cod, cusk becomes an accidental bycatch and subsequently consumed (Dultz 2013). Decreases in landings and size of fish caught likely indicate a decline in population. In March 2007, a status review for cusk was initiated by NOAA Fisheries to determine if listing cusk under the ESA as endangered or threatened is necessary (NOAA Fisheries 2018c). Cusk is currently still listed as a candidate species throughout its entire range under the ESA.

3.4.6.3 Threatened and Endangered Marine Mammals

Five of the marine mammals known or expected to occur off the coast of New Jersey are listed as endangered pursuant to the Federal Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*): blue, fin, North Atlantic right, sei, and sperm whales. These five species are also listed as endangered under the New Jersey Division of Fish and Wildlife's ENSP. In addition, the humpback whale is listed as endangered under the ENSP, although the population of humpbacks that occurs off the coast of New Jersey was de-listed at the federal level under the ESA in 2016 (81 FR 62259).

3.4.6.3.1 Blue Whale

The distribution of blue whales (*Balaenoptera musculus*) in the Western North Atlantic generally extends from the Arctic to at least mid-latitude waters (see **Table 3.4.4-1** for summary data on the species' stock designation(s), best population estimate, MMPA status, ESA status, critical habitat designations, occurrence in the Project Area and vicinity, and seasonal occurrence). Although blue whales are sighted frequently off eastern Canada, most notably in the Gulf of St. Lawrence, some data suggest that blue whales rarely visit the U.S. Atlantic Exclusive Economic Zone (EEZ) (Waring *et al.* 2011, CetMap 2018). However, a PAM study in the New York Bight funded by the New York State Department of Environmental Conservation reported that blue whales were present about 20 nm southeast of the entrance to New York Harbor in late winter and early spring (Muirhead *et al.* 2018). No blue whales were observed in the Project Area during the EBS or AMAPPS, but recent sightings of blue whales off the coast of Virginia include a vessel sighting of a juvenile in April 2018 (Engelhaupt *et al.* 2019), and a sighting of an adult whale made in February 2019 during a systematic aerial survey (Cotter 2019). The aerial sighting was recorded in deep waters beyond the shelf break, but the vessel sighting was over the shelf near the 50-m isobath. Both sightings are considered extremely rare and constitute the southernmost sightings of blue whales off the U.S. east coast in the U.S. EEZ. Nevertheless, this assessment assumes blue whales could occur in the Project Area. There have been no recorded strandings of blue whales in New Jersey since 2008 (Hayes *et al.* 2020; Henry *et al*. 2020).

3.4.6.3.2 Fin Whale

Fin whales (*Balaenoptera physalus*) are common in the U.S. Atlantic EEZ waters, from Cape Hatteras, North Carolina northward (see **Table 3.4.4-1** for summary data on the species' stock designation(s), best population estimate, MMPA status, ESA status, critical habitat designations, occurrence in the Project Area and vicinity, and seasonal occurrence). While they prefer deeper waters of the continental shelf (300 to 600 ft [91 to 183 m]), they are regularly observed anywhere from coastal to abyssal areas (Hayes *et al.* 2020).

Fin whales were observed during all seasons of the EBS. The EBS results indicate that the nearshore waters off New Jersey serve as nursery habitat because of the occurrence of a cow-calf pair. The EBS estimated a year-round abundance of two individuals offshore of New Jersey (NJDEP 2010b) (**Table 3.4.4-1**). Fin whales were observed in the WEAs in the fall 2012 aerial, spring 2013 aerial, spring 2014 aerial, spring and summer 2017 aerial, winter 2018 aerial, and summer 2016 shipboard AMAPPS surveys (NEFSC & SEFSC 2012, 2013, 2014, 2016, 2018, 2019). Fin whales were recorded in the Project Area during the summer 2017 HRG survey (Alpine 2017b) and during the Geotechnical 1A Survey in winter 2017-2018 (Smultea Environmental Sciences 2018). For the New Jersey WEA, seasonal estimates calculated for fin whales showed low numbers during the spring, summer and fall, with peaks in cooler months (Palka *et al.* 2017) (**Table 3.4.4-1**).

In addition, 10 fin whales are reported to have stranded along the New Jersey coast from 2008-2017 (Hayes *et al.* 2020; Henry *et al.* 2020). Of these 10 whale strandings, 9 were determined to be the result of vessel strikes, with the remaining individual being ruled an entanglement.

3.4.6.3.3 North Atlantic Right Whale

NARWs (*Eubalaena glacialis*) are known to occur off the coast of New Jersey (NJDEP 2010b; (see **Table 3.4.4-1** for summary data on the species' stock designation(s), best population estimate, MMPA status, ESA status, critical habitat designations, occurrence in the Project Area and vicinity, and seasonal occurrence; see **Figure 3.4.6-1** for sightings data). During the EBS surveys, NARWs were observed (i.e., detected visually or acoustically) in every season (NJDEP 2010b). Feeding behavior was recorded, as was the presence of a cow−calf pair, suggesting that near shore waters off New Jersey serve as feeding and nursery habitat. Initial sightings of females, and subsequent confirmations of these same individuals in calving grounds, illustrate that these waters are part of the species' migratory corridor (Whitt *et al.* 2013). NARWs may use the waters off New Jersey for short periods of time as they migrate and/or follow prey movements, or they may remain in the area for extended periods of time.

NARWs were observed in the spring 2014 aerial, the winter/spring 2015 aerial, the spring 2019 aerial AMAPPS surveys (NEFSC & SEFSC 2014, 2015, 2020). A single NARW occurred in the Project Area during the Geotechnical 1A Survey in winter 2017-2018 (Smultea Environmental Sciences 2018), but no NARWs were observed during the Ocean Wind 1 Offshore Wind Farm Survey in summer 2017 in the Project vicinity (Alpine 2017b). Three NARW sightings within the Project Area were reported between 13 and 14 December 2018 (NOAA Right Whale Sighting and Advisory System 2019).

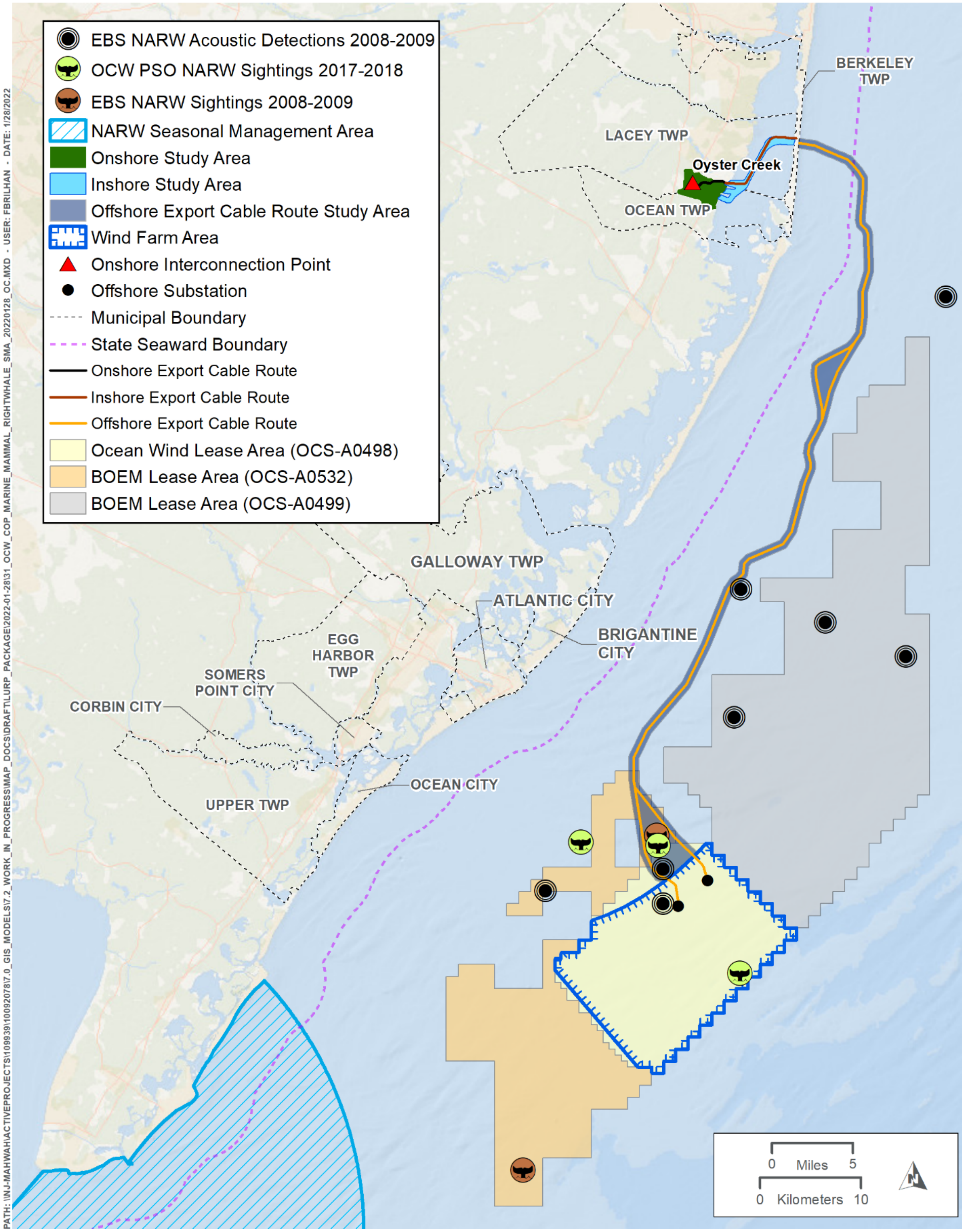


Figure 3.4.6-1. Sightings, acoustic detections, and Seasonal Management Areas for North Atlantic right whales in relation to the Project Area.

Notes: EBS = Ecological Baseline Studies (NJDEP 2010b); OCW PSO = Ocean Wind 1 Protected Species Observer reports (Smultea Environmental Sciences 2018; NOAA Right Whale Sighting and Advisory System 2019).

A 2008 study reported that between 2002 and 2006, NARWs in the western Atlantic were subject to the highest proportion of entanglements (25 of 145 confirmed events) and vessel strikes (16 of 43 confirmed occurrences) of any marine mammal studied (Glass *et al.* 2008). Bycatch of NARWs has also been reported in pelagic drift gillnet operations by the Northeast Fisheries Observer Program; however, no mortalities have been reported (Glass *et al.* 2008). From 2013 through 2017, the minimum rate of annual human-caused mortality and serious injury to this species from fishing entanglements averaged 6.85 per year, while vessel strikes averaged 1.3 whales per year (Hayes *et al.* 2020). Environmental fluctuations and anthropogenic disturbance may be contributing to a decline in overall health of individual NARWs that has been occurring for the last 3 decades (Rolland *et al.* 2016).

To mitigate the potential for vessel strikes, in 2008 NMFS designated certain nearshore waters of the Mid-Atlantic Bight (within a 20 nm radius of ports and bays) as Mid-Atlantic U.S. Seasonal Management Areas (SMAs) for NARWs (73 FR 60173). NMFS requires that all vessels 65 ft (19.8 m) or longer must travel at 10 nm/hr or less within the SMAs from November 1 through April 30 when NARWs are most likely to pass through these waters. An SMA is in place for this species at the entrance of the Delaware Bay between November 1 and April 30 (**Figure 3.4.6-1).**

3.4.6.3.4 Sei Whale

Sei whales (*Balaenoptera borealis*) occur in every ocean except the Arctic Ocean (see **Table 3.4.4-1** for summary data on the species' stock designation(s), best population estimate, MMPA status, ESA status, critical habitat designations, occurrence in the Project Area and vicinity, and seasonal occurrence). Sei whales are often associated with deeper waters and areas along the continental shelf edge (Hain et al. 1985); however, this general offshore pattern of sei whale distribution is disrupted during occasional incursions into more shallow and inshore waters (Waring et al. 2004).

In the western Atlantic Ocean, sei whales occur from Labrador to Nova Scotia in the summer months and migrate south to Florida, the Gulf of Mexico, and the northern Caribbean (Mead 1977, Gambell 1985).

Sei whales are most common on Georges Bank and into the Gulf of Maine and the Bay of Fundy during spring and summer, primarily in deeper waters. There are occasional influxes of sei whales further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy.

Sei whales are occasionally killed in collisions with vessels. Of three sei whales that stranded along the Atlantic Coast of the U.S. between 1975 and 1996, two showed evidence of collisions with ships (Laist et al. 2001). Between 1999 and 2005, there were three reports of sei whales being struck by vessels along the Atlantic Coast of the U.S. and the Maritime Provinces of Canada (Cole et al. 2005, Nelson et al. 2007). Two of these vessel strikes were reported as having resulted in the death of the sei whale.

Sei whales are unlikely to be encountered in the Project Area, although small numbers have been documented there during the spring and summer months (Hayes et al. 2020). No sei whales were recorded during EBS surveys (NJDEP 2010b). This species is encountered closer to shore during years when oceanographic conditions force planktonic prey, such as copepods and euphausiids, to shelf and inshore waters (Payne et al. 1990). There have been no recorded strandings of sei whales in New Jersey since 2008 (Henry et al. 2020); however, in summer of 2017, a sei whale carcass was found on a bow of a ship in the Hudson River, Newark, New Jersey (Hayes et al. 2020).

3.4.6.3.5 Sperm Whale

Sperm whales (*Physeter macrocephalus*) occur in every ocean except the Arctic Ocean (see **Table 3.4.4-1** for summary data on the species' stock designation(s), best population estimate, MMPA status, ESA status, critical habitat designations, occurrence in the Project Area and vicinity, and seasonal occurrence). In the western

Atlantic Ocean, sperm whales are distributed in a distinct seasonal cycle, concentrated east-northeast of Cape Hatteras in winter and shifting northward in spring when whales are found throughout the Mid-Atlantic Bight. Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the Mid-Atlantic Bight.

Sperm whales have a strong preference for the 3,281 ft (1,000 m) depth contour and seaward. While deep water is their typical habitat, sperm whales have been observed near Long Island, New York, in water between 135 and180 ft (41-55 m; Scott and Sadove 1997). When they are found relatively close to shore, sperm whales are usually associated with sharp increases in bottom depth where upwelling occurs and biological production is high, implying the presence of a good food supply (Clarke 1956).

Sperm whales are very unlikely to be encountered in state waters. During the summer 2017 AMAPPS aerial survey, a sperm whale was documented in the waters off New Jersey, in the deeper portion of the shelf edge (NFFSC & SEFSC 2018). There have been no recorded strandings of sperm whales in New Jersey since 2008 (Henry *et al*. 2020).

3.4.6.3.6 Humpback Whale

Humpback whales (*Megaptera novaeangliae*) were observed during all seasons of the EBS. Based on feeding behavior and cow-calf pairs observed off New Jersey, waters of the Project Area may support feeding and nursery habitat as well as a migratory pathway. Abundance estimates generated from the EBS surveys predict a year-round abundance of one humpback off the coast of New Jersey (NJDEP 2010b). Humpback whales were also observed during the spring and fall AMAPPS aerial survey (NEFSC & SEFSC 2013, 2016, 2018, 2019, 2020). A single humpback whale was recorded during the Ocean Wind 1 Offshore Wind Farm Survey in summer 2017 in the Project vicinity (Alpine 2017b) and one individual occurred during the Geotechnical 1A Survey in winter 2017-2018 (Smultea Environmental Sciences 2018). Seasonal estimates for humpback whales showed low numbers during the spring, summer and fall in the New Jersey WEA (Palka *et al.* 2017). Humpback whales are found year-round off New Jersey, with peak numbers in cooler months (fall to winter) (Geo-Marine 2010a, 2010b, Palka *et al.* 2017).

A UME (UME Number 63) for humpback whales was declared in January 2016. Since then, 145 humpback whales have stranded between Maine and Florida, with approximately 50 percent due to vessel strike or entanglement (NOAA Fisheries 2021b). Since 2016, there have been 16 humpback strandings off New Jersey (NOAA Fisheries 2021b). Necropsy examinations were conducted on approximately half of the whales, and about 50 percent of those examined had evidence of human interaction, either vessel strike or entanglement (NOAA Fisheries 2021b).

3.4.6.4 Threatened and Endangered Sea Turtles

Five sea turtle species have been reported to occur in the Project Area: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) sea turtles. All of these turtles are listed as endangered or threatened pursuant to the ESA and by the State of New Jersey. Kemp's ridley, leatherback, and loggerhead sea turtles are also listed as endangered under the New Jersey Division of Fish and Wildlife's ENSP.

Although hawksbill sea turtles have been reported from the Project Area and are listed as endangered by the State of New Jersey, they rarely occur north of Florida. They were not observed in NJDEP's Ocean/Wind Power Ecological Baseline Studies (NJDEP 2010b), the AMAPPS study (Palka et al. 2017), or the other baseline data collection studies discussed previously in this document. There are also no records of them having stranded along the New Jersey coast since 1995 (unpublished Marine Mammal Stranding Center [MMSC] data). Based on these data, hawksbill sea turtles are not likely to be exposed to the activities associated with the Project and will not be considered further in this document.

Similarly, the Project Area does not overlap with critical habitat that has been designated for sea turtles. Therefore, critical habitat for sea turtles will not be discussed further in this document.

A number of visual surveys have been completed in and around the Project Area starting in the early 2000s to monitor the occurrence and abundance of sea turtles (NJDEP 2010b [**Figure 3.4.6-2**], Palka *et al.* 2017, NMFS 2017a).

There are no known nesting locations along the coast of New Jersey, other than a few reports of animals coming ashore without successfully nesting. Although sea turtles have been reported in these waters throughout the year, most sea turtles are more likely to occur there from spring through autumn as they migrate through New Jersey waters to foraging areas in the North Atlantic and wintering area near Cape Hatteras (NJDEP 2010b). Therefore, sea turtles that occur in the Project Area would be migrating through the Project Area or foraging in the area.

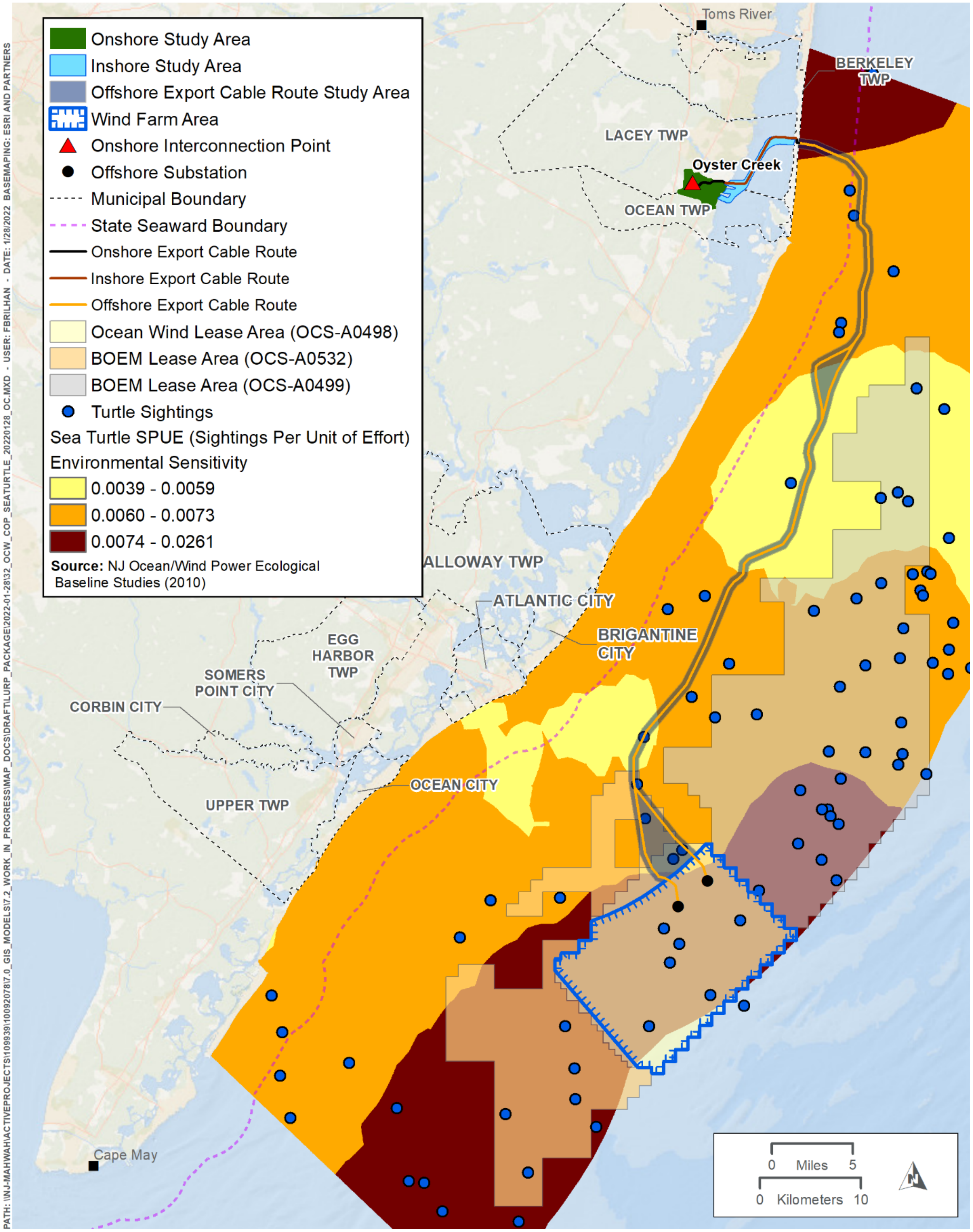


Figure 3.4.6-2. Sea turtle sighting locations and sightings per unit effort (sightings per km), shown in relation to the Project Area, during NJDEP (2010b) surveys conducted from January 2008 through December 2009.

The narratives that follow summarize information necessary to understand patterns of sea turtle occurrence in the Project Area, pre-existing stressors that affect sea turtles in the Project Area, and their status and trends in the Project Area. These narratives also present information on the diving and social behavior of the different sea turtles and their hearing and vocalizations to facilitate evaluation of impacts.

3.4.6.4.1 Green Sea Turtle

Green sea turtles are found in the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea, primarily in tropical or, to a lesser extent, subtropical waters. Green sea turtles in the Project Area belong to the North Atlantic DPS of green sea turtles and listed as threatened (81 FR 20057).

Green sea turtles are generally associated with warmer water masses and appear most frequently in U.S. coastal waters with temperatures exceeding 18°C (Stinson 1984). Because of their association with warm waters, green sea turtles are typically found in New Jersey waters during the summer. Green sea turtles do not nest on beaches in the Project Area. Instead, they forage on marine algae and marine grasses (CWFNJ 2018).

In the western Atlantic Ocean, green turtles are commonly associated with drift lines or surface current convergences which commonly contain floating *Sargassum* capable of providing small turtles with shelter and sufficient buoyancy to raft upon (NMFS and USFWS 1991, 1992). These turtles rest underwater in coral recesses, the underside of ledges, and sand bottom areas that are relatively free of strong currents and disturbance from natural predators and humans.

The MMSC in New Jersey rescued eight green sea turtles between 1995 and 2005 and another 17 between 2013 and 2018. Of the eight green sea turtles rescued between 1995 and 2005, six had evidence of human interactions including with fishing activities, boat strike, and impingement on a power plant grate (Schoelkopf 2006). In 2017 one green sea turtle had evidence of human interactions.

3.4.6.4.2 Kemp's Ridley Sea Turtle

Adult Kemp's ridley turtles are restricted to the Gulf of Mexico in shallow near shore waters, although adult-sized individuals sometimes are found as far north as the Grand Banks and Nova Scotia (Bleakney 1955, Márquez 2001, Watson *et al.* 2004). Adult females rarely leave the Gulf of Mexico and adult males do not migrate. Juveniles feed along the east coast of the United States up to the waters off Cape Cod, Massachusetts (Spotila 2004). A small number of individuals reach European waters (Brongersma 1972, Spotila 2004) and the Mediterranean (Pritchard and Marquez-M. 1973). Kemp's ridley sea turtles were listed as endangered on December 2, 1970 (35 FR 18320). No DPS or subpopulations are currently recognized.

Juvenile Kemp's ridley sea turtles are the second most abundant sea turtle in the mid-Atlantic region from New England, New York, and the Chesapeake Bay, south to coastal areas off North Carolina. Juvenile Kemp's ridley sea turtles migrate into the North Atlantic during May and June and forage for crabs in submerged aquatic vegetation (Keinath *et al*. 1987, Musick and Limpus 1997). In the fall, they migrate south along the coast, forming one of the densest concentrations of Kemp's ridley sea turtles outside of the Gulf of Mexico (Musick and Limpus 1997).

Kemp's ridley turtles forage in a variety of benthic habitat types, including seagrass beds (Byles 1988; Carr and Caldwell 1956), oyster reefs (Schmid 1998), sandy bottoms (Morreale and Standora 1992), mud bottoms (Ogren 1989; Schmid 1998), or complexes of these communities (Ogren 1989; Rudloe *et al*. 1991). In New Jersey, Kemp's ridley sea turtles are typically found in shallow coastal waters in the summer and fall where they forage on mollusks and crustaceans (CWFNJ 2018).

The MMSC in New Jersey rescued 45 Kemp's ridley turtles each year between 1995 and 2005 and another 15 between 2013 and 2018. Of the turtles rescued between 1995 and 2005, 18 percent had become impinged on power plant grates, 4 percent had been struck by boat propellers, and 20 percent showed signs of other impacts (Schoelkopf 2006).

3.4.6.4.3 Leatherback Sea Turtle

Leatherback turtles are found in the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. Leatherback sea turtles are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Morreale *et al.* 1994, Eckert 1998, Eckert 1999). In the North Atlantic Ocean, leatherback turtles regularly occur in deep waters (>328 ft or 100 m) and have been reported in depths ranging from 3 to 13,618 ft, with a median sighting depth of 131.6 ft (CeTAP 1982). They occur in waters ranging from 44.6 °F to 81 °F (7 to 27.2 °C) (CeTAP 1982). They can be found in the coastal waters of New Jersey throughout the year, but primarily in the summer and fall where they forage on soft-bodied animals such as jellyfish and sea squirts (CWFNJ 2018).

Leatherback sea turtles were listed as endangered on December 2, 1970 (35 FR 18320). No DPS or subpopulations are currently recognized although the NMFS and USFWS have been petitioned to list leatherback turtles in the Northwest Atlantic as a DPS.

The MMSC in New Jersey rescued 177 leatherback turtles between 1995 and 2005 and another 10 between 2013 and 2018. Of the turtles rescued in this time interval, 14 percent had been struck by boat propellers, 8 percent had an interaction with fishery equipment, and 2 percent had been struck by a boat (Schoelkopf 2006).

3.4.6.4.4 Loggerhead Sea Turtle

Loggerhead sea turtles are found in tropical and temperate regions of the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. Loggerhead turtles in the Project Area belong to the North Atlantic DPS of loggerhead turtles and are listed as threatened (76 FR 58868;).

Loggerhead turtles commonly occur throughout the inner continental shelf from Florida through Cape Cod (Massachusetts). However, there is a seasonal pattern to their occurrence: they tend to be associated with water masses with surface temperatures between 44.6° and 86°F (7 ° and 30 °C) with a stronger association with temperatures of about 51.8 °F (11 °C) (Shoop and Kenney 1992, Epperly *et al.* 1995, Braun and Epperly 1996). Aerial surveys conducted over the continental shelf reported loggerheads at water depths of 72 to 161 ft (22 to 49 m) (Shoop and Kenney 1992).

Using geostatistical mixed effects models, Winton *et al*. (2018) estimated the distribution and density of satellite-tagged loggerhead turtles in shelf waters along the U.S. Atlantic coast and found that predicted spatial distribution of tagged loggerheads was concentrated in the region of central Florida to New Jersey. From May to September, predicted densities of tagged turtles were highest in the shelf waters from Maryland to New Jersey, and from November to April, the highest densities occurred on the shelf off Cape Hatteras, North Carolina.

The MMSC in New Jersey rescued an average of 47 loggerhead turtles each year between 1995 and 2005 and another 138 between 2013 and 2018. Of the loggerhead turtles rescued between 1995 and 2005, 16 percent had been struck by propellers, 3.9 percent had evidence of boat collisions, and 3.7 percent had evidence of fisheries interactions (Schoelkopf 2006).

3.5 Contaminated Sites

Ocean Wind 1 will adhere to the rules and regulations of the NJDEP Site Remediation Program (SRP) as a Linear Construction Project (LCP) with an assigned Licensed Site Remediation Professional (LSRP). The substations will not be managed as an LCP and will follow the SRP guidelines under the direction of an LSRP if contamination is encountered during construction activities. During the construction activities, contaminated materials will be handled in accordance with the Sediment Sampling and Analysis Plan (SSAP), Materials Handling Plan (MHP), Materials Management Plan (MMP) and in accordance with applicable regulations at N.J.A.C. 7:26C and N.J.A.C. 7:26E. The LSRP will be retained, and appropriate documents prepared by the contractor prior to the start of construction.

3.5.1 BL England

3.5.1.1 Block 479 Lot 76

The proposed location of the BL England Substation is identified as an NJDEP Deed Notice Area under program interest (PI) number 011645. It has groundwater known to be contaminated with VOCs, base/neutrals (BN), metals and total petroleum hydrocarbons (TPH). It has a groundwater contamination area classification exception area (CEA) for a well restriction area and depth to 100 ft below ground surface for benzene, lead, chromium, arsenic, metals and BNs. It is enrolled in the NJDEP SRP with an LSRP assigned to the case. The current status, per NJDEP Dataminer, is the site is under remedial action.

3.5.1.2 Historic Fill

Per the NJDEP Historic Fill Material Technical Guidance, historic fill is material generally deposited to raise the topographic elevation of the site, which was contaminated prior to emplacement and was used extensively throughout the state, particularly along industrialized waterfront areas in northeastern and southwestern New Jersey. Portions of the Project Area are mapped historic fill. Specifically, from 35th Street, Bay Avenue, and Roosevelt Boulevard, stopping east of the Waterview Boulevard turnaround are mapped as historic fill. Contaminated sites within the BL England area are shown in **Figure 3.5.1-1**.

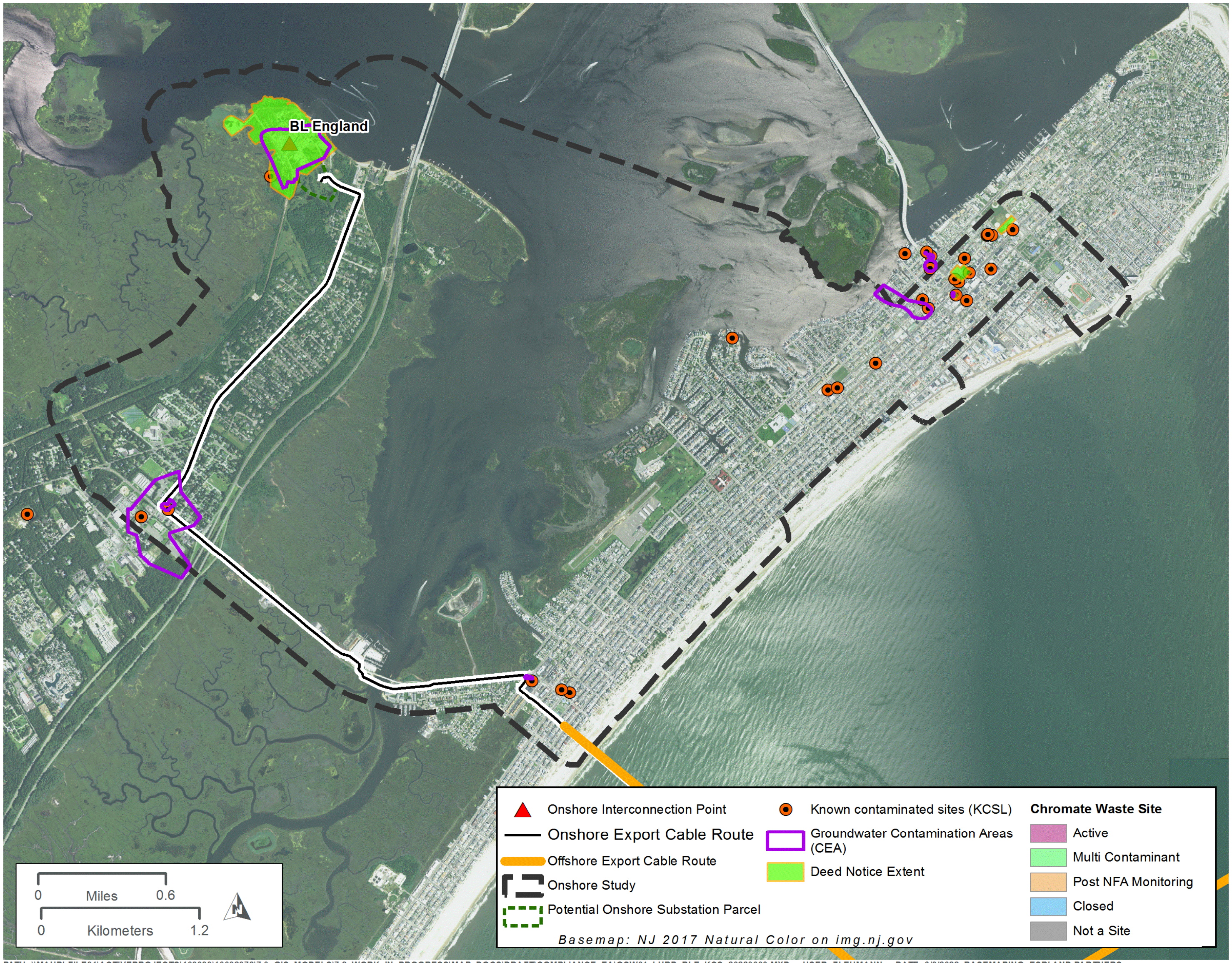


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Figure 3.5.1-1. Contaminated sites within the BL England Area.

3.5.2 Oyster Creek

3.5.2.1 Exelon Generation Co. LLC. Oyster Creek Gas Site

The proposed location of the Oyster Creek Substation is identified as an NJDEP groundwater CEA with the PI number 004306, for groundwater contaminated with trichloroethane (TCE), tetrachloroethene (PCE), and BNs. The well restriction depth is 90.00 ft below ground surface. It is enrolled in the NJDEP SRP with an LSRP assigned to the case. The current status, per NJDEP Dataminer, is the site is under remedial action.

3.5.2.2 Forked River Site

Block 1001, lot 4.06 is known as the Forked River Site. It is an active SRP LSRP site. The site is under the timeframe for the Remedial Action Report (RAR) and has multi-media contamination including groundwater. Contaminated sites within the Oyster Creek area are shown in **Figure 3.5.1-2**.

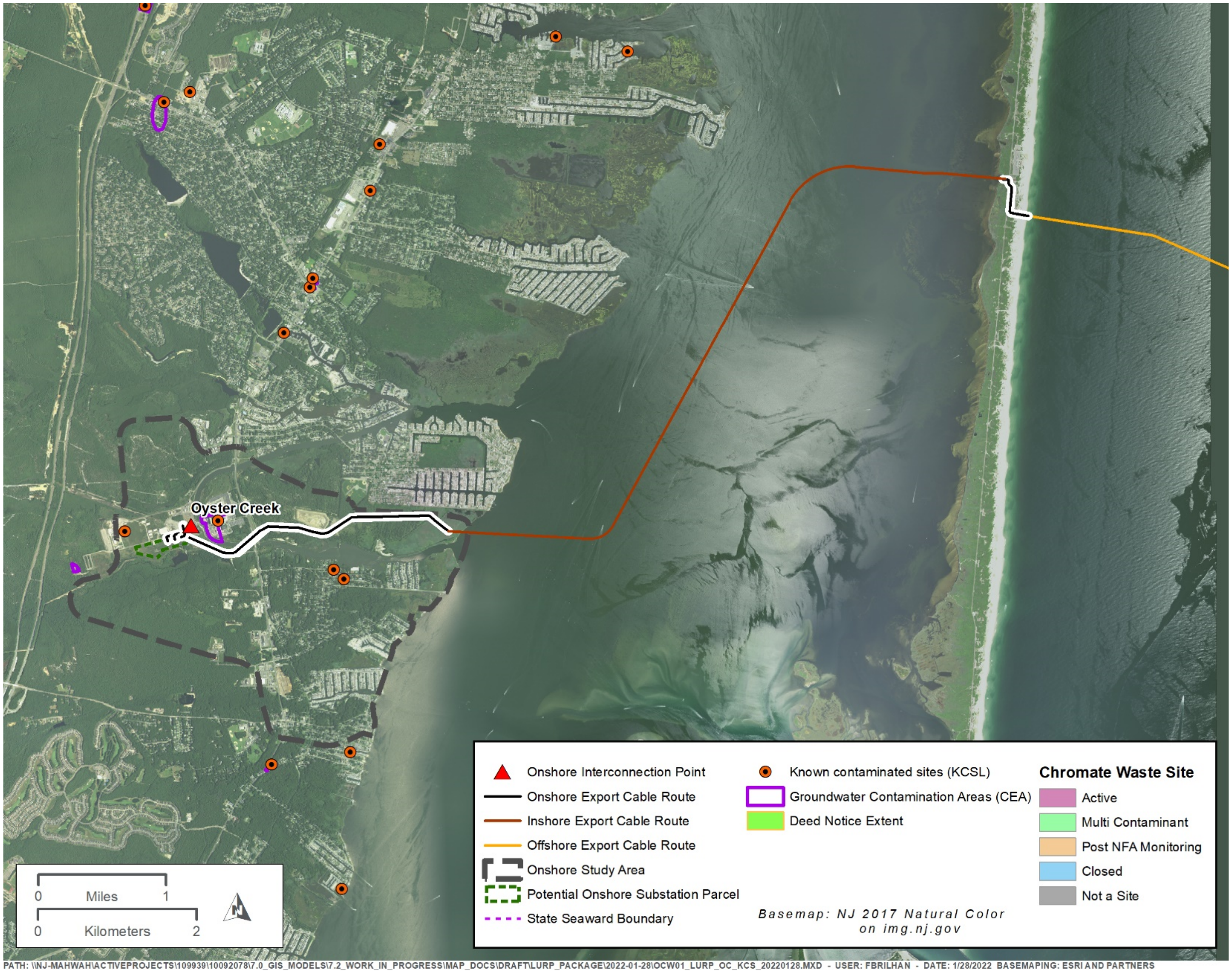

Figure 3.5.1-2. Contaminated sites within the Oyster Creek area.

3.6 Historic and Cultural Resources

Cultural resources include archaeological sites, historic structures, and districts, and traditional cultural properties that represent important aspects of prehistory or history, or that have important and long-standing cultural associations with established communities or social groups. Significant archaeological and architectural properties are generally defined by the eligibility criteria for listing in the National Register of Historic Places (NRHP). BOEM is the lead agency for Section 106 consultation and is coordinating with NJSHPO.

Previous desktop reviews, cultural resource reconnaissance studies, and environmental assessments have determined that some portions of the Project Area have a high potential to contain cultural, historical, and archaeological resources (TRC Environmental Corporation 2012). Expectations of the high potential are due to the natural environment, geologic timeline, sea-level trends, and history of southern New Jersey and its offshore region.

3.6.1 Maritime Archaeology

Ocean Wind 1 conducted HRG within the Preliminary Area of Potential Effect (PAPE) between 2018 and 2020 and collected data following BOEM archaeological survey guidelines and the Project's QMA data transfer protocol. Comprehensive cultural and historical contexts were developed from background research to support archaeological interpretation of HRG survey data. The Project's offshore PAPE was analyzed and assessed by the Qualified Marine Archaeologist (QMA) in accordance with BOEM regulations and guidance. The results are provided in the Marine Archaeological Resource Assessment in detailed in Appendix N.

The QMA's assessment includes an analysis of potential cultural resources sitting on top of the seafloor, as well as partially or fully buried items. The QMA also assessed buried geomorphic features of archaeological interest that could represent paleolandscapes with traditional religious and cultural importance. It also includes a literature review and background research in order to understand the environmental and cultural contexts of the region and to determine the potential for undiscovered archaeological sites within the PAPE. Additionally, the QMA analysis includes a full marine archaeological resources assessment, utilizing data from HRG survey campaigns, including multibeam echosounder, side scan sonar, sub-bottom profiler, magnetometer, and geotechnical investigation data.

The marine archaeological resources assessment of the HRG data within the PAPE in state waters identified three potential submerged cultural resources (Targets 12, 13, and 14) within the gradiometer, side-scan sonar, and/or multibeam echosounder datasets along the BL England offshore ECR corridor and none along the Oyster Creek offshore ECR corridor. Three targets consist of magnetic anomalies that share characteristics with verified shipwreck magnetic signatures and, therefore, may represent a buried shipwreck source. Two are in close proximity to reported shipwrecks (Targets 12 and 13). The QMA recommends avoidance of these targets by a distance of 50 m (164 ft) from the outer edge of magnetic anomalies. HRG data analysis did not identify any geomorphic features of archaeological interest within the PAPE in state waters (Marine Archaeological Resources Assessment in Appendix N).

3.6.2 Terrestrial Archaeology

Phase 1a and 1b archaeological surveys were conducted within the onshore PAPE along the cable routes and at the substations and interconnection line locations. The onshore PAPE has been previously disturbed from construction activities, sites do not appear to retain integrity and no intact archaeological resources likely remain. No further onshore archaeological work is recommended for the Project unless project boundaries change (Terrestrial Archaeological Resources Assessment in Appendix N).

3.6.3 Architectural History

Background research, reconnaissance architectural surveys of the cable route, intensive survey, and visual effects analysis have been completed for all historic properties within the PAPE (included in Appendix N). Publicly available geospatial data was collected to identify historic resources aged 45 years or older potentially impacted by the Project. Infrastructure in New Jersey was reviewed under two different methods depending on the potential permanent visibility of the infrastructure. Onshore infrastructure associated with the Project includes buried cables, construction of new substations, and overhead grid connections connecting the new substations with the existing grid. Areas with planned aboveground infrastructure (substations) were given individual visual PAPEs, and any historic resources within the PAPE aged 45 years or older were intensively surveyed and evaluated for NRHP-eligibility. Eligible or listed properties within the PAPE were evaluated for visual effects from the Project. The proposed onshore and offshore cables will be buried in existing streets and utility corridors and below the seabed. Because the buried cables will pose no permanent visual effects intensive surveys were not conducted along cable routes. Additional information is provided in Appendix N.

4. Evaluation of Potential Environmental Impacts

The following section evaluates the potential impacts of the proposed Project on resources under the NJDEP's regulatory jurisdiction. Potential Impacts will vary based on the proposed activity and project phase. Project phases are described below. Potential impacts are described by resource based on these phases along with duration, extent and overall significance.

Cable operation during the life of the Project could result in impacts related to EMF. EMF occurs naturally in the ocean, with the primary source being the geomagnetic field of the earth. Shielding of cables eliminates electric fields; magnetic fields cannot be shielded. The flow of seawater through the Earth's magnetic field creates a weak electric field, which is called an induced electric field (Slater et al. 2010). Species most likely to experience impacts from the cable EMF would be benthic and demersal fish and invertebrates.

Construction impacts as described below relate to both pre-construction preparation activities and any activities related to construction of the Project. A number of site preparation activities may be necessary along the offshore ECR prior to the start of construction including pre-construction surveys, UXO and MEC risk mitigation, boulder clearance, pre-lay grapnel run, and sandwave clearance. Construction of the Project in New Jersey waters includes installation of offshore export cables and onshore facilities include landfall facilities, onshore export cables, substations, and grid connections.

Operations and Maintenance impacts as described below are based on the reasonably foreseeable planning and unplanned maintenance activities for the Project's offshore and onshore components. The Project is anticipated to have an operational life of 35 years. Maintenance activities will include both preventative and corrective maintenance. Preventative maintenance will be undertaken in accordance with scheduled services whereas corrective maintenance covers unexpected repairs or emergency repairs, component replacements, retrofit programs and breakdowns.

Decommissioning impacts would be related to the dismantling, removal, and "reverse installation", and disposal of the onshore and offshore project components. Activities in New Jersey at the time of decommissioning will include removal or abandoning of offshore and onshore export cables and associated onshore infrastructure. The decommissioning activities will be according to the best practices and regulations at the time of decommissioning. It is anticipated that potential impacts associated with decommissioning would be similar to those during construction, but in reverse, so decommissioning is not discussed separately for each resource below.

4.1 Sediment and Soils

The following section describes the potential impacts on sediment and soils from the construction and operation and maintenance phases of the Project for the onshore and offshore components in New Jersey. Impacts may include physical disturbance to the seabed and land surface, sediment suspension, erosion and sedimentation.

Permanent impacts would result from placement of facilities/structures on soils. Onshore, the substation facilities are expected to result in permanent impacts to soils from building foundations, equipment placement, parking, permanent access, fencing and landscaping. No permanent impacts are anticipated on the seabed. Temporary impacts would result from sediment and soil removal or displacement and re-suspension. Impacts to geological resources would be minimized with the application of APMs.

4.1.1 Construction and Installation

4.1.1.1 Offshore Export Cables

Installation of offshore export cables would be conducted using jet-assisted cable plow. Impacts to sediment are limited to the cable corridor and are associated with resuspension of sediments, direct removal of sediments via dredging (in Barnegat Bay and at the HDD exit pits in the Atlantic Ocean -see Section 2 of the application), pre-lay grapnel run, vessel anchoring and potential sandwave leveling, if required.

For the offshore export cable corridors sediments resuspended in the Atlantic Ocean during trenching would settle quickly to the seabed within the trench. Potential plumes would be limited to right above the seabed and not within the water column. Plume concentrations greater than 10 mg/l would be short in duration (up to 6 hours) and limited to within approximately 164 to 656 ft (50 to 200 m) of the center of the trench in these offshore areas (Vineyard Wind 2018, Tetra Tech 2012, BOEM 2015).

Temporary Impacts to sediment from vessels include spudding, anchoring, and sweeping from anchor chains. The extent of impacts will vary based on the number and type of vessels. Resuspension of sediments will be localized and temporary.

For the Oyster Creek area, no sandwave levelling is proposed at this time. However, if sandwaves are present at the time of construction, levelling using controlled flow excavation (CFE) may be required. Levelling impacts would include a temporary localized change in seabed topography and localized sediment resuspension and deposition. Due to the coarse-grained sediment type, sediment resuspension and deposition would be localized and short-term. These activities would not permanently impact or change hydrodynamics or sediment movement in the area. No sand wave leveling is expected for BL England.

4.1.1.1.1 Landfall

The proposed cable installation technology at the 35th Street landfall in Ocean City, at IBSP, and the Holtec Property landfalls is HDD. HDD installation would avoid impacts to surface sediments including those in the dunes and beaches.

Prior to cable pull through, conduits will be installed via HDD for the landfalls made via HDD. During HDD, a sediment mix including drilling mud (i.e., bentonite) is used. HDD entry and exit pits would be required for each cable conduit to contain drilling mud. During drilling, reaming, or pulling events, some drilling mud may be released from the end of the bore hole within the exit pit. Bentonite is heavier than water, so it will remain in the exit pit. While unlikely, there is also the potential for release of drilling mud outside of the HDD pits. Ocean Wind 1 will implement an Inadvertent Returns Contingency Plan (Appendix P) during construction to prevent release of drilling mud or respond to any releases of drilling mud outside of the drill pits to minimize the potential for and impacts from inadvertent returns.

BL England

Onshore, overlying surfaces disturbed during the process would be restored to pre-disturbance conditions upon completion of work at the 35th Street landfall to minimize impacts. Offshore, the HDD pit will remain open for the short-term duration of construction activities. Following construction, the offshore pit in the Atlantic will be allowed to naturally infill. This is expected to occur quickly due to dynamic wave action and sediment transport within the offshore environment. No other long-term impacts to surface geological resources are expected with HDD landfall. HDD will result in minor long-term changes to subsurface geology along the drill path due to the presence of conduit.

Oyster Creek

In the Oyster Creek area at the IBSP auxiliary parking lot of Swimming Area #2 landfall, overlying surfaces disturbed during the process will be restored to pre-disturbance conditions or per agreement with the landowner upon completion of work.

Some areas at the Holtec Property landfall the Oyster Creek area will be permanently altered to provide permanent access to the site and TJB (Site Plans in Appendix C). At the Oyster Creek HDD onshore entry pits, a small hardstand area flush with the ground surface around the TJBs will remain permanently to allow for access and maintenance during operation as needed. This will provide a stable surface to support access vehicles. In addition, a winch permanent winch pad for each TJB will remain.

Offshore, the HDD pits will remain open for the short-term duration of construction activities. Following construction, the offshore pits in the Atlantic will be allowed to naturally infill. This is expected to occur quickly due to dynamic wave action and sediment transport within the offshore environment. In Barnegat Bay, the exit pit will be filled with clean compatible fill. No other long-term impacts to surface geological resources are expected with HDD or open cut installation. HDD will result in minor long-term changes to subsurface geology along the drill path due to the presence of conduit.

4.1.1.1.2 Onshore Project Area

Potential impacts associated with the construction of the transition joint bays (TJBs), onshore export cables, and onshore substations include temporary and permanent impacts to soil. Impacts have been minimized by siting onshore facilities in areas that have been previously disturbed (e.g., parking lots, road ROWs, a disturbed farm property, and existing industrial properties).

During construction, soils will be excavated along the cable route for installation of the cables and associated facilities, and at the onshore substation site for foundations and equipment installation. Following construction, soils will be back filled, where applicable, and surface grades returned to previous contours. Soils will be decompacted as needed. With the exception of permanent manholes, disturbances to soils within the construction corridor for the onshore cable will be temporary, short-term and localized to the work areas. There is a potential for erosion and sedimentation and contamination of soils through inadvertent spills during construction. These impacts will be prevented and mitigated via adherence to the APMs and best management practices (BMPs) during construction, including development of an SPCC Plan and SWPPP.

Soils at the substation sites will be permanently impacted by building foundations, equipment placement, parking, permanent access, fencing and landscaping. Impacts at BL England have been minimized to the extent practicable by siting the substation in an area that was previously disturbed in association with earthwork at a former golf course and adjacent BL England Generating Station property. Impacts at Oyster Creek have been minimized by siting the substation within areas previously disturbed for the OCGS. Temporary impacts, such as potential for erosion and sedimentation or inadvertent spills, will be mitigated by implementation of the APMs and BMPs during construction, including implementation of the Project-specific SWPPP and SPCC plans.

Disturbance to upland soils within developed areas of New Jersey may result in contact with contaminated soils, which if not managed, could result in the spread of contamination, resulting in impacts to clean soils and other resources or receptors. A discussion of contaminated sites is provided in Section 4.5.

4.1.2 Operations and Maintenance

4.1.2.1 Offshore Project Area

Once the Project is constructed and operational, temporary disturbance to seabed sediments will occur as a result of vessels anchoring during maintenance and cable repairs.

Cable maintenance would include inspection of the seabed and inspection of cable burial. Cable reburial and protection maintenance would be undertaken as needed, resulting in impacts to the seabed that would be similar in nature to impacts during construction but on a smaller geographic scale.

It may be necessary to repair segments of cable during cable operation. In these instances, cables would be exposed, repaired, and reburied. Sediment disturbance and resettlement would occur during any repair and reburial activities, but these disturbances would be temporary, short-term, and localized to the repair area.

4.1.2.2 Onshore Project Area

Soil disturbance during operation and maintenance is not anticipated. Repairs would be conducted through manholes for access to cable conduits the extent practicable. However, in the case of emergency repair activities where soil disturbance is required, impacts will be similar to construction and installation but on a smaller scale, localized to the area of the repair.

4.2 Water Resources and Wetlands

This section describes impacts to water resources and wetlands as a result of the Project. These resources are regulated under the Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A) and Coastal Zone Management Rules (N.J.A.C. 7:7).

At BL England, impacts to watercourses will be minimized by siting the cables primarily within a maintained road ROW and installing the cables under Crook Horn Creek/Peck Bay using HDD. At Oyster Creek, impacts to Oyster Creek and its tributary will be minimized through HDD installation. Impacts to watercourses will be further minimized by implementing APMs (Section 2), including a Project-specific SWPPP and SPCC Plan. No long-term impacts to water quality are anticipated. Impacts to water quality are expected to be localized, temporary, and short-term with the application of APMs and BMPs.

Onshore coastal and freshwater wetlands will experience temporary disturbance from construction and installation activities, including clearing and grading, trenchless cable installation, open trench excavation, onshore substation construction, equipment and construction staging and potential contamination from spills.

Permanent impacts to wetlands at BL England have been minimized by siting the facilities to avoid impacts to wetlands with the exception of minimal areas of emergent wetland associated with water features created for the former golf course. For Oyster Creek, the impacts to freshwater and coastal wetland habitats from cable landfall and onshore cable burial will include permanent placement of fill as well as temporary clearing, excavation, erosion and sedimentation, dewatering, and potential discharge/releases. The onshore substation facilities will result in permanent impacts to previously disturbed wetland habitat. Other impacts to terrestrial and coastal habitats are expected to be localized, temporary and short-term with the application of APMs (Section 2). The Project intends to purchase wetland mitigation credits from a mitigation bank that services the area. The Mitigation Plan will be finalized prior to construction per State requirements.

Impacts to each wetland habitat type found in the Project Area are provided in **Tables 4.2-1 and 4.2-2**. Potential impacts to water resources and wetlands during construction and operation are described in more detail in Sections 4.2.1.1 and 4.2.1.2 below. In addition, wetland and transition area impacts are provided on Site Plans in Appendix C, with a temporary and permanent impact summary included for each plan sheet, and callouts on the plan view to provide the habitat type and location of temporary and permanent impacts. Non-wetland habitat types are discussed in Section 4.4.1.

Table 4.2-1. Habitat Impacts for BL England.

Habitat Type	Area of Impacts (acres)
Drainage Swale	0.06
Emergent Non-tidal Wetland	1.64
Emergent Tidal Wetland	0.06
Palustrine Forested Wetland	0.04

Table 4.2-2. Habitat Impacts for Oyster Creek.

Habitat Type	Area of Impacts (acres)
Ditch	0.17
Emergent Non-tidal Wetland	1.24
Palustrine Emergent/Shrub-Sapling Wetland	0.0003
Emergent Tidal Wetland	5.15
Palustrine Forested Wetland	0.20

4.2.1.1 Construction

Wetland habitats will experience temporary impacts from construction activities, including clearing and grading, HDD cable installation, and open trench excavation as well as permanent impacts from permanent access to TJBs, onshore substation construction, and habitat conversion.

Clearing and grading will result in temporary impacts to emergent tidal wetlands and long-term impacts to palustrine forested wetlands. Temporary impacts may also occur as a result of excavation, rutting, compaction, and mixing of topsoil and subsoil. Impacts will be minimized through the use of BMPs, such as equipment with low-ground pressure tracks to distribute weight over wetland surfaces and timber matting, to the extent practicable. Following construction, the temporarily impacted areas would be restored to pre-existing contours, soils would be decompacted as necessary, and it is expected that herbaceous vegetation would become reestablished within one to three years following construction.

HDD installation at landfall and along the onshore ECRs has the potential for inadvertent returns of drilling lubricant (bentonite), which can potentially enter surface waters and increase turbidity. The potential for returns and impacts from returns will be minimized with implementation of the Inadvertent Returns Contingency Plan (Appendix P). The Inadvertent Returns Contingency Plan (Appendix P) includes BMPs, such as monitoring of the drilling mud volumes, pressures, and pump rates and returns, which would be followed to determine if drill mud loss occurs in amounts that signal a possible inadvertent return. The Inadvertent Returns Contingency Plan will be implemented to prevent releases or respond in a way that minimizes impacts in the unlikely event of a release.

Water quality within wetlands and adjacent streams could be affected by erosion and sedimentation from nearby exposed soils, or inadvertent spills of fuel or chemicals. However, Ocean Wind 1 contractors would use erosion and sedimentation controls and BMPs and will develop and implement a SWPPP and SPCC Plan to avoid and minimize water quality impacts during onshore construction. Potential impacts would be minimized by following proper storage and disposal protocols, and by limiting the amount of hazardous or regulated materials to be used onsite to minimize the risk of a spill, per the APMs in Section 2.

Additionally, during onshore construction, dewatering may be required. BMPs will be used during discharge of water, such as energy dissipation devices and erosion and sediment controls. Dewatering activities will be temporary, short-term, and water drawdown would be minimal. An NJDEP Temporary Dewatering Permit will be required during construction activities. Discharges and releases will be managed using the SPCC Plan.

Additional area-specific discussion of impacts is provided below.

4.2.1.1.1 Offshore Export Cable

Seabed disturbance for offshore construction activities will result in temporary increases of suspended sediment. Potential contamination may occur from unforeseen spills or accidents, and any such occurrence will be addressed in accordance with the SPCC Plan. Spills and inadvertent releases would be minimized with application of the APMs.

The offshore export cables will be installed using a jet-assisted cable plow. Site preparation activities will take place prior to placement and burial of cable in the offshore export cable corridor. These activities potentially include a pre-lay grapnel run and boulder removal. Temporary, localized sediment suspension may occur during site preparation activities and installation of the cables. However, impacts associated with sediment suspension and deposition are anticipated to be short-term and temporary due to the predominantly sandy composition of upper sediments in the Project Area.

Sediments resuspended in the Atlantic Ocean during trenching would settle quickly to the seabed within the trench, potential plumes would be limited to right above the seabed and not within the water column and concentrations greater than 10 mg/l would be short in duration up to 6 hours and limited to within approximately 50 to 200 m of the center of the trench in these offshore areas (Vineyard Wind 2018, Tetra Tech 2012, BOEM 2015).

Potential contamination may occur from unforeseen spills or accidents. These potential impacts would be minimized by implementing an approved SPCC Plan, by following proper storage and disposal protocols, and by requiring vessel operators to have a vessel-specific spill response plan for use in the event of an accidental release, per the APMs in Section 2. Any spills would be reported and addressed in accordance with the SPCC Plan.

Jet plow and diver activities in shallow water areas in Barnegat Bay, where there is predominantly fine sediment (silts and clays), are expected to result in temporary short-term water quality impacts localized adjacent to the trench. Given the known hydrodynamic conditions within the area of the Project and the BMPs associated with jet-assisted plowing technologies, no long-term impacts to water quality are anticipated following cable installation activities.

4.2.1.1.2 Offshore Export Cable Landfall

BL England

The proposed BL England landfall will be installed using HDD. The HDD workspace will be within previously disturbed areas within the road ROW at 35th Street in Ocean City (see Site Plans in Appendix C).

Wetlands

No impacts to wetlands are anticipated as part of the cable landfall at Ocean City.

Waterbodies

Offshore of Ocean City, the Project will have temporary impacts to state-regulated open water of the Atlantic Ocean. All impacts will occur below the regulated intertidal and subtidal shallows depth of -4 ft mean low water (MLW). HDD marine construction vessels will occupy an area within the Atlantic Ocean during HDD construction activities (see Section 2). HDD construction will require dredging of an offshore exit pit within the sediment. All dredging and disposal of dredged materials will be in accordance with regulations and NJDEP permit conditions. BMPs will be implemented during construction to reduce turbidity and the resuspension of sediments into the water column during dredging activities. Sediments resuspended in the Atlantic Ocean during trenching would settle quickly to the seabed within the trench. Potential plumes would be limited to right above the seabed and not within the water column. Plume concentrations greater than 10 mg/l would be short in duration (up to 6 hours) and limited to within approximately 164 to 656 ft (50 to 200 m) of the center of the trench in these offshore areas (Vineyard Wind 2018, Tetra Tech 2012, BOEM 2015).

Oyster Creek

The export cable landfall at Oyster Creek will require workspace for HDD installation and connections at TJBs at IBSP and the Holtec Property within mapped Coastal Wetlands. Cable installation will be made using HDD at the IBSP Atlantic landfall; HDD is the preferred installation method at the Holtec Property landfall (with open cut as a backup alternative); and open cut is proposed at the IBSP transition into Barnegat Bay. The installation will have temporary short-term and permanent impacts on wetland habitats and their associated buffers.

Holtec Property Landfall

Wetlands

At the Holtec Property landfall (onshore), construction of the Project will result in permanent and temporary impacts to coastal wetlands. The landfall workspace and access path will be within previously disturbed *Phragmites*-dominated coastal wetlands on the western shoreline of Barnegat Bay.

Permanent impacts to emergent tidal wetlands (NJDEP 1970 Mapped Coastal Wetlands) would result from 0.03 acre of permanent fill for concrete winch pads used at anchor points to pull the offshore cable into the buried onshore TJB position. A total of 5.06 acres of temporary impact to emergent tidal wetlands would occur within the HDD and TJB workspace (see Site Plans in Appendix C). Two buried TJBs and subterranean pervious scour protection will be permanently installed to protect the TJBs and to provide a stable access route to the TJBs. There will be no impact to tidal hydrology as a result of this work. The TJBs and pervious scour protection will be installed below grade and surface contours will be reestablished, allowing revegetation to occur over top of the facilities. Each TJB will have two manholes at the surface resulting in 0.001 acre of permanent impacts to emergent tidal wetlands. Temporary impacts would result from clearing and grading within areas temporarily used for construction workspace (including areas used in the event of open cut installation). These temporary impacts would be within areas delineated as emergent tidal wetland. Timber mats will be used in temporary impact areas to protect the wetland from rutting and compaction. Following construction, the temporarily impacted areas would be restored to pre-existing contours, and it is expected that herbaceous vegetation would become reestablished within one to three years following construction.

An HDD staging area for fabricating high-density polyethylene (HDPE) conduits will be required on the Holtec Property. The HDPE conduit stringing is proposed to take place primarily within upland areas adjacent to the existing paved access road into the site. Upland trees will be cleared along the existing paved access road. Additionally, a small area (0.01 acre) of nontidal emergent wetlands and (0.82 acre) of associated transition area near the shoreline of Oyster Creek will be temporarily impacted as a result of the conduit transfers out to Oyster Creek for installation within the HDD exit pits in Barnegat Bay. Timber matting will be used to minimize impacts (Site Plans in Appendix C).

Waterbodies

Offshore of the Holtec Property on the western shoreline of Barnegat Bay, two HDD exit pits will be dredged approximately 400 m (1,300 ft) from the onshore HDD entry points. All dredging and disposal of dredged materials will be in accordance with the regulations and NJDEP permit conditions. These pits will be backfilled with approved, suitable material. Dredging will occur at water depths of deeper than -4 ft MLW, outside of Intertidal and Subtidal Shallows areas regulated by the NJDEP. BMPs will be implemented during construction to reduce turbidity and the resuspension of sediments into the water column during dredging activities. Potential plumes would be limited to right above the seabed and not within the water column.

Sediment dispersion modeling conducted for submerged cable installation in Raritan Bay found the fine sediments within the Raritan Bay had small increases (less than 50 mg/L) in suspended sediment concentrations at distances greater than 1,000 ft (305 m) from the cable route (ESS Group In. 2013). Large increases in suspended sediment concentrations (greater than 200 mg/L) were limited to areas less than 500 ft (152 m) from the cable route for short periods of time (less than 4 hours). Based on these modeling results, increases in suspended sediment in the water column would have a short duration with concentrations typically returning to ambient conditions in one to four hours and in all cases in less than 24 hours after the passage of the jet plow (ESS Group Inc. 2013). Plume concentrations greater than 10 mg/L that contain coarser sediments would be short in duration (up to 6 hours) and limited to within approximately 50 to 200 m of the center of the trench, similar to in the offshore areas (Vineyard Wind 2018, Tetra Tech 2012, BOEM 2015).

Inadvertent Returns Contingency Plans were developed and will be used during trenchless cable installation (Appendix P).

<u>Island Beach State Park Atlantic Landfall</u>

Wetlands

At the IBSP Atlantic landfall, the onshore landfall workspace has been sited entirely within the paved auxiliary lot of Swimming Area #2 to avoid wetland impacts to the extent practicable. HDD installation will be used to install the cables under the adjacent dunes (50 linear ft) and beach (850 linear ft [400 linear ft for one cable and 450 linear ft for the other]) to minimize impacts to these habitats. There is a potential for inadvertent release of drilling mud in the dune and beach areas. However, the Inadvertent Returns Contingency Plan (Appendix P) will be implemented to prevent these releases or respond in a way that minimizes impacts in the unlikely event of a release.

Waterbodies

Offshore of IBSP, the Project will have temporary impacts to state-regulated open water of the Atlantic Ocean. All impacts will occur below the regulated intertidal and subtidal shallows depth of -4 ft MLW. HDD marine construction vessels will occupy an area within the Atlantic Ocean during HDD construction activities. HDD construction will require dredging of an exit pit within the seabed. All dredging and disposal of dredged materials will be handled in accordance with the regulations and NJDEP permit conditions. BMPs will be implemented during construction to reduce turbidity and the resuspension of sediments into the water column during dredging activities. Sediments resuspended in the Atlantic Ocean during trenching would settle quickly to the seabed within the trench. Potential plumes would be limited to right above the seabed and not within the water column. Plume concentrations greater than 10 mg/l would be short in duration (up to 6 hours) and limited to within approximately 164 to 656 ft (50 to 200 m) of the center of the trench in these offshore areas (Vineyard Wind 2018, Tetra Tech 2012, BOEM 2015).

Transition from Island Beach State Park to Barnegat Bay

Wetlands

At the transition from IBSP into Barnegat Bay, construction of the Project will result in temporary impacts to 0.45 acre of emergent tidal wetlands. Impacts to these wetlands have been minimized by siting the workspace within an area that has been previously disturbed for use as an access road, maintenance and storage area, to the extent practicable. The permanent TJBs are sited within the upland maintenance area and the permanent access road is within the existing permanent access road for the maintenance area. These are also coastal wetlands transition areas and temporary impacts would total 0.65 acre. Temporarily impacted areas would be restored to pre-existing contours.

Waterbodies

Ocean Wind 1 proposes to create a living shoreline at the IBSP export cable landing off of the western shoreline, in the form of a wave attenuation structure (rock sill). The structure will be installed to protect the shoreline from erosion following construction, allowing it to stabilize and wetlands to restore through natural revegetation. The structure will be made of graded, natural stone riprap. The riprap will be reasonably well graded and have a median weight of approximately 50 to 100 pounds and a median diameter of 8 to 10 inches. The structure will serve to attenuate wave velocity, protecting the western shoreline of IBSP from erosion following construction at the site of the prior channel, where the export cables enter Barnegat Bay from IBSP. The structure will protect the shoreline and allow natural revegetation along the bank to stabilize the berm. The structure will also serve as a living shoreline and be consistent with N.J.A.C. 12:23 (Section 3.1.5 of application). Appendix C includes a plan of the proposed living shoreline. The establishment of the living shoreline would maintain the existing functionality of the common reed ecosystem.

4.2.1.1.3 Onshore Export Cable

BL England

Onshore export cables would carry electricity from the TJBs at landfall to the substations. Cable installation will require permanent ROW and temporary workspace along onshore export cables. The onshore export cables would be installed primarily via typical trenching and open cut methods. Cables would be installed in duct banks, and sections would be joined within joint bays (i.e., manholes). Manholes would be similar in function to the TJBs described above for landfall, but smaller. They would be required along the onshore ECR, would be buried, and the overlying surface would be restored following installation and jointing. Impacts associated with installation of the onshore export cables would be similar to those described above for cable landfall. Clearing and excavation will only affect any specific area for a short period, and areas will be restored when installation is complete in that area. HDD will be used along portions of the onshore ECRs to avoid impacts to wetlands, surface water crossings, or other sensitive and unique habitats (Crook Horn Creek/Peck Bay). Workspace for TJBs, open trench installation, and potential areas of impact from trenchless installation operations are provided on the Site Plan in Appendix C.

Wetlands

Cable installation along the proposed alignment at BL England will take place almost entirely within roadways and previously disturbed areas. Impacts to freshwater and coastal wetland habitats from onshore cable burial are limited to 0.015 acre of workspace within the limit of the 1970 coastal wetland line, which is within the upland vegetated maintained road ROW along Roosevelt Boulevard (see Site Plans in Appendix C). The area will be used as a temporary lay down area and there will be temporary clearing and overlay of stone or timber matting for a laydown area, within the maintained road ROW along Roosevelt Boulevard. There is the potential for erosion and sedimentation and potential discharge/releases at this location. In addition, there will be 0.25 acre of temporary impact to coastal wetlands transition area within the maintained road ROW along Roosevelt

Boulevard in association with onshore cable installation. No other freshwater or coastal wetlands will be impacted at the onshore landfall or onshore ECR. HDD installation will be used to install the cable under Crook Horn Creek/Peck Bay along Roosevelt Boulevard. Crossing using HDD at this location will allow for avoidance of impacts to coastal saline marsh wetlands. Use of BMPs for soil erosion and sediment control along with the HDD installation methodology will avoid or minimize impacts to water resources. Workspace for TJBs, open trench installation, and potential areas of impact from HDD installation operations are detailed Appendix C.

Waterbodies

HDD will be used to install the cable under Crook Horn Creek/Peck Bay along Roosevelt Boulevard. Crossing using HDD at this location will allow for avoidance of impacts to coastal saline marsh wetlands. Coastal wetland transition area will be temporarily impacted on the eastern side of the crossing within Ocean City. The western side of the crossing is proposed to occur within an existing paved area used by a rowing club in Upper Township. Impacts would be avoided through the use of BMPs for soil erosion and sediment control along with installation methodology, such as HDD, to avoid surficial impacts to water resources.

Oyster Creek

Cable installation along the proposed alignment at Oyster Creek will take place within previously disturbed areas and be co-located with existing access roads and berms to the extent practicable. The onshore export cables would be installed primarily via typical trenching and open cut methods. Cables would be installed in duct banks, and sections would be joined within joint bays (i.e., manholes). Manholes would be similar in function to the TJBs described above for landfall, but smaller. They would be required along the onshore ECR, would be buried, and the overlying surface would be restored following installation and jointing. Impacts associated with installation of the onshore export cables would be similar to those described above for cable landfall. Clearing and excavation will only affect any specific area for a short period, and areas will be restored when installation is complete in that area. HDD will be used along portions of the onshore ECRs to avoid impacts to wetlands, surface water crossings, or other sensitive and unique habitats (Oyster Creek). Workspace for TJBs, open trench installation, and potential areas of impact from trenchless installation operations are provided on the Site Plan in Appendix C.

Wetlands

Cable installation will take place primarily within the previously disturbed Holtec Property and along the access road to the OCGS. The Project would result in permanent impacts to 0.147 acre of palustrine forested wetland on the Holtec property along the onshore ECR. In addition, the cable installation along the onshore ECR will result in 2.06 acres of permanent impact to forested wetland transition area, and temporary impacts to 0.573 acres of coastal wetlands transition area and temporary impacts to 3.25 acres of emergent and scrub/shrub wetland transition area. The workspace and location of wetland and transition area impacts are depicted on Site Plans in Appendix C.

Open cut cable duct installation techniques would be used for the majority of the onshore cable installation. The entire Holtec Property was previously subjected to extensive ground disturbance and development of canals and berms to drain the property for farming in the 1960s. The farm was subsequently abandoned but excavations and berms were left in place. The project has been sited to follow existing access roads and berms to the extent practicable. BMPs will be used to minimize impacts as a result of erosion or potential spills during construction activities. Any dewatering from the trenching will be in accordance with state permit requirements for dewatering and will use BMPs. Wetland impacts are summarized in **Table 2.2.5-1** and impacts to each habitat type, including wetland habitats, are provided in **Table 4.2-2**.

Waterbodies

HDD installation will be used to install the cable under Oyster Creek and Route 9. The workspace for the HDD will be located within upland areas.

A series of man-made ditches runs along the existing dirt trails on the Holtec Property. The Project would result in temporary impacts to 0.09 acre of open water wetland in these ditches as a result of cable installation and maintained construction vehicle access during construction. Water may be discharged into these ditches during cable burial trenching activities. Any dewatering from the trenching will be in accordance with state permit requirements for dewatering and will use BMPs. BMPs will be used to minimize impacts as a result of erosion or potential spills during construction activities.

4.2.1.1.4 Onshore Substation

Construction of the onshore substations would result in temporary and permanent impacts to freshwater wetlands from construction of the permanent substation facilities and use of temporary construction workspace. The Project intends to purchase wetland mitigation credits from a mitigation bank that services the area. The Mitigation Plan will be finalized prior to construction per State requirements. Construction of the onshore substation would require a permanent site, including area for the substation equipment and buildings, equipment yards, energy storage, stormwater management, a parking area, access road, and landscaping. During construction, additional areas will be required for temporary workspace.

Construction at the onshore substation will begin with installation of fencing around the construction workspace and a security gate, site preparation, and site access. Site preparation will include installation of erosion and sediment controls, clearing and grading, installation of a gravel layer, and excavation for foundation installation. Site access will require the installation of an access road. Foundations will be installed, and equipment will be delivered and installed on pre-installed foundations. Buswork and ductwork for electrical connections would be installed. Cables and control equipment would be installed, and electrical connections would be completed.

BL England

The existing habitat at the proposed onshore substation at BL England is within a previously disturbed vegetated area. The area was maintained as a golf course and is currently reverting to forested uplands and wetlands. The property contains patches of forested wetlands and wet meadows. The area is still somewhat maintained by the existing property owner through mowing and clearing and offers marginal, fragmented wetland habitat in its current state. The onshore substation facilities and associated access road will result in permanent impacts to 0.65 acre of previously disturbed wetland habitat (0.04 acre of PFO wetland and the remaining emergent) and 0.04 acre of permanent impacts to freshwater wetlands transition area as well as 1.10 acres of temporary impacts to emergent wetland habitat, and 0.83 acre of temporary impact to freshwater wetlands transition area. Wetland impacts are limited to emergent wetlands associated with water features created for the former golf course (Site Plan- Appendix C).

Oyster Creek

The existing habitat at the proposed onshore substation site at Oyster Creek is already developed and fragmented. The Project will result in 1.22 acre of permanent impact and temporary impact to 0.02 acre of emergent freshwater wetlands dominated by common reed. The site has been historically disturbed going back to the development of the Oyster Creek Nuclear Generating Station in the 1960s.

4.2.1.2 Operations and Maintenance

The permanent easement will be maintained in an herbaceous or small shrub state (no trees or deep-rooted species) throughout the life of the Project. During regular operations and maintenance activities, other impacts to wetlands and open water resources are not anticipated. If cable inspection and repair operations are needed, additional impacts may be associated with clearing and excavating and may result in additional disturbance within areas disturbed during construction. These impacts would be similar to those during installation of the cables but on a smaller scale and would be temporary and localized to the area of repair.

4.3 Floodplains, Riparian Zones, Coastal Zone, Tidelands, Pinelands

4.3.1 Floodplains

Impacts to floodplains as a result of the Project would be related to HDD installation activities, onshore cable installation open trenching activities, and construction of the onshore substations. For more information on Flood Hazard Area compliance, refer to Appendix K. Floodplains are depicted on **Figure 3.3.1-1** and **Figure 3.3.1-2**.

4.3.1.1 Construction

4.3.1.1.1 Offshore Export Cable Landfall

BL England

The BL England onshore export cable landfall is located within the FEMA-mapped 100-year floodplain, Zones VE under the beach and AE within 35th Street. Impacts within floodplain areas from offshore export cable landfall construction will be temporary and short-term during construction. The cable will be installed underground via HDD under the beach with workspace in paved areas within 35th Street. No aboveground structures are proposed that would displace floodwaters. Therefore, no long-term impacts to floodplains would occur once offshore export cable landfall construction is complete. During construction, equipment and materials will be secured, contained, or removed in the event of flooding to prevent any spills or transport of unsecured materials.

Oyster Creek

The Oyster Creek onshore export cable landfall at both IBSP Atlantic and the Holtec Property are located within the FEMA-mapped 100-year floodplain, zones VE and AE. Impacts to floodplains at the landfall location will be temporary and short-term during construction. The cable will be installed underground via HDD or open cut. No aboveground structures are proposed that would displace floodwaters. Therefore, no long-term impacts to floodplains would occur once offshore export cable landfall construction is complete. During construction, equipment and materials will be secured, contained, or removed in the event of flooding to prevent any spills or transport of unsecured materials.

4.3.1.1.2 Onshore Export Cable

BL England

At BL England, portions of the onshore export cable corridor for the Project will be located in FEMA-mapped 100-year floodplains (Zone AE) along Roosevelt Boulevard (**Figure 3.3.1-1**). Impacts within floodplains will be temporary and short-term during construction. The onshore export cable will be located underground and existing contours will be restored following construction; therefore, the onshore export cable will not impact the floodplain or flood storage. It will not impact lawfully existing impervious land use. All hydraulic calculations to support Project avoidance of long-term impacts to floodplains are provided in Appendix K.

Oyster Creek

At Oyster Creek, limited sections of the onshore export cable for the Project will be located within FEMA-mapped 100-year (Zone VE and AE) or 500-year floodplains (**Figure 3.3.1-2**). Impacts within floodplains will be temporary and short-term during construction. The onshore export cable will be located underground and existing contours will be restored following construction; therefore, the onshore export cable will not impact the floodplain or flood storage. It will not impact lawfully existing impervious land use. All hydraulic calculations to support Project avoidance of long-term impacts to floodplains are provided in Appendix K.

4.3.1.1.3 Onshore Substation

BL England

The BL England onshore substation is located within the FEMA-mapped 100-year floodplain (Zone AE). The substation will be built in compliance with the NJDEP FHA regulations and therefore the first floor will be at least base flood elevation (BFE)+ 1 ft NAVD88. The Project will create more than ¼ acre of new impervious surface or 1 acre of disturbance and will therefore be considered Major Development. All Project activities will be done in accordance with NJDEP Stormwater Management and NJDEP FHA requirements. No long-term impacts to floodplains would occur once construction of the onshore substation is complete as the structure would be above the base flood elevation. No long-term impacts to floodplains would occur once construction of the onshore substation is complete per the FHA Verification Engineer's Report in Appendix K.

Oyster Creek

The Oyster Creek onshore substation is not located within the FEMA-mapped 100-year floodplain. The substation is above the FHA design elevation.

4.3.1.2 Operations and Maintenance

During regular operations and maintenance activities, additional impacts to floodplains are not anticipated. Cable repairs will be conducted using manholes to the extent practicable. If cable repairs require land disturbance, these impacts would be temporary and localized to the area of repair. Although operations and maintenance for the onshore substation may temporarily occur in the floodplain, they would be conducted according to FHA regulations and there will be no increase in flooding risk to the Project Area.

4.3.2 Riparian Zone

Within BL England, a small area of riparian zone may be impacted during cable installation. Within Oyster Creek, a riparian zone along the onshore ECR may be subjected to temporary or permanent impacts from construction activities, including clearing and grading, trenchless cable installation, open trench installation, and equipment and construction staging. This section details these potential impacts to riparian zones as well as the avoidance and mitigation measures that Ocean Wind 1 will adopt to minimize these potential impacts. riparian zone impacts are summarized in **Table 2.2.1-1**.

4.3.2.1 Construction

4.3.2.1.1 Offshore Export Cable Landfall

Within the BL England landfall workspace, there are no anticipated impacts to riparian zones. Riparian zones do not exist along the Atlantic Ocean, nor do they exist within coastal wetlands.

The preferred cable installation at the Holtec Property landfall site would be made using HDD technology to avoid impacts to SAV and shellfish within the Bay. Two approximately 360-m (1,200 ft) HDPE conduit pipes will be required for these HDDs. This conduit pipe will be fabricated and staged within existing upland forested area adjacent to the existing paved access road into the Holtec Property (see Site Plans in Appendix C). The pipe will then be transferred into position within the Bay via tugboat tow on Oyster Creek. In this area Oyster Creek is not a Category 1 water, does not have threatened or endangered species present that are dependent on the waterbody for survival, nor is it a trout production or maintenance water. Therefore, it has a 50-foot riparian zone. During this conduit transfer, clearing or matting of riparian zone vegetation may be required (a maximum of 0.32 acre). Impacts will be short term, on the order of days, during this activity and the area will be restored and replanted following construction if necessary.

4.3.2.1.2 Onshore Export Cable

Within BL England, riparian zone impacts are not anticipated along the onshore ECR but may occur in the event of an inadvertent return during HDD. At the crossing of Crook Horn Creek/Peck Bay riparian zone impacts will be avoided due to the use of HDD technology.

The Holtec Property has a series of manmade ditches that run along the proposed export cable alignment within the existing dirt trail. There will be a 50-foot-wide temporary construction easement in this area. Cable installation activities may require riparian zone vegetation to be cleared during construction activities (1.73 acres), including a small area of forested riparian area (**Table 2.2.1-1** and Site Plans in Appendix C). With the exception of the tree clearing, impacts would be temporary, and mitigation will be implemented, if necessary, in accordance with the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13). HDD installation will be used to cross Oyster Creek and avoid impacts to the creek and associated riparian zone. In the unlikely, event of an inadvertent return of drilling mud during HDD installation, the riparian zone may be impacted.

Ocean Wind 1 will implement an Inadvertent Returns Contingency Plan (Appendix P) during construction to prevent release of drilling mud or respond to any releases of drilling mud outside of the drill pits to minimize the potential for and impacts from inadvertent returns. All other impacts associated with the export cable installation are anticipated to be within uplands, outside of riparian zones or within previously disturbed paved areas.

4.3.2.2 Operations and Maintenance

During regular operations and maintenance activities, additional impacts to the riparian zone are not anticipated. If cable repair operations are needed, they would be conducted through manholes to the extent practicable and additional ground disturbance is not expected.

4.3.3 Tidelands

Tidelands in the Project Area will be subjected to temporary or permanent impacts from construction activities, including clearing and grading, HDD cable installation, open trench excavation, and equipment and construction staging. The sections below detail these potential impacts as well as measures that Ocean Wind 1 will adopt to avoid and minimize these potential impacts. A separate Tidelands Utility License Application is submitted to NJDEP for this Project concurrently with this permit application. Appendix J identifies the areas of the Project site located within a NJDEP Tidelands Claim Area, including lands that are currently and formerly flowed by the mean high tide of a natural waterway.

4.3.3.1 Construction

4.3.3.1.1 BL England

The proposed landfall is within previously disturbed areas within the road ROW at 35th Street in Ocean City. The Project will have temporary impacts to the mapped claimed tidelands areas offshore of Ocean City. There are mapped claimed tidelands along the onshore ECR. Impacts to mapped tidelands would be temporary and no long-term impacts to tidelands are anticipated.

4.3.3.1.2 Oyster Creek

The TJBs at IBSP and the Holtec Property are not located in mapped claimed tidelands areas. Cable installation at the landfall sites will be made using either open cut (i.e., “trenching” on the west side of IBSP) or HDD (at the Atlantic side of IBSP and at the Holtec Property) and will have temporary short-term impacts on tidelands. The wave attenuation structure at IBSP will be a permanent impact within Tidelands.

There are mapped claimed tideland areas along the onshore ECR in Oyster Creek and along Discharge Drive. Impacts to tidelands are anticipated to be temporary during onshore export cable installation. No permanent impacts to mapped tidelands are anticipated.

The proposed substation location is outside of any mapped claimed tidelands.

4.3.3.2 Operations and Maintenance

During regular operations and maintenance activities, additional impacts to tidelands are not anticipated. Cable repairs will be made using manholes for access to the extent practicable. If ground disturbance is required for cable repair operations, additional disturbance to tidelands may occur. These impacts would be localized and temporary.

4.3.4 Pinelands

Pinelands in the Project Area will be subjected to temporary or permanent impacts from construction activities, including clearing and grading, trenchless cable installation, open trench excavation, and equipment and construction staging. The sections below detail these potential impacts as well as avoidance and mitigation measures that Ocean Wind 1 will adopt to minimize these potential impacts. Correspondence with the Pinelands Commission is included in Appendix F.

4.3.4.1 Construction

4.3.4.1.1 BL England

The proposed BL England facilities are located within the following PMAs as designated by the New Jersey Pinelands Commission: Forest Area with Parkway Overlay and Regional Growth Area (NJDEP GIS 2016). The proposed onshore ECR along Route 9 and at the substation site in Upper Township is located within the Regional Growth Area PMA. Within Regional Growth Areas, public service infrastructure such as the electric transmission cables are permitted (Pinelands Commission 2018). While the onshore ECR crosses a Forest Area PMA, it is at the Garden State Parkway Crossing in Upper Township which is within the Garden State Parkway Overlay. The Garden State Parkway Overlay allows for the development of public service infrastructure.

Impacts to PMAs would be temporary during construction. The Project will conform to the land use standards and permitted uses of the Pinelands. No permanent impacts to mapped PMAs or non-conformance with standards would occur.

4.3.4.1.2 Oyster Creek

The Oyster Creek facilities are located within the following PMAs: Forest Area, Forest Area Water, and Rural Development Area (NJDEP 2016). Portions of the ECR at IBSP are within a Forest Area PMA and portions within Barnegat Bay are within a Forest Area Water PMA. A portion of the onshore ECR at the Holtec Property is within a Forest Area PMA. The remaining ECR and substation are within a Rural Development Area PMA. The cables are considered public service infrastructure, which is allowed in Rural Development Area PMAs (Pinelands Commission 2018). Based on the letter from the Pinelands Commission in December 2021, the proposed cables are not inconsistent with the Forest Area PMA.

Cable installation at the landfall sites will be made using either open cut (i.e., “trenching” at the western side of IBSP or as an alternative option at the Holtec landfall) or HDD (at the Atlantic side of IBSP and the Holtec Property) and will have temporary short-term impacts on Pinelands. Impacts to Pinelands are anticipated to be temporary during cable landfall and onshore export cable installation. The Project will conform to the land use standards and permitted uses of the Pinelands. No permanent impacts to mapped PMAs or non-conformance with standards would occur.

4.3.4.2 Operations and Maintenance

During regular operations and maintenance activities, additional impacts to Pinelands are not anticipated. Cable repairs will be made using manholes for access to the extent practicable. If ground disturbance is required for cable repair operations, additional disturbance to Pinelands may occur. These impacts would be localized and temporary.

4.4 Vegetation, Wildlife, and Threatened and Endangered Species

4.4.1 Vegetation

Vegetation will be subjected to temporary or permanent impacts from construction activities, including clearing and grading, HDD cable installation, open trench excavation, onshore substation construction, and equipment and construction staging. The impacts to vegetation include clearing, potential discharge/releases, and habitat conversion. This section focuses on potential impacts to upland vegetation as wetland and riparian zones are discussed previously.

The onshore substation facilities will result in permanent impacts to previously disturbed habitat, and habitat will be permanently converted to developed land.

Installation of onshore export cables and cable landfall with result in permanent impacts to coastal and terrestrial habitats from permanent conversion to an access road and winch pad and tree clearing. Temporary workspaces will be subjected to disturbance from construction and installation activities, including clearing and grading, trenchless cable installation, open trench excavation, equipment and construction staging and potential contamination from spills. Impacts to forested areas will be long term and temporarily impacted areas will be replanted and mitigated per permit conditions. Temporary impacts to herbaceous communities will be short-term and expected to become reestablished in one to three years.

The sections below detail these potential impacts as well as the avoidance and mitigation measures that Ocean Wind 1 will adopt to minimize these potential impacts. A summary of impacts to each non-wetland habitat types is provided in **Table 4.4-1**. Ocean Wind 1 will restore contours within temporarily impacted habitat and replant according to a planting plan to be developed in coordination with NJDEP and designed to comply with permit conditions.

Table 4.4-1. Habitat Impacts for Non-Wetland Areas.

Habitat Type	Area of Impacts (acres)
BL England	
Upland Forest	3.34
Upland Meadow	4.82
Oyster Creek	
Upland Meadow Early-Successional Forest	11.53
Pine Barrens Forest	1.45
Mixed Pine Barrens/Oak-Dominated Forest	2.96
Upland Meadow	11.94
Barren Land – ATV Trails	0.06
Upland Forest	4.76

4.4.1.1 Construction

Impacts to all habitat from construction include the potential for clearing and grading, rutting, soil compaction, potential spills, and habitat conversion. Clearing and grading within forested areas will result in permanent conversion to developed land or long-term impacts within temporary workspace. Impacts from spills will be avoided and minimized through implementation of APMs and BMPs. Following construction, contours will be restored in temporarily impacted areas, soils will be decompacted as needed, herbaceous areas will become reestablished, and areas will be replanted per permit conditions.

4.4.1.1.1 Offshore Export Cable Landfall

BL England

The landfall workspace will be located in paved areas within 35th Street in Ocean City. HDD will be used to install the cable under the beach and dune habitat to minimize the potential for impacts. There is a potential for impacts to beach, dune and nearshore habitat from inadvertent release of drilling mud. The Inadvertent Returns Contingency Plan (Appendix P) will be implemented to avoid releases to the extent possible, and in the unlikely event that there is a release, to respond in a manner that minimizes impacts to habitat.

Oyster Creek

<u>Holtec Property</u>

The potential landfall location at the Holtec Property is located within common reed dominated herbaceous wetlands. An access road to and stable workspace around the TJBs within the landfall workspace would be required. Subterranean pervious fill will be used to provide the stable access and workspace for the TJBs (Appendix C). Following construction, the material will be left in place, buried and the surface will be allowed to return to herbaceous condition over the previous material. The pervious material below grade will allow a stable path for access during operation while allowing the habitat to return to previous state and function. The permanent access road has been sited to utilize the existing network of dirt trails to the landfall workspace. In addition, a permanent winch pad associated with each TJB will be required. The permanent winch pads would result in minimal permanent conversion of habitat to developed workspace (Site Plans in Appendix C).

Temporary workspace would be required along the access road and around the permanent TJB pad. Timber mats will be used to minimize impacts in temporary impact areas.

HDD will be used to install the cable under the nearshore habitat, to the extent practicable, to minimize the potential for impacts. There is a potential for impacts to wetland habitat outside of the permanent and temporary workspace from inadvertent release of drilling mud. The Inadvertent Returns Contingency Plan (Appendix P) will be implemented to avoid releases to the extent possible, and in the unlikely event that there is a release, to respond in a manner that minimizes impacts to habitat. If open cut installation is used at the Holtec landfall, impacts would be temporary. Following construction, existing contours will be restored and allowed to revegetate. Herbaceous vegetation would be expected to become reestablished within one to three years.

<u>Transition from Island Beach State Park to Barnegat Bay</u>

The workspace for transition from IBSP to Barnegat Bay has been sited within an existing maintenance area and associated access road to the extent practicable. Additional space will be required within emergent wetland and forested communities surrounding the maintenance area, resulting in clearing and grading within these areas. Following construction, existing contours will be restored, and replanting will be undertaken per permit conditions. Herbaceous vegetation would be expected to become reestablished within one to three years, while forested areas are expected to take more than 5 years to become reestablished resulting in long-term impacts within temporary workspace.

Island Beach State Park Atlantic Landfall

The workspace for the IBSP landfall from the Atlantic will be within an existing paved parking lot. HDD will be used to install the cable under the beach and dune habitat to minimize the potential for impacts. There is a potential for impacts to beach, dune and nearshore habitat from inadvertent release of drilling mud. The Inadvertent Returns Contingency Plan (Appendix P) will be implemented to avoid releases to the extent possible, and in the unlikely event that there is a release, to respond in a manner that minimizes impacts to habitat.

4.4.1.1.2 Onshore Export Cable

BL England

Onshore export cable installation will take place within existing road ROWs except at the Crook Horn Creek/Peck Bay crossing. HDD installation will be used to install the cable under Crook Horn Creek/Peck Bay along Roosevelt Boulevard. Crossing using HDD at this location will allow for avoidance of impacts to coastal saline marsh wetlands. Coastal wetland transition area will be temporarily impacted on the eastern side of the crossing within Ocean City (**Table 2.1.4-1**). The western side of the crossing is proposed to occur within the paved parking lot of the adjacent marina in Upper Township. The remainder of the onshore ECR will be installed within maintained road ROW. Workspace for TJBs, open trench installation, and potential areas of impact from HDD operations are detailed on Site Plans in Appendix C.

Oyster Creek

Mainland

Installation of the onshore export cables will result in temporary and long-term impacts to vegetative communities (Site Plans in Appendix C). The cable route is co-located with the landfall access road and sited within berms and previously disturbed areas, to the extent practicable, to minimize impacts. However, the cable route diverges from the road on the approach to Route 9 to allow for HDD installation under Route 9 and Oyster Creek. Clearing of woody vegetation resulting in long-term impacts to forest habitat would be required on the approach to Route 9. The area within the permanent easement would be maintained in an herbaceous state during the operational life of the project, resulting in permanent habitat conversion in forested areas.

The cables will be installed under Oyster Creek and Route 9 using HDD installation techniques (Site Plans in Appendix C). The HDD workspace on the east side of Route 9 has been sited adjacent to the road within upland meadow to the extent practicable but will result in clearing within upland forest. The HDD workspace on the west side of Route 9 has been sited adjacent to the access road for the OCGS within upland meadow/early-successional forest. Clearing for these workspaces will result in long-term impacts to forest habitat. Following construction, these areas will be restored to preconstruction contours and replanted and mitigated per permit conditions.

A temporary construction laydown area has been sited within a previously disturbed upland meadow adjacent to Route 9 at the access to the Holtec Property. In addition, an HDD stringing area has been sited adjacent to the access road within previously disturbed upland forest (Site Plans in Appendix C).

Following construction, existing contours would be restored in temporarily impacted areas, herbaceous communities would become reestablished, and forested areas would be replanted in accordance with the replanting plan and permit conditions.

Island Beach State Park

The onshore ECR within IBSP has been sited primarily within existing paved parking lots. Minimal clearing of forested habitat would be required east of Shore Road between the road and the existing parking lots. These areas would be replanted and mitigated per the planting plan and permit conditions. A replanting plan will be developed in coordination with the NJDEP and consistent with federal mitigation/restoration requirements and submitted to NJDEP for approval prior to construction.

4.4.1.1.3 Onshore Substations

Construction of the onshore substations would result in temporary and permanent impacts to vegetation from construction of the permanent substation facilities and use of temporary construction workspace (Site Plans in Appendix C). Construction of each onshore substation would require a permanent site, including area for the substation equipment and buildings, equipment yards, energy storage, stormwater management, a parking area, access road, and landscaping. During construction, additional areas will be required for temporary workspace.

Construction at the onshore substations will require clearing of vegetation for site preparation and grading. Any vegetated areas temporarily impacted during construction for laydown areas are expected to become reestablished within one to three years following construction. Permanent impacts to vegetation will occur during installation of a gravel layer, excavation for foundation installation, and installation of an access road. The existing habitat at the proposed onshore substations is already developed and fragmented. Any remnant habitat within the permanent substation sites will be converted to developed land with landscaping for the duration of the project's operational lifetime. Landscaped areas will provide some habitat for species acclimated to human activity. The substations were sited within an already disturbed and developed area to minimize impacts to low value vegetative habitat.

4.4.1.2 Operations and Maintenance

The permanent easement will be maintained in an herbaceous or small shrub state (no trees or deep rooted species) throughout the life of the Project. Cable repair access will be through manholes to the extent practicable. If ground disturbance is required for cable repairs, impacts to vegetation would be similar to those during construction but on a smaller scale.

4.4.2 Wildlife

4.4.2.1 Terrestrial Wildlife

This section provides a discussion of impacts on terrestrial wildlife. Impacts to fauna are related to impacts on habitat, which are described in Section 4.4.1. For additional detail on impacts to birds and bats, see the bird and bat assessment included in Appendix G.

4.4.2.1.1 Construction

Short-term and long-term impacts on wildlife are expected to occur as a result of habitat impacts (from clearing and grading) and increased noise and traffic from construction. Impacts would vary depending on the specific habitat requirements and mobility of the species. Potential short-term impacts include displacement of individuals from construction areas and adjacent habitats. During construction, the project will implement APMs (Section 2) and BMPS and will adhere to special permit conditions, which will reduce the likelihood of direct impacts to terrestrial and coastal fauna, including potential threatened and endangered species.

Impacts to fauna are related to impacts on habitat, which are described in Section 4.4.1. These habitats provide forage, cover, and breeding/nesting habitat for a variety of wildlife species. Developed land (industrial/commercial and residential) typically provides limited habitat for wildlife as compared to more natural settings. As described above, Ocean Wind 1 has sited onshore facilities and construction workspace in previously disturbed habitat (i.e., existing road ROWs, parking lots, developed lands, maintenance area at IBSP and disturbed area at the proposed substations) to the extent practicable. Construction of onshore facilities will require clearing and some permanent removal of trees between the parking lot and maintenance area at IBSP, and along the onshore cable route within Oyster Creek. Clearing and grading during construction within these workspaces will result in loss of forage and cover for some wildlife. In areas with sensitive or unique habitats, HDD installation is proposed (e.g., under beach and dune habitat at landfall and under Crook Horn/Peck Bay and Oyster Creek along the onshore ECR), thereby reducing impacts to more sensitive species reliant on specialized habitats.

Offshore Export Cable Landfall and Onshore Export Cable

It is expected that the direct loss of habitat for most faunal species would be minimal and that the extent of available intact adjacent habitat would be suitable for faunal species. Mobile organisms (e.g., medium and larger fauna) are expected to avoid disturbed habitat; however, the operation of construction equipment may have direct impacts on sessile or slow-moving organisms, especially within coastal habitats. Sessile organisms would be unable to move away from construction activities or areas with loss of habitat, in general. Therefore, adverse direct impacts to these sessile organisms are possible. However, because the disturbed area would be small and localized, and the habitat altered would represent only a small portion of the available habitat, population-level impacts to sessile organisms are unlikely. Habitat assessments have been completed to avoid sensitive habitat areas (Appendix G) and the work schedule established in permit conditions will be implemented to reduce impacts to terrestrial and coastal fauna during sensitive periods, including potential threatened and endangered species.

Noise would be generated from activities such as operation of heavy equipment for clearing, grading, excavation, and HDD installation. Construction activities also would generate vehicular traffic in the area but would typically be consistent with current levels of traffic. It is possible that noise and traffic would be notable at times within the immediate construction areas. Mobile organisms would either be acclimated to these activities due to the relatively urban setting or would be frightened by increased human activity and noise generation, resulting in movement away from disturbed habitat and avoidance of potential impacts. Smaller fauna and sessile organisms around construction areas may be unable to avoid noise generation; however, disturbances at these sites would be short-term, localized, and temporary.

Onshore Substations

The proposed onshore substation site consists of habitat that is already developed and fragmented in association with the BL England Generating Station and golf course and the Oyster Creek Generating Station. Although construction activities at the onshore substations are expected to result in permanent habitat loss, the affected habitat is common to the region and wildlife would have availability and access to similar habitats in the vicinity of the substations. Additionally, the development footprint (Appendix C) of the onshore substation in previously fragmented habitat of low quality avoids potential impacts to more high-quality wildlife habitat (such as forested wetland and upland habitat south of the substation and emergent tidal wetland west of the substation), including habitat for threatened, endangered, or candidate species.

Noise would be generated from activities such as operation of heavy equipment for clearing, grading, excavation, and construction of structures. Construction activities also would generate vehicular traffic in the area but would typically be consistent with current levels of traffic and would likely go unnoticed. It is possible that noise and traffic would be notable at times within the immediate construction areas. Impacts would be as described for cables.

Disturbances at these sites would be localized and temporary, resulting in minimal impacts to these organisms. Noise and vehicular traffic impacts during construction activities would be temporary.

4.4.2.1.2 Operations and Maintenance

Operations and maintenance of onshore facilities are expected to result in noise, vehicular traffic, and habitat disturbance impacts on terrestrial and coastal fauna. During operational activities, noise would be generated at the onshore substation and vehicular traffic would occur. Noise and traffic are expected to be consistent with existing levels. Therefore, it is expected that wildlife in the area are already acclimated to these activities. During maintenance activities, noise, vehicular traffic, and habitat disturbance would occur in association with maintenance and repair of onshore facilities (similar to those described for construction); however, these disturbances would be limited to specific areas and would occur over shorter periods of time in comparison to the construction phase of the Project.

4.4.2.2 Fish and Essential Fish Habitat

The Project construction activities affecting fish and EFH include seabed disturbance, sediment suspension, discharge/releases and withdrawals, noise, electromagnetic field (EMF), and vessel traffic. Potential impacts to the finfish community during construction include bottom disturbance including resuspension of sediments, noise from sheet pile driving, and an increase in vessel traffic. Activities associated with bottom disturbance, including seabed preparation, dredging, and cable installation could impact benthic prey species, EFH, and demersal fish habitat. Noise impacts are associated with sheet pile driving and vessel noise. In situ UXO/MEC disposal during site preparation activities could also result in potential impacts.

Impacts to the federally threatened Atlantic sturgeon are also discussed in this section. Supplemental information on potential impacts can be found in Appendix G. Impacts specific to shortnose sturgeon are not discussed because this species is unlikely to be encountered within the marine waters affected by the Project. Additional detail regarding EFH is included in Appendix H. As noted in the APMs in Section 2, a monitoring plan will be developed in consultation with resource agencies prior to construction and implemented to monitor environmental impacts.

Seabed disturbance could result in short-term suspended sediment/sedimentation and direct mortality of sessile or slow-moving organisms. Noise from vessel traffic, and sheet pile driving, and potential in-situ UXO/MEC disposal will result in short-term impacts. EMF produced by cables decreases rapidly with distance from the cable and shielding and burial of the cables will further minimize potential EMF impacts. These impacts to fish and EFH would be minimized by implementing APMs.

Impacts to benthic habitat and prime fishing areas are summarized in **Tables 2.1.1-1 and 2.2.5-1**.

4.4.2.2.1 Construction

Offshore Project Area

Overall, impacts associated with cable installation include direct burial of life stages along the route, entrainment of early life stages when operating a jet-assisted cable plow, or removal of demersal life stages during dredging, if required. It is anticipated that pelagic species and life stages will move out of the way based on typical installation speeds, and direct impacts are not anticipated. Direct impacts to foraging habitat are expected to be localized to the width of the trench and temporary as benthic organisms would recolonize the area. Sediments are generally medium to coarse grained and are likely to settle to the bottom of the water column quickly (as described in Section 4.2). Sand re-deposition would be minimal and close in vicinity to the trench centerline, minimizing impacts to demersal fish eggs.

The potential exists for noise generation from piling at HDD exit pits or from in-situ UXO/MEC disposal. Underwater sounds are composed of both pressure and particle motion components and are perceived by fish in different ways. An underwater sound originates from a vibrating source, which causes the particles of the surrounding medium (water) to oscillate, which causes adjacent particles to move and transmit the sound wave. All fish perceive the particle motion component of sound and have sensory structures in the inner ear that function to detect particle motion (Popper and Hawkins 2018, Nedelec et al. 2016). Particle motion is an important part of a fish's ability to orient itself in its environment and perceive biologically relevant sounds of prey, predators, and other environmental cues (Popper and Hawkins 2018).

Current exposure criteria for the onset of behavioral and physiological effects to fish are based on sound pressure levels and not particle motion (Popper and Hawkins 2018, Popper et al. 2014, Faulkner et al. 2018). The following sound pressure level-based thresholds are regularly used during NMFS Section 7 consultations for listed species of fish, and represent the threshold at which the onset of behavioral or physiological effects could potentially be observed (NMFS 2019d, NMFS 2018b):

- Fish Behavioral: 150 dB re 1 µPA root mean square (RMS)
- Fish Physiological: 206 dB re 1 µPA Peak
- Fish Physiological (>2g): 187 dB re 1 µPa2s SELcum
- Fish Physiological (<2g): 183 dB re 1 µPa2s SELcum

There is currently a lack of data on the potential adverse effects and responses of fish to exposure to elevated levels of particle motion caused by anthropogenic activities. The paucity of data has been attributed to the difficulty of measuring particle motion with readily available equipment, and the overall lack of scientists and engineers with the expertise to measure particle motion (Nedelec et al. 2016, Popper and Hawkins 2018).

The pressure wave from an intense underwater sound source has the potential to result in physiological effects and injuries to fish (California Dept. of Transportation [Caltrans] 2015). However, the same sound source with the ability to produce behavioral effects or potentially injurious levels of sound pressure also produces high levels of particle motion (Popper and Hawkins 2018). The contribution of the particle motion to potential adverse effects is not yet fully understood. The longfin squid has been found to exhibit an initial startle response, similar to that of a predation threat, to pile driving impulses, but upon exposure to additional impulses, the squid's startle response diminished quickly, indicating potential habituation to the sound (Jones et al. 2020). After a 24-hour period, the squid seem to re-sensitize to the noise, which is an expected response to natural stimuli, as well. Squid schooling and shoaling behavior could be interrupted when exposed to pile driving impulse noises, which could impact predation risk (Jones et al. 2020).

Impacts of sound on fish vary with acoustic intensity but can include behavioral alterations and physiological damage such as minor ruptured capillaries in fins or severe hemorrhaging of major organs or burst swim bladders (Stephenson et al. 2010, Halvorson et al. 2011). Increased vessel traffic would also likely increase noise levels and may cause fish to avoid areas around construction activities. Short-term and temporary sounds from vessels used during installation of cables are not expected to affect fish because the area affected would be small compared to the abundant surrounding habitat available for fish to move to if they seek to avoid construction activities. Vessel noise associated with Project construction (or operations) would be similar to existing conditions, given the high vessel traffic in the region offshore of New York, New Jersey, and Delaware.

Impacts to fish and EFH resources during construction activities would be localized and short-term in duration resulting from disturbance of habitat during cable installation. Potential direct mortality of invertebrates may occur in the footprint of cable installation. Indirect impacts causing displacement may also occur due to increased turbidity, noise, and vibration. At the scale of the New Jersey coastal waters, these impacts will occupy just a fraction of the fishery resources and habitat available. Following construction, fishery resources are expected to recover quickly in areas of cable installation. Benthic prey species are expected to recolonize the area, and foraging habitat would be available for fish species. Benthic fish species are expected to move back into the area following construction.

Potential contamination may be introduced by liquid wastes that are discharged to coastal and marine waters from vessels or facilities, such as sewage, solid waste or chemicals, solvents, oils, and greases from equipment. These potential impacts will be minimized by implementing an approved oil spill response plan, by following proper storage and disposal protocols, and by requiring vessel operators used for construction to have a vessel-specific spill response plan in the event of an accidental release, per the APMs in Section 2.

Atlantic Sturgeon

About 95 percent of all Atlantic sturgeon captured in sampling off New Jersey occurred in depths less than 66 ft (20 m) with the highest CPUE at depths of 33 to 49 ft (10 to 15 m). At these depths in open coastal and marine environments, which would not constrain the distribution or movement of Atlantic sturgeon, they are not likely to be struck by Project-related vessels. In nearshore cable export areas, sturgeon are more likely to be present. However, they would avoid the cable burying activities during construction. As discussed for other fish, if present, Atlantic sturgeon are expected to move out of the way, based on typical installation speeds, and direct impacts are not anticipated. Ocean Wind would extend the APM seasonal restriction of UXO detonations (January to April) to include months of increased Atlantic sturgeon presence in the offshore wind area. No UXOs can be detonated from November to April in the offshore areas, subject to final UXO survey results expected in fall 2022, which defines the exact location and size of UXO.

Sheet piling and goal posts (pipe structures that support the drill rig) may be required at HDD exit pits within the Atlantic Ocean. Installation of sheet piling and goal posts may result in physical impacts on sturgeon. Because of their swim bladders, Atlantic sturgeon would be sensitive to underwater impulsive sounds with a sharp sound pressure peak occurring in short intervals of time (Caltrans 2001). As pressure waves pass through a fish, its swim bladder would be rapidly squeezed by the high pressure then would rapidly expand as the under-pressure component of the wave passes through the fish. The pneumatic pounding on tissues contacting the swim bladder may rupture capillaries in internal organs as indicated by observed blood in the abdominal cavity and maceration of kidney tissues (Caltrans 2001).

Monitoring associated with the Pile Installation Demonstration Project associated with the Tappan Zee bridge replacement (in New York State) suggests Atlantic sturgeon may avoid the area close to an active pile-driving operation (AKRF 2012a).

BL England Estuarine Project Area (Onshore Export Cable Corridor)

The onshore export cable will cross Crook Horn Creek/Peck Bay along Roosevelt Boulevard. Impacts will be minimized by the use of HDD, which installs the cable beneath overlying sediments without direct physical disturbance. Trenchless installation has the potential for impact in the event of inadvertent return of drilling fluids. An Inadvertent Returns Contingency Plan (Appendix P) will be implemented to prevent and minimize impacts.

Oyster Creek Estuarine Project Area (Offshore Export Cable Corridor)

The estuarine portion of the Project will be affected by cable installation within back-bay areas behind barrier islands in Barnegat Bay. These areas have diverse fish assemblage. Species that inhabit estuarine waters utilize the unique in-shore habitats, such as shellfish and SAV beds, and shoreline structures for shelter, feeding, and spawning. During cable installation, habitat alteration will likely cause adult and juvenile fish to relocate temporarily. Summer flounder, whose HAPC exists within SAV beds in its EFH range, would be an example of a species that could be impacted by the loss of SAV habitat during construction. Summer flounder HAPC within SAV could be disturbed as a result of the installation of the cable along the Oyster Creek cable route. Impacts to SAV will be minimized, at landfall, by siting within the prior channel near IBSP and the use of HDD installation methods at the Holtec Property landfall, which install the cable beneath overlying sediments and SAV without direct physical disturbance. Trenchless installation has the potential for impact in the event of inadvertent return of drilling fluids. An Inadvertent Returns Contingency Plan (Appendix P) will be implemented to prevent and minimize impacts.

Open-cut installation is proposed from IBSP into Barnegat Bay to minimize impacts to SAV. The proposed solution is a combination of a location with less SAV, and which requires less dredging (a previously disturbed, prior channel with deeper water) and using open cut installation which allows the two cables to be installed closer to each other (20 m for open cut rather than 50 m for HDD) which keeps the majority of the workspace within areas without SAV. This is described in more detail in the Section 2 of the Application and the Alternatives Analysis in Appendix A. These unique habitats will be avoided wherever possible, and impacts minimized through compliance with permit conditions. Impacted species will likely relocate to surrounding similar habitat during and immediately following construction. Following construction, the cable would be buried, and natural succession would proceed, reestablishing the habitat. A permanent wave attenuation structure would be installed to create a living shoreline on the west side of IBSP (see Site Plans in Appendix C). This would provide a small area of permanent hard bottom/structure habitat.

Finfish will also experience temporary displacement due to sediment resuspension. In inshore areas (i.e., back bays), sediments are fine to medium grained. Therefore, suspension and settlement of sediments is expected. The finer sediments in these areas would become suspended and extend above the trench and take longer to settle to the seabed than in areas of sand or coarser grained sediments. As described in Section 4.2.1.1.2, these impacts to water quality for finer sediments are anticipated to be temporary in nature. BMPs will be implemented during construction to reduce turbidity and the resuspension of sediments into the water column. Potential plumes would be limited to right above the seabed and not within the water column. A sediment dispersion model conducted for the submerged cable installation in Raritan Bay found the fine sediments within the Raritan Bay had small increases (less than 50 mg/L) in suspended sediment concentrations at distances greater than 1,000 ft (305 m) from the cable route (ESS Group In. 2013). Large increases in suspended sediment concentrations (greater than 200 mg/L) were limited to areas less than 500 ft (152 m) from the cable route for short periods of time (less than 4 hours). Increases in suspended sediment in the water column will have a short duration with concentrations typically returning to ambient conditions in one to four hours and in all cases in less than 24 hours after the passage of the jet plow (ESS Group Inc. 2013).

Direct impacts are associated with early life stages of demersal species. Immediately following installation, indirect impacts from suspended sediments can potentially cause mortality to demersal fish eggs due to burial and reduced hatching success (Berry et al. 2011). However, across many different USACE dredging projects in New York Harbor, even when dredging sediments with high percentage of fine grain particles, plumes dissipated rapidly over distance (within 650 ft [200 m] in the upper water column and 2,000 ft [600 m] in the lower water column) to levels not detectable against background conditions. Active swimmers would be able to easily avoid plumes, and passive drifters would only be exposed over short distances (USACE 2015). Indirect impacts are also associated with potential changes to benthic habitat along the trench.

Construction vessels may also cause temporary finfish displacement during the installation process as a result of anchoring and vessel traffic and the increased noise associated with these activities. This impact will be short-term with fish returning to the area after the vessels leave.

As discussed previously, indirect impacts of cable installation also include mortality from entrainment of eggs and larvae during water withdrawals from jet-assisted cable plowing. Those impacts will be as discussed in previous sections.

<u>Atlantic Sturgeon</u>

As discussed for other fish, if present, Atlantic sturgeon are expected to move out of the way based on typical cable installation speeds, and direct impacts are not anticipated. Impacts would be similar to those discussed for other fish species, and the impact area would be small compared to the scale of the surrounding suitable habitat within the back bays.

4.4.2.2.2 Operations and Maintenance

Cable operation during the life of the Project could result in impacts related to the EMF emitted by the cables. EMF occurs naturally in the ocean, with the primary source being the geomagnetic field of the earth. Shielding of cables eliminates electric fields; magnetic fields cannot be shielded. Species most likely to experience impacts from the cable EMF would be benthic and demersal fish and invertebrates. Sharks, rays, and skate species have been well documented to detect electric fields with anatomical structures known as ampullae of Lorenzini, a feature absent in most bony fish. These species utilize this feature to locate and capture prey (Normandeau et al. 2011). While these species can detect EMF, little research has been done to conclusively determine the extent to which these impacts are manifested (Acres 2006). Recent evidence indicated that the Atlantic halibut (*Hippoglossus hippoglossus*), Dungeness crab (*Metacarcinus magister*), and American lobster (*Homarus americanus*) showed few behavioral responses that would indicate explicit avoidance or attraction to EMF in a laboratory setting (Pacific Northwest National Laboratory 2013, Hutchison et al. 2018).

The University of Rhode Island evaluated the behavioral response of little skate, contained in netted enclosures, to EMF from the Cross Sound Cable, a 330 megawatt (MW) capacity high voltage direct current (HVDC) subsea cable, south of New Haven, CT (Hutchison et al. 2018). The study found that while behavioral responses did occur in skate and lobsters when exposed to EMF, "neither of the species showed spatial restriction in their movements and at the power levels transmitted, the cable did not act as a barrier to movement." Skates appeared to demonstrate an attraction response to the EMF, which could be linked with benthic elasmobranch foraging behavior, and researchers stated that "…there is a low likelihood of significant biological impact associated with a single cable with a constant EMF". The researchers concluded "While the behavioral studies conducted in this project provided clear evidence of a behavioral response when receptive animals encountered the EMF, the evidence for a biological impact of a single HVDC cable under the conditions observed in this study would most likely be assessed as minor" (Hutchison et al. 2018).

Little evidence to date has been published that suggests major behavioral or biological impact on fish species. BOEM has evaluated EMF from power cables by conducting in-situ studies of both powered and unpowered cables (Love et al. 2015, 2016). Results from three years of surveys included:

- "Researchers did not observe any significant differences in the fish communities living around energized and unenergized cables and natural habitats;
- They found no compelling evidence that the EMF produced by the energized power cables in this study were either attracting or repelling fish or macroinvertebrates;
- EMF strength dissipated relatively quickly with distance from the cable and approached background levels at about one m from the cable; and
- Cable burial would not appear necessary strictly for biological reasons" (BOEM 2016).

EMF produced by cables decreases rapidly with distance from the cable. Shielding and burial of the cables will further minimize potential EMF impacts.

Impacts from sediment resuspension and deposition during operations and maintenance would result from vessel anchoring and repair of cables, if required. Bottom disturbances are not anticipated to occur frequently and impacts to fish and EFH species are anticipated to be similar to those experienced during the construction phase of Project, but shorter in duration and localized to the repair area.

Cable maintenance and repair activities, including vessel anchoring, may cause temporary impacts to the benthic community. Potential impacts associated with maintenance would be temporary and short in duration. If repairs are needed, impacts would be similar to those described above under construction.

<u>Atlantic Sturgeon</u>

Based on the information available and considering probability of exposure, detectability, duration, spatial extent, and severity, EMF resulting from Project operations is likely to have little or no measurable impact on the behavior, physiology, and ecology of Atlantic sturgeon.

4.4.2.3 Marine Mammals

Impacts associated with the Project that are relevant to marine mammals during construction, operations and maintenance are expected to be primarily from noise, vessel traffic and seabed disturbance. Specifically, these impacts would result from (1) underwater noise associated with the construction or installation of Project structures, (2) collision risks, noise, and disturbance associated with Project-related vessel traffic, and (3) seabed disturbance resulting from Project activities.

Suspended sediment, water quality impacts, and EMF have also been associated with offshore cable projects in the literature. However, based on the information available and using the variables (probability of exposure, detectability; duration; spatial extent; and severity), suspended sediments, water quality impacts, and EMF resulting from routine activities associated with Project construction and operation and maintenance would have little or no measurable adverse effect on the behavior, physiology, and social ecology of marine mammals that might be exposed to these impacts. As a result, these are not considered further.

Operation and maintenance of the Project may result in long-term impacts due to collision risks and disturbance associated with Project-related vessel traffic. Other potential impacts would be short-term. Specifically, potential temporary impacts to marine mammals would result from underwater noise associated with the construction (e.g., sheet pile driving, in-situ UXO/MEC disposal); construction related collision risks, noise, and disturbance associated with construction vessel traffic; and seabed disturbance resulting from construction, or maintenance activities.

4.4.2.3.1 Construction

The three primary impacts associated with the construction phase of the Project can be divided into the following sub-categories: pile-driving noise, risk of collision with surface vessels during construction, noise produced by construction vessels, disturbance created by construction vessels, and alteration of benthic habitat. Ocean Wind 1 has developed a Protected Species Monitoring and Mitigation Plan (PSMMP) in coordination with regulatory agencies and has developed APMs associated with construction and operational measures. With the implementation of environmental protection measures included in APMs and the PSMMP, the probability of a strike would be reduced.

Of these impacts, pile-driving noise and collisions appear to pose the greatest potential risk to marine mammals exposed to the Project construction activities. Over the past two decades, a considerable body of scientific information on anthropogenic sound and its effects on marine mammals and other marine life has become available. Many investigators have studied the potential effects of human-generated sounds in marine environments on marine mammals (for syntheses of these data, see Reeves 1992; Bowles *et al.* 1994; Norris 1994; Croll *et al.* 1999, 2001; Richardson *et al*. 1995; Frankel and Clark 1998; Gisiner 1998; McCauley and Cato 2001; NRC 1994, 1996, 2000, 2003, 2005; Southall *et al.* 2007; Tyack 2000, 2007; Wright *et al.* 2007; Abgrail *et al*. 2008, and Erbe *et al.* 2018). Despite this apparent abundance of information, substantial uncertainty remains about how marine mammals use sounds as environmental cues, how they perceive acoustic features of their environment; the importance of sound to the normal behavioral and social ecology of marine mammals; the mechanisms by which human-generated sounds affect the behavior and physiology (including the non-auditory physiology) of marine mammals, and the circumstances that are likely to produce outcomes that have adverse consequences for marine mammals (see NRC 2000 for further discussion).

Landfall Installation

Offshore export cables would be installed up to the TJB using open cut (i.e., jet-assisted cable trenching) to the in-water HDD landfall exit pit, then by HDD from landfall to the onshore TJB. For Oyster Creek, offshore export cables would be installed from IBSP into Barnegat Bay and across Barnegat Bay using open cut (i.e., jet-assisted cable plowing).

Sheet piles could be installed at the in-water HDD exit pits for landfalls and in dredged areas along the cable route. Sound generated by vibratory installation and removal of sheet piles could potentially cause acoustic disturbance to in-water marine mammals during Project construction. Likewise, the physical disturbance associated with landfall works has the potential to impact any hauled-out (i.e., resting) seals located in close proximity to the construction site(s) via the presence and/or operation of construction equipment. Any potential impacts are expected to be short-term and localized.

UXO/MEC detonation

Ocean Wind 1 is continuing to evaluate the risk of encountering UXO/MEC. These include explosive munitions such as bombs, shells, mines, torpedoes, etc. that did not explode when they were originally deployed or were intentionally discarded to avoid land-based detonations. The risk of incidental detonation associated with conducting seabed-altering activities, such as cable laying, in proximity to UXO/MECs jeopardizes the health and safety of project participants.

Ocean Wind 1 follows an industry standard As Low as Reasonably Practical (ALARP) process that minimizes the number of potential detonations. While avoidance is the preferred approach for UXO/MEC mitigation, there may be instances when confirmed UXO/MEC avoidance is not possible due to layout restrictions, presence of archaeological resources, or other factors that preclude micro-siting. In such situations, confirmed UXO/MEC may be removed through physical relocation or in situ disposal. Physical relocation will be the preferred method but is not an option in every case. Selection of a removal method will depend on the location, size, and condition of the confirmed UXO/MEC, and will be made in consultation with a UXO/MEC specialist and in coordination with the agencies with regulatory oversite of UXO/MECs.

For UXO/MECs that will require in situ disposal, this will be performed with low order (deflagration) or high order (detonation) methods or by cutting the UXO/MEC to extract the explosive components.

To better assess the potential UXO/MEC encounter risk, geophysical surveys have been and continue to be conducted to identify potential UXO/MECs that have not been previously mapped. As these surveys and analysis of data from them are still underway, the exact number and type of UXO/MECs in the Project Area are not yet known. If necessary, detonations at different locations would occur on different days (i.e., one detonation would occur per day). There is a possibility that some may be identified in state waters.

Underwater noise from UXO/MEC detonations can impact marine mammals through mortality, physical injury, auditory damage, physiological stress, acoustic masking, and behavioral responses (Merchant et al. 2020). Marine vertebrates, including marine mammals, can suffer lethal and sub-lethal effects from the shock waves generated by underwater explosions (Koschinski 2011). Acoustic trauma via damage to the cochlear structures can either be temporary threshold shift (TTS) due to sensory cells being overwhelmed by intense acoustic energy, or permanent threshold shift (PTS) due to neural cell damage and loss of hair cell bodies (Koschinski 2011). The rapid changes in pressure and short signal rise time involved in explosions may lead to PTS (Ketten 1995).

Underwater explosions can result in masking, a phenomenon which occurs when the perception of a biologically important signal is interfered with by another signal in the environment (i.e., noise) (DoN 2018). For marine mammals, masking could result in a reduced ability to communicate with conspecifics, find food, and navigate in their environment. However, masking only occurs when the sound source is operating, and direct masking effects stop immediately upon cessation of the sound-producing activity (DoN 2018).

Underwater explosions can also result in behavioral changes such as disturbance to regular migration and movement patterns, feeding, mating, calving/pupping, and resting (von Benda-Beckmann et al. 2015). Behavioral responses consist of reactions ranging from very minor and brief changes in attentional focus, changes in biologically important behaviors, and avoidance of a sound source or area, to aggression or prolonged flight (DoN 2018).

The behavior of the pressure wave in the water column depends on water depth, sediment, sea state, stratification of the water column, temperature, salinity, and other variables (Koschinski and Kock 2009; Salomons et al. 2021). Therefore, the specific effects on a given marine mammal will depend on all of these factors, as well as species, body size, the distance of the animal from the blast site, and the charge weight of the UXO/MEC in question (Hannay and Zykov 2021). Marine mammals that communicate in the high-frequency range, such as harbor porpoise, are particularly sensitive to the effects of underwater explosions. Studies also indicate that smaller cetacean species are at greatest risk for shock wave or blast injuries (Ketten 2004).

Impacts associated with UXO/MEC detonation for the proposed Project are expected to be negligible given the adoption of extensive mitigation measures, which will reduce or eliminate the possibility of injury and/or behavioral harassment. A noise mitigation system (NMS), also known as a noise abatement system, will be used during installation of both monopiles and pin piles. The NMS will be a combination of two devices that will function together as a system to reduce noise propagation during pile driving. The same or a different NMS will be used during UXO detonations. Adverse effects are therefore not anticipated on marine mammal stocks or populations.

Construction vessel traffic

While wind turbines and offshore substations are in federal waters, the installation of wind turbines and substations for the Project will involve installation vessels, dedicated transport vessels, tugboats for turbine transport, anchored hotel vessels, and support vessels (including crew boats), and other support vessels that will transit through state waters. In addition, there may also be helicopter traffic during the turbine installation phase of the Project. Potential disturbance associated with this traffic include collision risks, vessel noise, and vessel disturbance.

While all marine mammals present in the Project Area at the time of construction are potentially at risk of collision with construction vessels (i.e., “vessel strikes”), a variety of factors influence the probability of these collisions. These include vessel speed, vessel type, and visibility, as well as the animal’s size, behavior, and habitat preferences (Laist *et al.* 2001; Douglas *et al.* 2008; Pace 2011 as cited in CSA Ocean Sciences Inc. [CSA] 2020). Vessel strikes to marine mammals have been reported at vessel speeds from 2 to 51 knots, with the majority of lethal strikes or serious injuries caused by vessel speeds above 14 knots (MMS 2007 as cited in CSA 2020). In addition, the most severe or lethal vessel strikes have been found to involve large ships, typically over 262 ft (80 m) in length (Laist et al. 2001). Slow-moving large whales that tend to rest and feed on the surface, most notably the NARW, are frequently involved in vessel collisions (Parks *et al.* 2012). Other large whale species including fin, humpback, minke, sperm, sei, and blue whales are also vulnerable to vessel strikes (Dolman et al., 2006 as cited in CSA 2020). All known vessel strike events involving marine mammals are tracked and reported by NMFS and can play a role in the declaration of a UME event (Hayes et al. 2020). Smaller cetaceans and pinnipeds are also at risk of vessel strikes; however, these species tend to be more agile swimmers and as such are more capable of avoiding collisions with oncoming vessels (MMS, 2007 as cited in CSA 2020).

Despite the risks vessel strikes pose to vulnerable marine mammal species, relatively few quantitative approaches have been developed to estimate the probability of encounters between whales and ships. Vanderlaan et al. (2008) developed a method for estimating the probability of an encounter between NARW and surface vessels in the Bay of Fundy and the Scotia Shelf. More recently, a vessel encounter risk model tool is currently in development which attempts to standardize potential vessel strike impacts to large whales from offshore wind development along the United States Atlantic Outer Continental Shelf and allows users to assess these potential impacts (Barkaszi 2020).

Because of their slow speeds, construction vessels (such as installation vessels and tugboats) pose minor risks to marine mammals that might occur in the Project Area, and these risks could be further minimized with existing mitigation measures. Because of their higher speeds, smaller vessels pose moderate risks to marine mammals in the Project Area although those risks could also be minimized with existing mitigation measures. In both cases, potential impacts are expected to be short-term and localized.

Numerous studies of interactions between surface vessels and marine mammals have demonstrated that free-ranging marine mammals engage in avoidance behavior when surface vessels move toward them. It is not clear whether these responses are caused by the physical presence of a surface vessel, the underwater noise generated by the vessel, or an interaction between the two (Lusseau 2006). However, several authors suggest that the noise generated during motion is probably an important factor (Blane and Jackson 1994; Evans *et al.* 1992, 1994). These studies suggest that the behavioral responses of marine mammals to surface vessels are similar to their behavioral responses to predators.

Helicopters associated with the construction phase of the Project, if used, would also generate noise that would have the potential to affect marine mammals, depending on their altitude.

Nevertheless, noise and disturbance associated with surface vessels and helicopter traffic during the construction phase of the Project would likely have little or no measurable impact on the behavior, biology, or ecology of marine mammals exposed to it. In all cases, potential impacts are expected to be short-term and localized. Ocean Wind 1 will apply for an ITR from NMFS and will adhere to permit conditions.

Offshore Export Cables

The offshore export cables will be buried below the seabed within federal and state waters. The offshore export cable will connect with the onshore export cable at the onshore TJBs at each landfall location. Portions of the offshore ECR corridors will be located within the state seaward boundary (Figure 1.1-1). Vessel traffic associated with cable installation for the Project will include main laying vessels, main burial vessels, dredging vessels, anchor handling tugs, jointing vessels, crew service vessels, diver vessels, and additional support vessels. During the cable laying operation, there may also be daily helicopter traffic between the major vessels and shore. The primary factors associated with cable installation that are relevant to marine mammals are risk of collisions with cable-laying and support vessels, associated noise and disturbance, and seabed disturbance caused by the clearing, trenching, and cable-laying process.

<u>Risk of collisions with cable-laying vessels</u>

During the process of laying cables, cable-laying ships would generally move at speeds ranging from 0.54 to 2 knots (1 to 3.7 km per hour). The ship would reduce speed or stop to maneuver cables into the water and onto the ocean bottom before resuming the cable installation process. Ships moving at these speeds in the open ocean are not likely to strike marine mammals, although a strike is not impossible.

Because of their slow speeds, installation vessels and tugboats pose minor risks to marine mammals that might occur in the Project Area. Because of their higher speeds, smaller vessels pose moderate risks to marine mammals in the Project Area. In both cases, potential impacts are expected to be short-term and localized.

<u>Vessel noise and disturbance</u>

Noise and disturbance associated with surface vessels and helicopter traffic during the installation of the offshore export cables would have little or no measurable impact on the behavior, biology, or ecology of marine mammals exposed to it. In all cases, potential impacts are expected to be short-term and localized.

Seabed disturbance

The cable-laying process involves pre-construction surveys and clearing the seabed of UXO/MEC and boulders as needed. While no sandwave clearance is proposed in state waters, surveys will be conducted prior to construction and sandwave leveling using CFE will occur if needed.

A study of the benthic community following installation of 59 mi (95 km) of subsea cable in California showed that there were few changes in the distribution or abundance of benthic fauna (epifauna and infauna) and that the cable had had minimal statistically-significant effect on the benthic community along the cable route (Kogan *et al.* 2006). In some instances, the presence of the cable had created habitat diversity that increased the density of sea anemones (Actiniarians) and some fish along the cable's route.

The cable-laying process will impact a relatively small area along cable routes and the seabed is expected to recover quickly from the disturbance. The short-term loss of benthic habitat along the cable route is not expected to affect the distribution or abundance of marine mammals in the Project Area or how they use the benthic habitat along cable routes.

Entanglement risks

Several investigators have studied the potential risk of entanglement between marine vertebrates and submarine cables (ICPC [no date], Heezen 1957). The marine mammals that had become entangled were believed to have encountered slack cable as they swam along the ocean floor; when they struggled to break free of the cable, they became more entangled or broke the cable (Heezen 1957). Since 1960, the ICPC has no reports of whales becoming entangled in submarine cables or of cables that required repairs as a result of such entanglements. The ICPC attributes the difference to improved methods of installing submarine cable (for example, installing cable under tension) and burying the cable at greater depths.

Mooring systems associated with offshore construction may pose some entanglement risk for marine megafauna, including large whales. Harnois et al. (2015) found that taut mooring configurations were associated with the lowest relative risk of entanglement, whereas the highest risk was associated with catenary moorings with chains, nylon ropes, or accessory buoys. The overall risk of entanglement was found to be low, however, regardless of mooring configuration (Harnois et al. 2015). Benjamins *et al.* (2014) assessed the potential risk of phocid pinnipeds becoming entangled in mooring systems and power cables. Based on their foraging strategies, body size, body flexibility, and ability to detect mooring devices, the potential risk of pinnipeds becoming entangled in these systems is apparently small, at least when these systems are tethered and taut from being in active use. However, gray seals and harbor seals feed on benthic and epibenthic prey (Payne and Selter 1989, Bowen and Harrison 1996, Ampela 2009, Kenney and Vigness-Riposa 2010), and commonly become entangled in discarded fishing gear, or "ghost gear", that accumulates on the seabed (Bogomolni *et al.* 2010). Should construction activities result in marine debris consisting of discarded tether lines, or other mooring systems or cables which become slack when discarded, these could pose an entanglement risk for harbor and gray seals, since they could become involved in discarded gear during foraging activities.

Because cables associated with the Project will be buried, they do not pose any risk of entangling marine mammals. Ocean Wind 1 will implement APMs (Section 2) to reduce the potential for marine debris during construction and operation.

4.4.2.3.2 Operations and Maintenance

The activities causing impacts associated with the operations and maintenance phase of the Project can be divided into the following sub-categories: risk of collision associated with operations and maintenance vessels, and noise and disturbance produced by these vessels. Collision risk and vessel disturbance are similar to what has been described for construction in the preceding section, though more vessel traffic is associated with construction than with operations and maintenance, and therefore there is less of a risk to marine mammals during the operations and maintenance phase. In addition, Ocean Wind 1 will comply with NMFS permit conditions and BOEM mitigation measures.

4.4.2.4 Sea Turtles

Impacts associated with construction and operations and maintenance activities that are relevant to the sea turtles that are expected to occur in the Project Area (green, Kemp's ridley, leatherback, and loggerhead sea turtles) are from noise, vessel traffic and seabed disturbance. Specifically, the impacts are (1) underwater noise associated with the construction or installation of the Project (for this application this is focused on potential sheet piling at HDD in-water pits and potential UXO/MEC clearance), (2) collision risks, noise, and disturbance associated with Project-related vessel traffic, and (3) seabed disturbance. Two other potential impacts - suspended sediment and EMF - have been discussed in the literature. However, based on the information available and using the variables (probability of exposure, detectability; duration; spatial extent; and severity), suspended sediments and EMF resulting from routine activities associated with Project construction and operations and maintenance would have little or no measurable impact on the behavior, physiology, and social ecology of sea turtles that might be exposed to these impacts. As a result, suspended sediments and EMF will not be considered further.

Operation and maintenance of the Project may result in long-term impacts due to collision risks and disturbance associated with Project-related vessel traffic. Other potential impacts would be short-term. Specifically, potential temporary impacts to sea turtles would result from underwater noise associated with construction (e.g., sheet pile driving, in-situ UXO/MEC disposal); construction related collision risks, noise, and disturbance associated with construction vessel traffic; and seabed disturbance resulting from construction and maintenance activities

4.4.2.4.1 Construction

Offshore Export Cables

The offshore export cables will be buried below the seabed within federal and state waters. The offshore export cable will connect with the onshore export cable at the onshore transition joint bays (TJBs) at each landfall location. Portions of the offshore ECR corridors will be located within the state seaward boundary. Vessel traffic associated with cable installation for the Project will include main laying vessels, main burial vessels, dredging vessels, anchor handling tugs, jointing vessels, crew service vessels, diver vessels, and additional support vessels. During the cable laying operation, there may also be daily helicopter traffic between the major vessels and shore. The primary impact producing factors associated with cable installation that are relevant to sea turtles are risk of collisions with cable-laying and support vessels, associated noise and disturbance, and seabed disturbance caused by the clearing (e.g., in-situ UXO/MEC disposal), jet-assisted cable plowing, dredging, and cable-laying process.

<u>Risk of collisions with cable-laying vessels</u>

Sea turtles spend at least 20 to 30 percent of their time at the ocean surface (Lutcavage *et al*. 1997) during which they would be vulnerable to being struck by vessels or struck by vessel propellers. Vessel strikes and injuries to sea turtles from boats within New Jersey is not uncommon. In 2017, 19.6 percent of the sea turtles that stranded along the coast of New Jersey had evidence of interactions with vessels (boat or propeller strikes). By November 2018, 23 percent of the stranded turtles had evidence of boat or propeller strikes. Variables that contribute to the likelihood of a collision include vessel speed, vessel size and type, and visibility (Southeast Fisheries Science Center 2018).

Sea turtles are able to avoid collisions with slow-moving (<5 knots) vessels. The most informative study of the relationship between ship speed and collision risk was conducted on green sea turtles (Hazel *et al*. 2007). In that study, green turtles avoided approaching vessels at distances of 39 ft (12 m); the proportion of turtles that avoided those vessels decreased as vessel speeds increased. Turtles fled frequently in encounters with vessels moving at speeds of 2.2 knots (4 km/hr), infrequently in encounters with vessels moving at moderate speeds (5.9 knots or 11 km/hr), and rarely in encounters with a fast vessel (10.3 knots or 19 km/hr; Hazel *et al*. 2007). It is important to note that these speeds are based on sea turtle behavior in relatively warm water; cold water temperatures would decrease their ability to avoid vessels moving at even slow speeds.

During the process of laying cables, cable-laying ships would generally move at speeds ranging from 0.5 to 2 knots (1 to 3.7 km per hour). The ship would reduce speed or stop to maneuver cables into the water and onto the ocean bottom before resuming the cable installation process. Ships moving at these speeds in the open ocean are not likely to strike a sea turtle, although a strike is not impossible.

Vessel speed appears to be the primary factor that determines whether sea turtles are likely to be struck by surface vessels. Although the data available on the response of sea turtles to vessels are limited, they suggest that slow-moving vessels associated with the cable-laying activities have minimal risk of striking sea turtles because of their slow speeds. Slow-moving vessels associated with the installation of offshore export cables have little or no risk of striking sea turtles. Increased vessel traffic associated with construction and installation of the offshore export cables will be relatively short-term and localized and is anticipated to represent a negligible addition to normal traffic in the area. Transport vessels will travel to and from shore over the duration of the Project. Ocean Wind 1 has developed a PSMMP in coordination with regulatory agencies and has developed APMs associated with construction and operational measures. With the implementation of environmental protection measures included in APMs and the PSMMP, the probability of a strike would be reduced, and therefore, an adverse impact to sea turtles caused by vessel traffic is considered unlikely to occur.

<u>Underwater noise impacts: landfall installation</u>

As described above, offshore export cables would be installed at landfall using HDD. Any associated sheet piles, if required, would be installed via vibratory methods. Sound generated by vibratory installation and removal of sheet piles are within the estimated hearing range of sea turtles and could potentially cause acoustic disturbance to in-water sea turtles during Project construction. However, the distances to the relevant injury and behavioral acoustic isopleths for sea turtles are expected to be relatively small, and impacts will be easily minimized or avoided altogether using planned mitigation measures.

<u>Underwater noise impacts: UXO/MEC detonation</u>

UXO/MEC detonation may be required during seabed preparation for the Project in state waters. UXO/MEC detonations can impact sea turtles through mortality, non-auditory injury, auditory injury, and behavioral modifications. Marine vertebrates, including sea turtles, can suffer lethal and sub-lethal effects from the shock waves generated by underwater explosions (Koschinski 2011). Acoustic trauma via damage to the cochlear structures can either be TTS or PTS (Koschinski 2011; Hannay and Zykov 2021).

As mentioned above, the behavior of the pressure wave in the water column depends on water depth, sediment, sea state, stratification of the water column, temperature, salinity, and other variables (Koschinski and Kock 2009; Salomons et al. 2021). Therefore, the specific effects on a given marine animal will depend on all of these factors, as well as species, body size, the distance of the animal from the blast site, and the charge weight of the UXO/MEC in question (Hannay and Zykov 2021).

Impacts associated with UXO/MEC detonation for the proposed Project are expected to be negligible given the adoption of extensive mitigation measures in the PSMMP, which will reduce or eliminate the possibility of injury and/or behavioral harassment. Any potential impacts associated with UXO/MEC detonation are expected to be short-term and localized. As described above for marine mammals, an NMS, also known as a noise abatement system, will be used during installation of both monopiles and pin piles. The NMS will be a combination of two devices that will function together as a system to reduce noise propagation during pile driving. The same or a different NMS will be used during UXO detonations.

Seabed disturbance

Installation of cable systems will result in some disturbance of the seabed. Cables will be installed via jet-assisted plow. Clearing the seabed of UXO/MEC (see previous section) and boulders will also occur as needed.

A study of the benthic community following installation of 59 mi (95 km) of subsea cable in California showed that there were few changes in the distribution or abundance of benthic fauna (epifauna and infauna) and that the cable had minimal statistically-significant effects on the benthic community along the cable route (Kogan *et al.* 2006). In some instances, the presence of the cable had created habitat diversity that increased the density of sea anemones (Actiniarians) and some fish along the cable's route.

The cable-laying process will impact a relatively small area along cable routes and the seabed is expected to recover quickly from the disturbance. The short-term loss of benthic habitat along the cable route is not expected to affect the distribution or abundance of sea turtles in the Project Area or how they use the benthic habitat along cable routes.

Entanglement risks

Cables associated with the Project will generally be buried, and therefore they do not pose any risk of entangling sea turtles. Cables that are not buried are expected to be large enough and with sufficient tension to avoid entangling sea turtles.

4.4.2.4.2 Operations and Maintenance

Potential impacts associated with the operations and maintenance phase of the Project fall into the following sub-categories: risk of collision associated with operations and maintenance vessels, and noise and disturbance produced by these vessels.

Collision risks

Vessel traffic during the operations and maintenance phase of the Project will include vessels required to maintain or repair cables. In addition, vessel traffic to the wind farm would travel through state waters. Vessel traffic would include crew transport vessels, service operation vessels, supply and jack-up vessels, and bathymetry survey vessels. In addition, air traffic would include helicopter transits.

The potential risks of vessels striking sea turtles have been discussed previously. With the implementation of environmental protection measures included in APMs and the PSMMP, the probability of a strike would be reduced, and therefore, an adverse impact to sea turtles caused by vessel traffic is considered unlikely to occur.

Vessel noise

As discussed above, vessel noise is expected to cause minimal behavioral disturbance to sea turtles. Noise associated with surface vessels and helicopter traffic during the construction phase of the Project would have little or no measurable impact on the behavior, biology, or ecology of sea turtles exposed to it.

Impacts during cable repair activities would be smaller and of shorter duration, but of similar type, to those that would occur during cable installation. A relatively short distance along the seabed would be disturbed by the jetting process used to uncover the cable and allow it to be cut so that the ends could be retrieved to the surface. In addition to the temporary loss of some benthic organisms, there would be increased turbidity for a short period, and a localized increase in disturbance due to vessel activity, including noise and anchor cable placement and retrieval. Given the small area, short duration, and low probability of a cable repair occurrence, sea turtles are not likely to be exposed and, if exposed, are not likely to experience a change in their behavior or physiology.

4.4.3 Benthic Resources

The Project impacts affecting benthic resources include physical seabed disturbance, sediment suspension, discharge/releases and withdrawals, EMF, and traffic. Impacts are summarized in **Tables 2.1.1-1 and 2.2.1-1**.

Activities that could cause impacts to benthic habitat include bottom disturbing activities such as pre-construction preparation of seabed (i.e., pre-lay grapnel surveys, in-situ UXO/MEC disposal[3]), sheet pile driving for HDD exit pits, installation of export cables, anchoring and spudding, and dredging, if necessary. Within Oyster Creek, permanent conversion of benthic habitat will occur where the wave attenuation structure is installed to form a living shoreline west of IBSP.

Impacts to benthic resources during construction activities include direct impacts such as habitat conversion and burial and indirect such as temporary displacement. Direct impacts including burial of benthic organisms is expected in the disturbance footprint for cable placement and would be localized. Indirect impacts causing displacement will also occur due to increased turbidity. Following construction, benthic resources are expected to recover quickly as the surrounding area will recolonize those areas impacted. Avoidance and mitigation measures will be implemented to minimize impacts to benthic resources wherever possible (Section 2).

Impacts to invertebrate resources as a result of the operation and maintenance of this Project would be related to EMF, and maintenance and cable repair. Routine maintenance and repairs to the cable may impact invertebrates due to vessel traffic, anchoring, and other bottom disturbances. Potential impacts from EMF will be localized to the cable corridor. However, the cable will be buried at a depth sufficient to minimize effects to the extent practicable.

Temporary, short-term sediment disturbing activities include pre-construction preparation of seabed (i.e., pre-lay grapnel surveys, potential in-situ UXO/MEC disposal), sheet pile driving for HDD exit pits, installation of cables, and anchoring. These activities would primarily result in localized and temporary impacts, though they could result in mortality of sessile or slow-moving benthic organisms. Potential impacts would be minimized by implementing APMs. Impacts to state regulated resources are provided in **Tables 2.1.1-1 and 2.2.1-1**.

4.4.3.1 Construction

4.4.3.1.1 Offshore Export Cables

During installation, vessels may require anchoring and/or spudding to facilitate construction activities. Anchoring will take place in areas of soft bottom and result in potential seabed disturbance from anchor placement, drag and chain sweep. Localized impacts on sessile and or slow-moving benthic resources will occur in these areas. Mobile benthic organisms will be temporarily displaced by the anchors. Vessels may also have a direct impact on benthic plankton entraining them while taking on ballast water, withdrawing water for engine cooling, and operating on-board reverse osmosis systems (U.S. Department of Energy [USDOE] 2012). Impacts from increased vessel traffic and construction activities will be temporary and localized in nature.

Bottom disturbance will occur during cable installation. Initial disturbance will include potential seabed boulder clearance and in-situ UXO/MEC disposal followed by cable installation. At Oyster Creek, no sandwave leveling is currently proposed. However, due to the dynamic nature of ocean sediments, surveys will be conducted prior to construction to determine if sandwave leveling would be required. Sandwave leveling, if required, will be

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[3] MEC - munitions and explosives of concern; UXO - unexploded ordnance.

performed using CFE. These activities could result in direct impacts such as burial, displacement, and/or mortality of benthic organisms. Sessile or slow-moving species of shellfish, sand dollars, starfish, and tube worms would be directly impacted. Direct mortality to slow moving and sessile organisms could result from fluidizing the sediments during cable burial. Indirect mortality could occur to sessile or slow-moving organisms during cable installation as a result of sedimentation, however, based on existing sediment type and hydrodynamics, sediment suspension would be short term. Mobile organisms such as certain polychaete species, amphipods, and crabs, and horseshoe crabs may be temporarily displaced by the habitat disturbance and noise and may be able to avoid these activities.

Installation of the offshore export cables could result in the burial, displacement, and/or mortality of benthic organisms. Impacts from this process will be short-term and benthic communities are expected to recover quickly as invertebrates from the surrounding area will recolonize the impacted area. Several studies have assessed the short- and long-term effects of submarine cables on the benthic and demersal ecosystems (Andrulewicz et al. 2003, Kogan et al. 2006, Marra 1989, Sultzman et al. 2002). One of the most thorough studies examined the effects of 59 mi (95 km) of coaxial cable installed from Pillar Point Air Station to Pioneer Seamount off Half Moon Bay, California, eight years after the cable had been installed (Kogan et al. 2006). Quantitative comparisons of benthic communities and sea-floor features at nine different sampling stations led these authors to conclude that there were few changes in the distribution or abundance of benthic fauna (epifauna and infauna) and that the cable had minimal statistically-significant effect on the benthic community along the cable route. In some instances, the presence of the cable had created habitat diversity that increased the density of sea anemones (Actiniarians) and some fish along the cable routes.

Pre- and post-construction benthic sampling that was completed for a transmission cable project in the Hudson River off Manhattan revealed that the benthic community nine months after cable installation showed no significant difference between areas sampled within the cable corridor and those sampled in excess of 100 ft on either side of the cable corridor. The sampling also showed no significant difference from the same sampling locations that had been sampled prior to the cable installation (HDR 2013).

Indirect impacts of cable installation include water withdrawals for jet-assisted cable plowing and sediment plume settlement impacts. In addition, entrainment of organisms typically results in high mortality due to temperature changes and mechanical and hydraulic injury from pump impellors and passage through piping (USDOE 2012).

BL England

At BL England, and as shown in **Table 2.1.1-1**, no impacts to SAV, shellfish habitat, or intertidal and subtidal shallows areas are anticipated.

Oyster Creek

At Oyster Creek, shellfish and SAV habitat are mapped by NJDEP throughout Barnegat Bay (**Figure 3.4.5-2**). Within Barnegat Bay, the NJDEP has published Shellfish habitat maps from 1963, 1986 and 2012. The proposed indicative cable route avoids moderate to high density shellfish (hard clam) beds mapped from 1986 and 2012, and portions of 1963 shellfish data to the maximum extent practicable. NJDEP has published SAV habitat maps from 1985 and 1979 for Barnegat Bay. Direct impacts to both SAV and shellfish habitat are minimized via routing and use of HDD. Although 1985 data includes the entire western shoreline of IBSP as SAV habitat, based on other available data, including Ocean Wind 1 SAV Surveys (Appendix L) the prior channel preferred alternative does not currently contain SAV. Potential indirect impacts to shellfish and SAV beds include temporary resuspension of sediments (described further in Section 4.2.1.1.2) and potential burial. A sediment dispersion model conducted for the Poseidon Project submerged cable installation in Raritan Bay found the fine sediments within the Raritan Bay had small increases (less than 50 mg/L) in suspended sediment concentrations at distances greater than 1,000 ft (305 m) from the cable route (ESS Group In. 2013). Large increases in suspended sediment concentrations (greater than 200 mg/L) were limited to areas less than 500 ft (152 m) from the cable route for short periods of time (less than 4 hours). Increases in suspended sediment in the water column will have a short duration with concentrations typically returning to ambient conditions in one to four hours and in all cases in less than 24 hours after the passage of the jet plow (ESS Group Inc. 2013). Plume concentrations greater than 10 mg/L that contain coarser sediments would be short in duration (up to 6 hours) and limited to within approximately 50 to 200 m of the center of the trench, similar to in the offshore areas (Vineyard Wind 2018, Tetra Tech 2012, BOEM 2015). However, impacts will likely be minimal because cable routes will avoid highest densities of shellfish and SAV to the extent practicable. Furthermore, shellfish such as the hardclam (*Mercenaria mercenaria*) have the ability to vertically migrate through sediment and survive burial events (Maurer *et al.* 1986). BMPs will be used to minimize potential resuspension of sediments and impacts to SAV and shellfish.

In ultra-shallow areas (less than 6 ft) along the proposed ECR within Barnegat Bay, dredging may be required for cable installation because available jetting technology may not be capable of operating within these shallow waters. These shallow areas of the Bay include the eastern shoreline landing at IBSP and the approach to the western shoreline HDD landfall at the Holtec Property.

Impacts to SAV and shellfish habitat, along with intertidal and subtidal shallows areas is summarized and quantified in **Table 2.2.5-1**. Should the open cut installation method be deemed the alternative with least overall impact due to the potential for inadvertent returns, an additional 1.3 acres of shellfish habitat may be temporarily disturbed.

4.4.3.1.2 Offshore Export Cable Landfall

Impacts to regulated resources such as SAV, shellfish and intertidal and subtidal shallows at landfall locations will be minimized using HDD methods, to the extent practicable. However, HDD will require some degree of benthic disturbance to be implemented properly. HDD exit pits within the Atlantic Ocean will require dredging of a prism within the sandy sediment. Handling of dredged material will be in accordance with the regulations and NJDEP- permit conditions.

Furthermore, the HDD marine construction vessel spread will require some dredging to access portions of the western side of Barnegat Bay at the Holtec Property landfall. In addition, In Barnegat Bay, where sediments are predominantly fine grain, potential temporary impacts due to resuspension of sediments may occur. Sabol *et al.* (2005) documented the impacts of dredging to SAV and found the distribution of eelgrass to be highly variable based on season and year. Indirect impacts due to increased turbidity were not discernible from the seasonal variation that was documented. A study by Wisehart *et al.* (2007) showed that eelgrass density and seedling recruitment five months following disturbance was also higher in dredged aquaculture beds than areas with long-line aquaculture beds. This suggests that potential impacts to SAV habitat are short-term and localized. BMPs will be used to minimize potential resuspension of sediments. Impacts to SAV and shellfish habitat, along with intertidal and subtidal shallows areas is summarized in **Table 2.2.5-1**.

There is a potential for inadvertent release of drilling mud during HDD installation. Ocean Wind 1 will implement the Inadvertent Returns Contingency Plans in Appendix P to avoid inadvertent returns and, in the unlikely event of a release, respond in a manner that minimizes impacts.

In addition, open cut for the Holtec landfall may be used if HDD is determined to be impracticable. Potential impact associated with open cut are included in the offshore plans in Appendix C.

4.4.3.2 Operations and Maintenance

Impacts to benthic habitat during offshore export cable maintenance and repairs would be similar to those described above during construction. Cable operation during the life of the Project could result in impacts related to EMF. Shielding of cables eliminates electric fields; magnetic fields cannot be shielded. Species most likely to experience impacts from the cable EMF would be benthic and demersal fish and invertebrates. Potential impacts to invertebrates from EMF have not been extensively studied and are dependent upon the sensory capabilities of the species that would be found near the cable, the life functions that the species' magnetic or electric sensory systems support, and the natural history characteristics of the species. Section 4.4.2.2.2 provides additional information regarding EMF relative to aquatic species.

EMF produced by cables decreases rapidly with distance from the cable, as shown for the offshore export cables in **Figure 4.4.3-1.** Shielding and burial of the cables will further minimize potential EMF impacts.

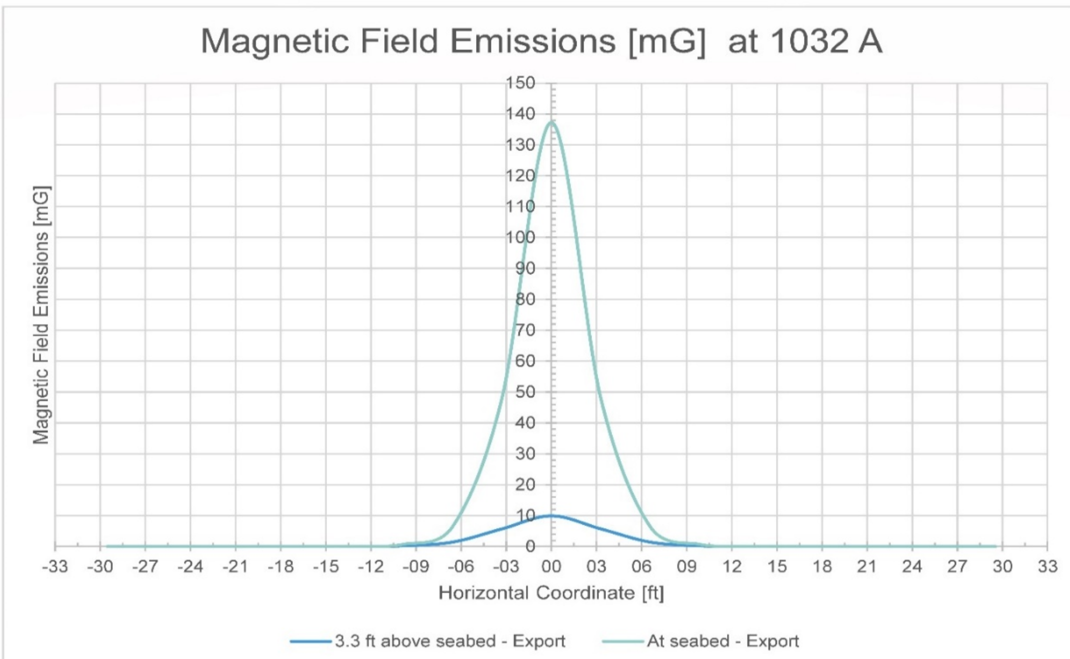

Figure 4.4.3-1. Magnetic field emissions of the Ocean Wind 1 offshore export cables (1,032 A) related to distance at the seabed and 1 m above the seabed.

Routine maintenance and repairs to the cable may impact invertebrates due to vessel anchoring, and other bottom disturbances. Cable repairs may require seabed disturbance to access cable and conduct repair. Vessels conducting surveys or repairs may need to anchor. Impacts from these activities would be similar to those during construction, but on a smaller scale.

4.4.4 Threatened and Endangered Species

Factors that may impact terrestrial and onshore coastal threatened and endangered species include physical seabed/land disturbance, habitat conversion, noise, traffic, sediment suspension and EMF. Habitat assessments have been conducted where necessary to minimize impacts to sensitive habitats and potential threatened and endangered vegetation species (Section 3.4.1 and 3.4.5). Impacts to threatened and endangered terrestrial species would be the same as described in Section 4.4.2.1, fish would be as described in Section 4.4.2.2, marine mammals would be as described in Section 4.4.2.3, and sea turtles would be as described in Section 4.4.2.4.

4.5 Contaminated Sites

4.5.1 Construction

4.5.1.1 Offshore Export Cable Landfall

Cable burial will be done via HDD and open cut installation. For the excavation work,a variety of equipment can be used depending on the water depth and local circumstances. A Sediment Sampling and Analysis Plan (SSAP) has been prepared and submitted to NJDEP for their review and approval. The NJDEP approved SSAP will be implemented, and analysis provided to NJDEP and a disposal facility for any dredged material. Disposal of dredged material will be in accordance with regulations and NJDEP permit conditions. The SSAP is provided in Appendix O.

4.5.1.2 Onshore Export Cable and Substations

Potential impacts associated with the construction of the TJBs, onshore ECRs, and onshore substations will occur in developed areas where previously disturbed soils lacking in soil horizons predominate. During construction, soils will be excavated at the landfall and installation of TJBs, along the cable routes, and at the onshore substation sites for foundations. Following construction, soils will be back filled, where applicable, and surface grades returned to previous conditions.

Disturbance to upland soils within developed areas of New Jersey may result in contact with contaminated soils, and if not managed, could result in the spread of contamination, resulting in impacts to clean soils and other resources or receptors. Project construction will require compliance with the NJDEP's Technical Requirements for Site Remediation (N.J.A.C. 7:26C and 7:26E). Installation of the onshore export cable will follow the NJDEP Site Remediation Program's LCP Technical Guidance (January 2012). Administrative Requirements for the Remediation of Contaminated Sites mandates that a LSRP be hired to oversee the management of contamination, including contaminated soil, during the project. Impacts from excavation, backfilling, grading, handling, transport, and disposal of contaminated soil are mitigated by the LSRP preparing a materials management plan (MMP) for the contractors to adhere to during construction.

As part of the MMP, the LSRP will gather information on the potential for contaminated areas along the construction corridor and may perform sampling if pre-existing data is lacking. This information will inform the MMP and will facilitate avoidance of unanticipated encounters with contaminated soil during construction, reducing the potential for impacts to human health and the environment.

Disturbances to soils within the onshore ECR construction corridors and at the onshore substations will be localized to the work areas and short-term. Impacts will be mitigated via adherence to the MMP during construction.

Under the NJDEP SRP, the LSRP will prepare an MMP for the contractor to follow for safe handling, storage and disposal of hazardous materials. Therefore, minimal impacts to contaminated sites are anticipated as a result of the Project construction.

4.5.2 Operations and Maintenance

Soil disturbance during operation and maintenance is not anticipated and will therefore have no impact to contaminated sites. Repairs will be made through access at manholes to the extent possible. However, in the unlikely event that repairs require ground disturbance, impacts and mitigation will be similar to construction and installation.

4.6 Historic and Cultural Resources

All phases of the Project have the potential to affect documented cultural, historical, and archaeological resources of the area, as well as undiscovered resources. Specifically, the cables will require deep seabed disturbance that may potentially impact submerged cultural resources as the cables will be buried below the seabed.

Onshore Project components include landfalls, onshore export cables, and onshore substations. The onshore export cables are expected to be predominantly buried within existing rights-of-way.The onshore export cables and grid connections may potentially impact buried cultural resources; however, with limited aboveground infrastructure, aboveground historic properties and districts are not likely to be impacted. The onshore substations may potentially impact buried cultural resources and visually impact aboveground historic properties.

4.6.1.1 Construction

4.6.1.1.1 Maritime Archaeology

The construction phase of the Project has the potential to affect offshore and nearshore submerged historic properties. The construction of offshore export cable infrastructure will introduce direct bottom impact to these environments.

BL England

As described in Section 3.6.1, HRG data identified three areas of magnetic anomalies along the BL England offshore ECR corridor that share characteristics with verified shipwreck magnetic signatures, and therefore, may represent a buried shipwreck. The QMA recommends avoidance of these targets by a distance of 50 m (164 ft) from the outer edge of magnetic anomalies. No magnetic anomalies indicative of submerged historic resources were identified along the Oyster Creek offshore ECR Corridor.

Previously identified shipwrecks and unidentified cultural resources (pre-Contact and historic) may be impacted directly by installation or indirectly by other associated bottom disturbance activities, such as vessel anchoring, spudding, ingress/egress, etc., occurring during construction. Disturbance to submerged marine archaeological and cultural resources will be avoided to the extent practicable through adherence to the QMA recommended avoidance buffers. Disturbance to known resources that cannot practicably be avoided would only occur with appropriate consultations and approvals. Additional archaeological investigation of resources that cannot be avoided may be needed in order to determine whether or not they are historic properties and to fully assess Project effects. Consultation between BOEM and the consulting parties under Section 106 of the National Historic Preservation Act (NHPA) will assist in the identification of, assessment of effects to, and mitigation measures to resolve effects for any HRG target or geomorphic feature potentially eligible for listing in the NRHP. Furthermore, Ocean Wind 1 will implement the Unanticipated Discoveries Plans (Appendix N) to avoid and mitigate impacts to unknown resources. A detailed analysis of potential impacts to marine archeological resources is included in the Marine Archaeological Resources Assessment in Appendix N along with the Unanticipated Discoveries Plan.

Oyster Creek

No submerged historic resources were identified during QMA review of HRG survey data. Furthermore, Ocean Wind 1 has developed and will implement an Unanticipated Discoveries Plan to avoid and mitigate impacts to unknown resources. A detailed analysis of potential impacts to marine archeological resources is included in the Marine Archaeological Resources Assessment in Appendix N along with the Unanticipated Discoveries Plan.

4.6.1.1.2 Terrestrial Archaeology

The construction phase of the Project has the potential to affect onshore cultural resources. The construction of onshore export cable infrastructure, onshore substations and underground grid connections will introduce direct ground impact to the onshore environment. Previously identified terrestrial archaeological resources and unidentified cultural resources (pre-Contact and historic) may be impacted directly by ground disturbances associated with the onshore Project construction activities.

The BL England onshore ECR is sited within existing road ROW from landfall to the substation. The substation is within a previously disturbed area formerly developed as a golf course. The underground interconnection is within an existing access road between the proposed substation and existing BL England Generation facilities.

The Oyster Creek onshore ECR is sited within existing parking lot and disturbed areas at IBSP, within a former farm property with extensive past ground disturbance at the Holtec Property, and within the existing paved access road to the OCGS. The substation and interconnection are within a property previously disturbed as part of the OCGS property.

Based on Phase 1a and 1b archaeological surveys conducted along the onshore ECRs and at the substations, the onshore PAPE has been previously disturbed from construction activities, sites do not appear to retain integrity and no intact archaeological resources likely remain. No further onshore archaeological work is recommended for the Project unless project boundaries change. An Onshore Unanticipated Discoveries Plan (see Appendix N) has been developed and will be implemented to avoid and mitigate impacts to unknown resources discovered during construction. A detailed analysis of potential impacts to terrestrial archeological resources is included in the Terrestrial Archaeological Resources Assessment in Appendix N along with the Unanticipated Discoveries Plan.

4.6.1.1.3 Architectural History

Potential visual effects on historic properties are anticipated from onshore infrastructure of the proposed Project at the proposed substations. Visual effects were analyzed for historic properties within the visual PAPE for the substations. Two properties within the visual PAPE surrounding the BL England substation and one property within the visual PAPE surrounding the Oyster Creek substation were evaluated, and all were recommended as No Adverse Effect. The full Visual Effects to Historic Properties Assessment is provided in Appendix N.

4.6.1.2 Operations and Maintenance

4.6.1.2.1 Maritime Archaeology

While the offshore and nearshore marine environments will be most affected during construction of the Project, operations and maintenance may also affect these environments. Any marine bottom disturbance activity, such as vessel anchoring, spudding, ingress/egress, etc., occurring during operations and maintenance or cable repairs may impact submerged historic properties. The maritime archaeological resources potentially impacted by the operations and maintenance phase of the Project would include all of the resources potentially impacted by construction if bottom disturbance is required due to emergency repairs outside of previously disturbed areas. The Unanticipated Discoveries Plan would be implemented during any repairs that require seabed disturbance.

4.6.1.2.2 Terrestrial Archaeology

Operations and maintenance activities will occur in the same areas that would have been cleared (evaluated for cultural resources) during construction, and therefore no impacts to cultural resources will be expected. The Unanticipated Discoveries Plan would be implemented during any repairs that require land disturbance.

4.6.1.2.3 Architectural History

Operations and maintenance activities will occur in the same areas that would have been cleared (evaluated for cultural resources) during construction, and therefore no impacts to architectural history resources are expected.

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